

Research Article

EFFECT OF DELTAMETHRIN IN THE INDIAN MAJOR CARP CIPRINUS CARPIO WITH SPECIAL REFERENCE TO CHOLINERGIC ACTIVITIES

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ABSTRACT

Effect of deltamethrin in the Indian major carp *Ciprinus carpio* with special reference to cholinergic activity was studied. The fishes were randomly divided into 3 groups having 6 in each group: (1) Control (2) Deltamethrin-induced toxic group (5ppm) (3) Deltamethrin-induced toxic group (10 ppm). Deltamethrin-induced toxic groups increased the Acetylcholine (ACh) and decreased the levels Acetyl cholinesterase (AChE) in Brain of fish. Exposure of fishes to 5ppm and 10ppm sub lethal concentrations of deltamethrin caused rigorous changes in the acetyl cholinesterase activity. Utmost activity was observed in the fish exposed to 10ppm sub lethal concentration.

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INTRODUCTION

Acetylcholine is an organic chemical that functions in the brain and body of many types of animals, including fish, as a neurotransmitter—a chemical released by nerve cells to send signals to other cells. Its name is derived from its chemical structure: it is an ester of acetic acid and choline. Parts in the body that use or are affected by acetylcholine are referred to as cholinergic. Substances that interfere with acetylcholine activity are called anticholinergics. Acetylcholine is synthesized in certain neurons by the enzyme choline acetyltransferase from the compounds choline and acetyl-CoA. Cholinergic neurons are capable of producing ACh. An example of a central cholinergic area is the nucleus basalis of Meynert in the basal forebrain (Siegal, A. and Sapru, H.N. 2006)

The enzyme acetylcholinesterase converts acetylcholine into the inactive metabolites choline and acetate. This enzyme is abundant in the synaptic cleft, and its role in rapidly clearing free acetylcholine from the synapse is essential for proper muscle function. Certain neurotoxins work by inhibiting acetylcholinesterase, thus leading to excess acetylcholine at the neuromuscular junction, causing paralysis of the muscles needed for breathing and stopping the beating of the heart.

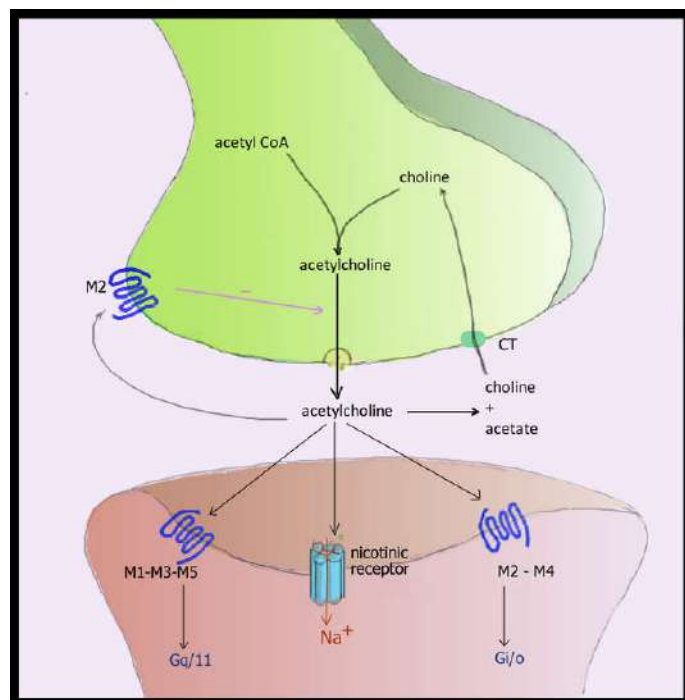


Fig 1 Acetylcholine processing in a synapse. After release acetylcholine is broken down by the enzyme

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Acetylcholine is the neurotransmitter used at the neuromuscular junction-in other words, it is the chemical that motor neurons of the nervous system release in order to activate muscles. This property means that drugs that affect cholinergic systems can have very dangerous effects ranging from paralysis to convulsions. Acetylcholine is also used as a neurotransmitter in the autonomic nervous system, both as an internal transmitter for the sympathetic nervous system and as the final product released by the parasympathetic nervous system. The main function of AChE is the rapid hydrolysis of the neurotransmitter, whereas BChE has no known specific natural substrate, although it is able to hydrolyse acetylcholine. Acetylcholinesterase hydrolyses the neurotransmitter, acetylcholine, thereby ending transmission of nerve impulses at the synapses of cholinergic neurons in the central and peripheral nervous system. Organophosphorus compounds are widely used for agriculture and domestic purpose for controlling insect pests (Videira *et al.*, 2001). Due to their rapid breakdown in water and their low environmental persistence, organophosphorus pesticides have largely replaced the use of organochlorines in recent years (Li and Zhang, 2001). Organophosphorus insecticides are known to inhibit acetylcholinesterase, which plays an important role in neurotransmission at cholinergic synapses by rapid hydrolysis of neurotransmitter acetylcholine to choline and acetate (Soreq and Zakut, 1993). These inhibit the action of the cholinesterase by phosphorylating or carbamylating the active centre of the enzymes. Cholinesterases (ChEs) are a ubiquitous class of serine hydrolases which physiologically remove acetylcholine from the synaptic cleft. ChEs are widely distributed among vertebrate and invertebrate animals (Bocquene *et al.*, 1997).

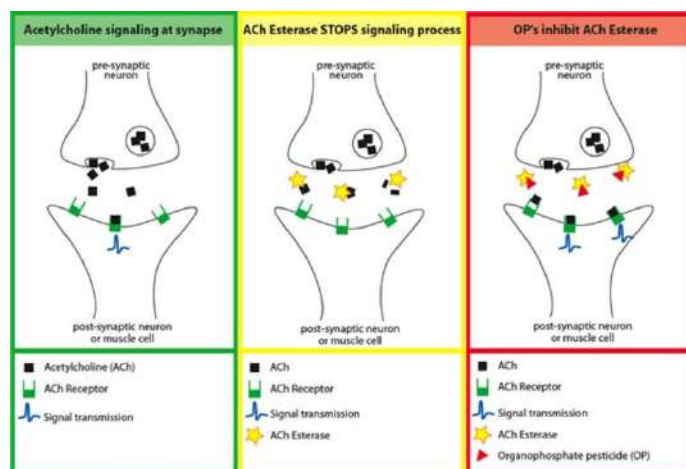


Fig 2 Acetylcholine signaling process from pre-synaptic neuron to post-synaptic neuron

Acetylcholinesterase hydrolyses the neurotransmitter, acetylcholine thereby ending transmission of nerve impulses at the synapses of cholinergic neurons in the central and peripheral nervous system. It has been suggested that BChE acts as a scavenging enzyme in the detoxification of natural compounds (Massoulie *et al.*, 1993). Choline, on the other hand, cannot be synthesized by the nervous tissue, but it has to be derived from the diet and delivered to the nerve cell via the blood stream (Schwartz, 1991).

Hence, the present study is undertaken to examine the toxic effect of different concentrations of deltamethrin on selected

biochemical parameters in functionally different types of fish organs with particular reference to cholinergic activity.

MATERIALS AND METHODS

Experimental animals

The tests were performed in a concrete holding tanks, glass aquaria, constant supply of water and good lighting system. The indoor tanks were filled with tap water and aerated for 3 days to help reduce the chlorine content. About 300 active test specimens ranging between 5 and 10 cm standard length were transported to the laboratory from a farm. The specimens were acclimatized to laboratory conditions for 7 days in the indoor holding tanks. The pH, dissolved oxygen concentration and temperature of water in the tanks were monitored.

Preliminary tests were conducted to provide guidance on range of concentration of pesticide to use in the bioassay. A stock solution of 25 mg/l was prepared from the original product concentration of 12.5 g/l. From the stock solution, the test solutions were prepared using distilled water. The specimens were not fed a day prior to and during toxicity tests to reduce faecal and excess food contaminating the test solution. The nominal test concentrations were 5ppm & 10ppm with six replicates each. The results from the toxicity tests were analyzed, using a World Health Organisation (WHO). The concentrations used were converted by the programme to log dose and the number of dead fishes to mortality Probit values. A plot of these two parameters was made from which the LC_{50} was estimated. The fishes were maintained according to the ethical guidelines.

Selection of Pesticide

Deltamethrin, a synthetic pyrethroid pesticide, was selected for the present study. It was obtained as commercial grade chemical from Sigma chemicals, USA.

Experimental design

The fishes were divided into 3 groups, each consisted of 6 and used for studying the effects of different concentrations of deltamethrin.

Group 1 -	Control
Group 2 -	5ppm concentration
Group 3 -	10ppm concentration

Isolation of Tissues

The animals were sacrificed. Brain was separated and frozen in liquid nitrogen (-180°C) and stored at -4°C until further use. At the time of analyses the tissues were thawed and selected parameters were estimated by employing standard methods.

Procurement of Chemicals

All chemicals used in the present study were Analar grade (AR) and obtained from the following scientific companies: Sigma (St. Louis, MO, USA), Fisher (Pittsburg, PA, USA), Merck (Mumbai, India), Ranbaxy (New Delhi, India), Qualigens (Mumbai, India).

Toxicity in aquatic fish for LC_{50}

Fishes were reared and acclimatized to the laboratory conditions in the glass aquaria containing aerated tap water avoiding overcrowding. The water was renewed every day and

the fishes were fed with poultry feed on alternate day. During the experimentation fishes were not fed. The physico-chemical characteristics of the test water such as temperature ($22\pm 2^{\circ}\text{C}$), water hardness (420 mg/lit), pH (7 ± 0.2) and Dissolved oxygen (4.27 ml/lit) were analyzed during the experiments according to standard methods suggested by APHA, (1989). The stock solution of pesticide, endosulfan (35%) was prepared by dissolving a known concentration of this pesticide into the distilled water and required concentrations were made from the stock solution. The acute toxicity as widely accepted for the period of 24, 48, 72 and 96 hrs have been carried out in the present investigation and the observations were made on the percentage mortality of the fish. The LC_{50} values were calculated by using regression equation method of probit analysis (Hubert and Schoch, 1984).

Biochemical Analyses

Cholinergic Metabolism

Acetyl cholinesterase (E.C. 3.1.1.7) activity

Acetyl cholinesterase activity was assayed by the method of Ellman *et al.*, (1961).

Acetylcholine (ACh) content

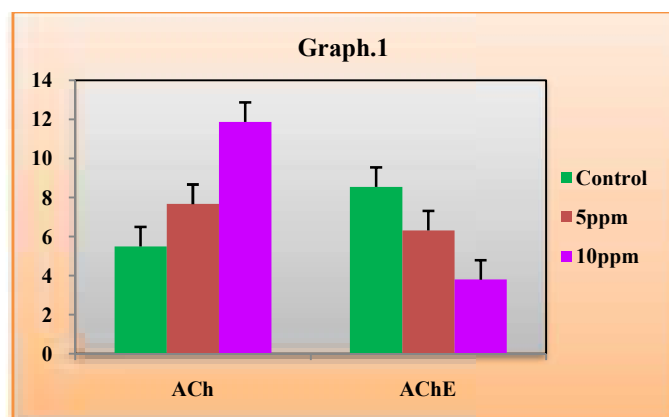
Acetylcholine content was estimated by the method of Hestrin (1949) as given by Augustinsson (1957).

Statistical treatment of data

All assays were carried out with six separate replicates from each group. The mean, standard error (SE) and Analysis of Variance (ANOVA) were done using SPSS statistical software for different parameters. Difference between control and experimental assays was considered as significant at $p < 0.05$.

RESULTS

An increase in the content of Acetylcholine is observed throughout dealing with different concentrations of deltamethrin (Tables 1). Acetylcholine esterase levels were decreased in the brain of fish when compared control with experimental groups (Tables 2) and Graph 1.



Acetylcholine esterase:

Control fish brain > 5 ppm deltamethrin > 10 ppm deltamethrin

Acetyl choline:

Control fish brain < 5 ppm deltamethrin < 10 ppm deltamethrin

DISCUSSION

Considerable information is available on the distribution and neurophysiological role of ACh and AChE in many regions of the CNS (Feldberg, 1945; Feldberg and Vogt, 1948; Burgen and Chipman, 1951; Hebb, 1955; Hebb and Silver, 1956; Crossland, 1960; Hebb and Krnjevic, 1962; Whittaker, 1963; Ryall *et al.*, 1964; Kasa *et al.*, 1970; Pepeu, 1972). The active substance was shown to be acetylcholine (ACh) (Loewi and Navratil, 1926; Dale, 1938; Crossland, 1960; Eccles, 1964; Ryall and De Groat, 1972), which was already known to have powerful biological action (Dale, 1938). ACh, the primary transmitter of the cholinergic system is one of the low molecular weight transmitter substances that are not an amino acid or derivative of amino acid (Sami Ikonen, 2001). ACh acts as the transmitter at the junctions between motor nerves and skeletal muscle (Brown *et al.*, 1936). It was shown that certain spinal cells presented into motor axons are strongly excited by ACh and the synaptic transmission of these cells is enhanced by anticholinesterases and blocked by ACh antagonists (Eccles *et al.*, 1954, 1956). In the synaptic terminals, ACh that is stored in the synaptic vesicles is released into the synaptic cleft as a result of an action potential (Caulfield, 1993). ACh diffuses to the pre- and post synaptic membranes where it binds to the receptors. The cholinergic receptors in the mammalian central nervous system can be divided into two groups: muscarinic and nicotinic receptors, based on the ability of two natural alkaloids, muscarine and nicotine, which mimic the effects of ACh (Dale, 1938; Arneric *et al.*, 1995). Nicotinic receptors are directly gated ion channels that are usually considered as mediators of acetylcholine in autonomic nervous system ganglia. Muscarinic receptors are the main type of cholinergic receptors in the central nervous system (Caulfield, 1993). Nicotinic actions are typically quick in onset and short-lasting, and are blocked by an excess of nicotine or by curare and curare-like agents. By contrast, muscarinic actions tend to be slow in onset and are prolonged and blocked by atropine and related drug compounds. In general, the parasympathetic system acts on its effector organs by muscarinic transmission. Whereas nicotinic actions are seen characteristically at skeletal neuromuscular junction and in autonomic ganglia, but ACh may act in both ways on the same cell, as in sympathetic ganglia; and the released ACh is normally taken up by the nerve endings. It is hydrolyzed by cholinesterases, and about half of the choline thus formed is immediately absorbed into the nerve endings by an active process that is blocked by hemicholinium-3. This choline is then re synthesized into ACh. In the presence of anticholinesterase agents accumulated exogenous ACh is probably not taken up by the nerve endings since it cannot be released by preganglionic stimulation (Katz *et al.*, 1973). In several areas of the nervous system the actions of ACh can be reproduced with nicotine and blocked by dihydro- β -erythroidine, for example in medulla (Salmoiraghi and Steiner, 1963), lateral geniculate (Curtis and Davis, 1963; Phillis *et al.*, 1968), cerebellum (McCance and Phillis, 1968). There is a good correlation between ACh content, choline acetyltransferase and AChE activity in all areas of brain but it is found to be very poor in the dorsal root fibers of cerebellum (Silver, 1967). In the cholinergic system, the inactivation of ACh is performed mainly by a specialized enzyme, acetylcholinesterase (AChE). This enzyme is located in the post-synaptic membrane of the synapse, and catalyses the

conversion of ACh molecule and water into acetic acid and choline, which can be returned back to the presynaptic terminal by reuptake process (Taylor, 1991). AChE is found in synapses of central and peripheral nervous systems, as well as neuromuscular junction which play a major role in normal neuronal and neuromuscular transmission (Brimijoin, 1986; Abiola *et al.*, 1988). The composition and removal of AChE from the synapse by collagenase, demonstrate that the enzyme is located in the outer basal lamina (Schumacher *et al.*, 1986). The active site of AChE contains anionic site and esteratic site. The anionic site is composed of glutamic acid residue which interacts with the nitrogen and choline moiety of acetylcholine, whereas esteratic site contains serine residue which is acetylated by acetylcholine during enzymatic hydrolysis (Derache, 1977). Inhibition of AChE that is responsible for the degradation of acetylcholine will result in excessive stimulation of cholinergic nerves. This will result in tremors, convulsion and finally the death of the aquatic organism (Baxter *et al.*, 1997). Several factors seem to be involved in affecting the AChE activity caused by OPs such as length to time and exposure concentrations (Uncer *et al.*, 2006).

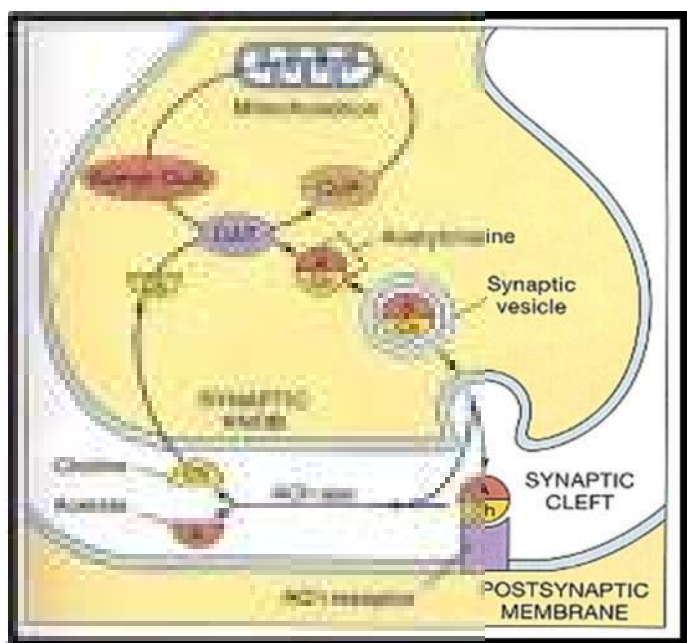


Fig 3 Degradation of acetylcholine in synaptic cleft

Inhibition of AChE, impairs cholinergic nerve impulses and may result in death of organisms (Salles *et al.*, 2006). As OPs exert their action by inhibiting AChE activity, measurement of AChE activity in the brain of fish has been described as a method for diagnosing anti cholinesterase pesticides in aquatic solutions (Zinkl *et al.*, 1987; Sams *et al.*, 2000). Inhibition of AChE was accompanied by an increase in acetylcholine levels (Brzezinski and Ludwicki, 1973). This condition can lead to increase of catecholamines which can affect the activity of enzymes involved in glycogenolysis and glycogen synthesis. Continuous stress may affect the synthesis site of AChE or decrease the levels of excess AChE. Mortality of fish may be due to inhibition of other enzymes, especially those taking part in carbohydrate and protein metabolisms. The inhibitory effect on AChE activity indicates that insecticides might interfere in vital processes like energy metabolism of nerve cells (Ansari *et al.*, 1987). Consequently, inhibition of AChE leads to paralysis

and death. AChE inhibition in brain, was observed earlier, when fish was exposed to other organophosphorous insecticides like chlorpyrifos and profenfos (Kumar and Chapman, 2001). Quite interestingly, the changes in ACh content and AChE activity occurred in fish brain. This indicates that the deltamethrin effect proceeds through generalized changes in brain of fish in addition to the specific impact on the target areas. Taking into consideration of neuronal damage as reported earlier, it is clear that Acetylcholine is accumulated due to AChE inhibition, which subsequently causes specific neurobehavioral symptoms.

Taking into consideration the role of cholinergic system as a segment of the multiple transmitter systems of the brain, an effort has been made in the present study to inspect the changes in the levels of acetylcholinesterase activity and acetylcholine content in the fish brain on exposure of different concentrations of deltamethrin.

Table 1 Alterations in the Acetylcholine (ACh) content in Brain of *Ciprinus carpio* after insecticide deltamethrin exposure.

Brain	Control	5ppm	10ppm
Acetylcholine (ACh)	5.495 ±0.348	7.668* ±0.452 (39.54)	11.874* ±0.775 (54.85)

(Values are expressed in μ moles of Acetylcholine/g wet wt of tissue)

All the values are mean, $\pm$ SE of six individual observations.

Values in '()' parentheses are % change over control.

*Values are significant at $P < 0.05$ in Scheffe test.

Table 2 Changes in the Acetylcholinesterase (AChE) activity in Brain of *Ciprinus carpio* after insecticide deltamethrin exposure.

Brain	Control	5ppm	10ppm
Acetylcholinesterase (AChE)	8.546 ±0.250	6.317* ±0.356 (-26.08)	3.796* ±0.128 (-39.90)

(Values are expressed in μ moles of Acetylthiocholine iodide hydrolyzed/mg protein/hr)

All the values are mean, $\pm$ SE of six individual observations.

Values in '()' parentheses are % change over control.

*Values are significant at $P < 0.05$ in Scheffe test.

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THE IMPACT OF GEOGEBRA IN TEACHING MATHEMATICS AND IN MATH TEACHERS PROFESSIONAL DEVELOPMENT

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Abstract :

Technology is essential in teaching and learning mathematics, it influences the mathematics that is taught and enhances student's learning. This paper presents new trends in technology and learning through GeoGebra, which could be especially important for the future development of e-learning for College mathematics. GeoGebra is a free, open source, multi-platform, translatable, dynamic mathematics software that has an extensive and very active international community of users who support each other with teaching materials and technical support in the use of the program. Examples of the use of GeoGebra will be shown using some concepts of 3D-geometry.

Keywords: *dynamic mathematics software, geometric concepts, college mathematics.*

Introduction

GeoGebra is a Dynamic Mathematics Software (DMS) for teaching and learning mathematics from middle school through college level. It is as easy to use as Dynamic Geometry Software (DGS) and also provides basic features of Computer Algebra Systems (CAS) to bridge some gaps between geometry, algebra and calculus. GeoGebra is open source software under the [GNU General Public License](https://www.gnu.org/licenses/gpl-3.0.html) and freely available at www.geogebra.org. There, you can either download installers for multiple platforms or launch the software directly from the Internet using [GeoGebra Web Start](http://www.geogebra.org/m).

GeoGebra was created to help students to gain a better understanding of mathematics. You can use it for active and problem-oriented teaching, it fosters mathematical experiments and discoveries both in classroom and at home. Mathematical skills and knowledge are steadily gaining importance for everyday life in a lot of countries all around the world where “mathematics is viewed as a necessary competency for critical citizenship”. This heightens the importance of making mathematics education accessible to all students and increasing their mathematics proficiency so as to prepare them for life outside school. In order to provide a higher quality education for students, capable teachers who are willing to implement creative learning environments with technology for the purpose of maximizing their students’ learning success are desperately needed.

Short History of GeoGebra

The development of GeoGebra began in 2001 as Markus Hohenwarter’s Master’s thesis project at the University of Salzburg, Austria. After studying mathematics education as well as computer engineering, he started to implement his idea of programming a software that joins dynamic geometry and computer algebra, two math disciplines that other soft-ware packages tend to treat separately. His main goal was to create an educational software that combines the ease of use of a dynamic geometry software with the power and features of a computer algebra system, which could be used by teachers and students from secondary school up to college level. After publishing a prototype of the software on the Internet in 2002, teachers in Austria and Germany started to use GeoGebra for teaching mathematics, which was, at this point, rather unexpected by the creator, who got a lot of enthusiastic emails and positive feedback from those. In 2002, Hohenwarter received the European Academic Software Award EASA, which finally inspired him to go on with the development of GeoGebra in order to enhance its usability and extend its functionality. Further

development of GeoGebra was funded by a DOC scholarship awarded to Hohenwarter by the Austrian Academy of Sciences, which also allowed him to earn his PhD in a project that examined pedagogical applications of GeoGebra in Austrian secondary schools.

Design of GeoGebra

Currently, there are two types of educational software that connect the mathematical fields of geometry and algebra and are used for mathematics teaching and learning. On the one hand, there is dynamic geometry software (DGS) that allows users to create and dynamically modify Euclidian constructions. Geometric properties and relations between objects used within a construction are maintained because manipulating an object also modifies dependant objects accordingly. Some dynamic geometry programs even provide basic algebraic features by displaying the equations of lines or conic sections, as well as other mathematical expressions which usually can't be modified directly by the user. On the other hand, there are computer algebra systems (CAS) which symbolically perform algebra, analytic geometry, and calculus. Using equations of geometric objects, a computer algebra system can decide about their relative position to each other, and display their graphical representations. Many computer algebra systems are also able to plot explicit and sometimes even implicit equations. Generally, the geometric representation of objects can't be directly modified by the user.

GeoGebra is an attempt to join these two types of software, whereby geometry, algebra, and calculus are treated as equal partners. The software offers two representations of every object: the numeric algebraic component shows either coordinates, an explicit or implicit equation, or an equation in parametric form, while the geometric component displays the corresponding solution set. In GeoGebra both representations can be influenced directly by the user. On the one hand, the geometric representation can be modified by dragging it with the mouse, whereby the algebraic representation is changed dynamically. On the other hand, the algebraic representation can be changed using the keyboard causing GeoGebra to automatically adjust the related geometric representation.

One of the key tasks in education is to motivate students and make them feel interested. Naturally, capable teachers had been able to motivate children even before computers became widespread without feeling the need for various types of software. Then the reader has every reason to ask why we should begin using software now? Well, first of all students have changed a lot since the world they live in has also undergone great changes. Secondly, the more varied tools teachers have, the more efficient they become. Last but not least, mathematics software very often provides teachers with such new tools that are not replaceable with anything else. Besides motivation, another major task is differentiation, since in almost every case teachers have to deal with heterogeneous groups. Using software, teachers are able to create extra materials of various content and level thus becoming able to properly differentiate between students. A substantial part of teachers' work is the preparation of different types of extra material such as test banks, progress tests, summaries etc. The use of various software utilities facilitate and accelerate this task. With the help of GeoGebra teachers are able to easily create precise and spectacular figures. Moreover, they can publish their dynamic worksheets on the Internet at ease, making them accessible for their students. The goal is to use GeoGebra to provide an environment for active exploration of mathematical structures through multiple representations, or to show students some aspects of the mathematics that are not possible with pen and paper.

Geometry has been defined by various scholars; "Geometry is a complex interconnected network of concepts, ways of reasoning, and representation systems that is used to conceptualize and analyze physical and imagined spatial environments".

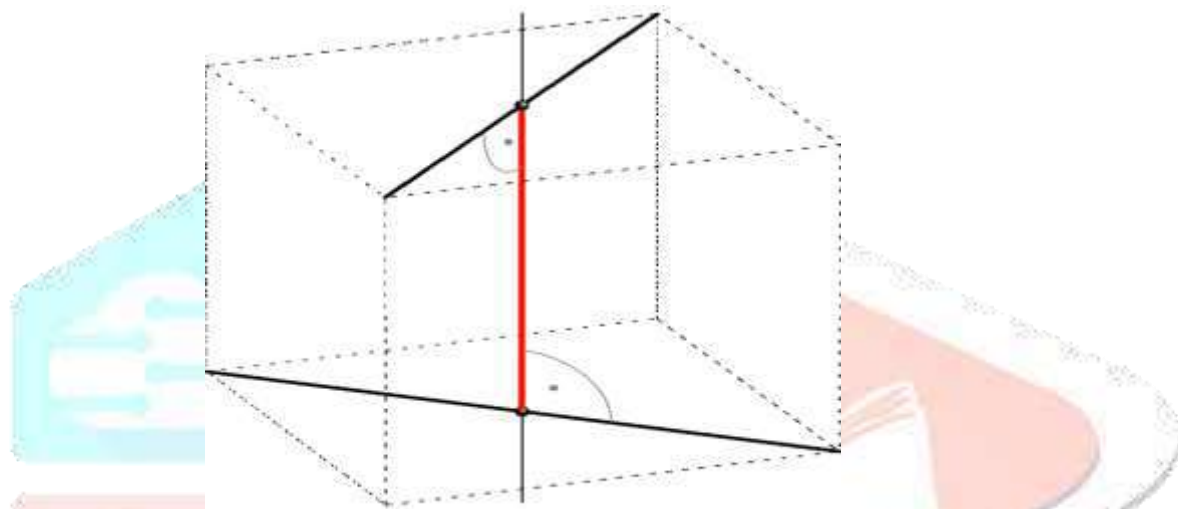
Geometry is also defined as a branch of Mathematics that is concerned with shapes, sizes, relative position of figures and the properties of space. Geometry is the branch of mathematics concerned with lengths, areas and volumes .

Geometrical definitions have to do with space and shape. Hence when defining a geometrical shape, properties such as angles and measurements are used. According to (Clements and Battista, 1990) "underlying most geometric thought is spatial reasoning which is the ability to see, inspect and reflect on spatial objects, images, relationships and transformations".

In the process of teaching topics and concepts involving Geometry, the teacher expects his/her students to be able to visualize figures, shapes and planes that many not be very obvious to the student. This concept is what makes geometry unique and difficult to learn and teach. This is because spatial ability is not easy for all students. In teaching the concepts of geometry, the teacher is faced with the task of helping learners 'see' the objects represented in the image and further derive some meaning from it. In the following examples we see how GEOGEBRA is useful in visualising some geometric concepts .

Example 1: Shortest distance between two skew lines

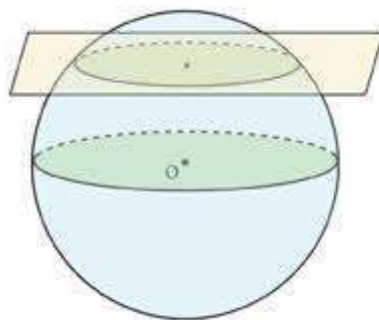
Any two non-parallel and non-intersecting lines are called skew lines. Skew lines are non coplanar. Shortest distance between two skew lines is difficult to visualize. Shortest distance between two skew lines equals the distance between their intersections with their common normal line. For every pair of skew lines exists a unique line that intersects both



Skew lines

lines and is perpendicular to both lines. This line is called normal line of two skew lines.

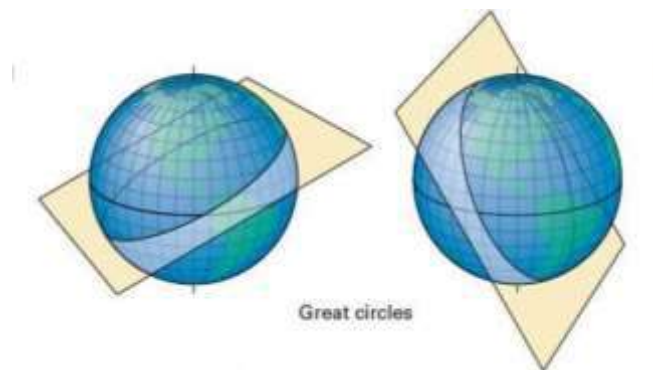
Example 2: Plane section of a sphere



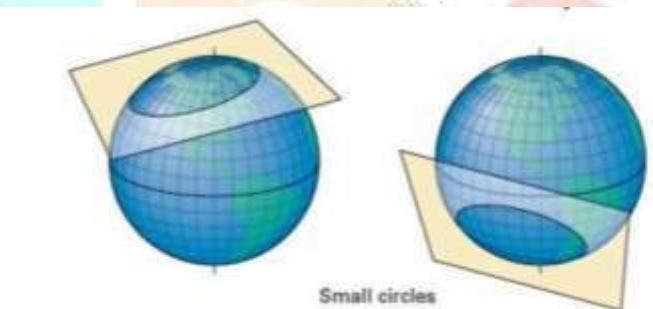
If S is a sphere and Π is a plane, the non empty set of points common to sphere S and the plane Π is called a plane section of sphere. Then we say that the plane intersects the sphere. A plane section of a sphere is a circle.

Example 3: Great circle

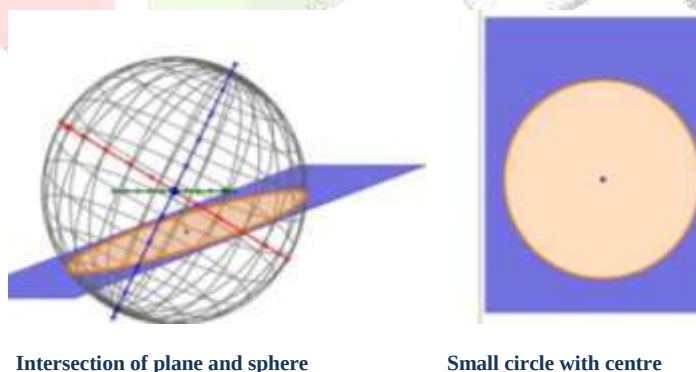
If a plane passes through the centre of a sphere, then the plane section of the sphere is called a great circle, irrespective of the inclination of the plane. The centre and radius of the great circle are respectively the centre and radius of the sphere.

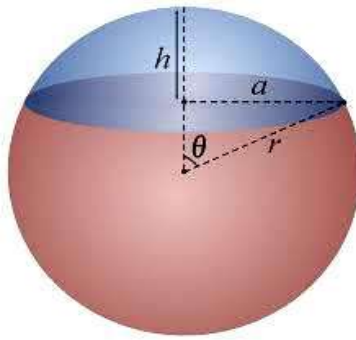
**Example 4: Small circle**

If the plane does not pass through the centre of the sphere and intersects the sphere, then the plane section of the sphere is called a small circle.



The centre of the small circle is the foot of the perpendicular from the centre of the sphere to the plane and the radius of the small circle is less than the radius of the sphere.





In the above diagram 'a' is the radius of the small circle and 'r' is the radius of the sphere.

Using GeoGebra we can make the students visualise and there by understand the geometric concepts like, planes bisecting the angle between the two intersecting planes, intersection of three planes, sphere through four given points, sphere through given circle, right circular cone, enveloping cone e. t. c.

CONCLUSION:

GeoGebra has been rapidly gaining popularity among teachers and researchers around the world, because it is easy-to-use dynamic mathematics software that combines many aspects of different mathematical packages. In addition, because of its open-source nature an extensive user community has developed around it. Mathematics teachers are encouraged to use technology in the teaching and learning of mathematics, as it allows teachers to convey their teaching ideas according to the topics. It may require some time before teachers become familiar with the use of GeoGebra in the classroom. In addition, it also requires teachers to spend some time in order to produce images or graphics in front of students, whereas the traditional approach to teaching only involves lecturing or drawing on a white board. Thus, the explanation on topic-related concepts takes a longer time compared to explanation on procedures. This is because concepts involve more activities that use GeoGebra and teaching aid materials, such as pictures that are uploaded in GeoGebra. Procedures produced can be created by students themselves using GeoGebra. For example, GeoGebra software can produce graphics directly, without requiring materials outside the GeoGebra program. The advantages of GeoGebra software have made teachers more creative in planning more effective lessons and lesson delivery, which involves two-way learning. The use of GeoGebra in the teaching and learning of function affects students' conceptual and procedural knowledge. Hence, GeoGebra can be considered as an alternative for schools and colleges to run their mathematics laboratories and to use GeoGebra in the teaching and learning process. The use of GeoGebra gives teachers an opportunity to create different teaching techniques.

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ON COMMUTATIVITY OF RA-SEMIGROUPS

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ABSTRACT:

An algebraic structure midway between a groupoid and commutative semigroup appeared in 1972. M.A.Kazim and MD.Naseerudin introduced left almost semigroups as a generalisation of commutative semigroups. They have introduced the braces on the left of the ternary commutative law $abc = cba$ to get a new pseudo associative law, i.e., $(ab)c = (cb)a$. It is since then called left invertive law. A groupoid satisfying the left invertive law is called a left almost semigroup and is abbreviated as LA- semigroup. Similarly, groupoid satisfying the right invertive law, $a(bc) = c(ba)$ is called a right almost semigroup and is abbreviated as RA- semigroup

In this paper we will prove some of the properties of RA-semigroups. In this paper in section 2 we define RA-semigroup with examples and prove some of the basic results. In section 3 we study the properties of commutative and bi-commutative and transitively commutative RA-semigroups. In 4 we prove some of the properties of the anti-commutative RA-semigroups.

Keywords: RA-semigroup, Commutative RA-semigroups, Bi-commutative RA-semigroup, Anti-commutative RA-semigroup.

1 INTRODUCTION :

The algebraic object encountered in this chapter is a set G with a binary operation $\cdot$ satisfying right invertive law is same as the algebraic structure "Right almost semigroup i.e., RA-semigroup" defined by MD.Naseeruddin in his Ph.D theses with the title "Some studies on almost semigroups and flocks". He defined RA-semigroup as a groupoid satisfying right invertive law. i.e.,

$$a(bc) = c(ba) \quad \forall a, b, c, \in G$$

Definition : Let G be a non empty set and $\cdot$ be a binary operation from $G \times G \rightarrow G$. Then $(G, \cdot)$ is called an RA-semigroup if it satisfies,

$$a(bc) = c(ba) \quad \forall a, b, c, \in G$$

The following multiplication table shows the existence of an RA-semigroup.

$\cdot$	x	y	z
x	x	z	y
y	y	x	z
z	z	y	x

Definition : An RA-semigroup is called a commutative RA-semigroup if $ab = ba \quad \forall a, b \in G$

Definition : Bi-Commutative RA-semigroup (BC- RA-semigroup) :

An RA-semigroup G is called right commutative RA-semigroup (RC- RA-semigroup) if $a(bc) = a(cb)$, for all $\forall a, b, c, \in G$.

An RA-semigroup G is called a left commutative RA-semigroup (LC- RA-semigroup) if $(ab)c = (ba)c$, for all $\forall a, b, c, \in G$

An RA-semigroup G is called a bi-commutative RA-semigroup (BC- RA-semigroup) if it is both LC- RA-semigroup and RC- RA-semigroup.

Definition : Anti-commutative RA-semigroup: An RA-semigroup G is called anti-commutative RA-semigroup if the identity $ab = ba \Rightarrow a = b$ holds $\forall a, b \in G$

Alternative RA-semigroup : An RA-semigroup G is called left alternative RA-semigroup if it satisfies the identity , $(aa)b = a(ab)$. for all $a, b \in G$

An RA-semigroup is called right alternative RA-semigroup G if it satisfies the identity, $(ab)b = a(bb)$, for all $a, b \in G$

Self-Dual RA-semigroup : An RA-semigroup which satisfies left invertive law $(ab)c = c(ba)$ for all $a, b, c \in G$ is called Self -Dual RA-semigroup.

Nuclear square : An RA-semigroup G is called left nuclear square if $\forall a, b, c, \in G, a^2(bc) = (a^2b)c$. Similarly S is called right nuclear square if $\forall a, b, c, \in G, (ab)c^2 = a(bc^2)$ and middle **nuclear square** if $\forall a, b, c, \in G, (ab^2)c = a(b^2c)$.

Right transitive RA-semigroup : An RA-semigroup G is called right transitive if , $ab.cb = ac$ for all $a, b, c \in G$

Left transitive RA-semigroup : An RA-semigroup G is called left transitive if , $ab.ac = bc$ for all $a, b, c \in G$

Locally associative: An RA-semiroup G is said be locally associative if, $a^2a = aa^2 \quad \forall a \in G$

Cancellative RA-semigroup : Let G be an RA-semigroup. If for all $a, b, c, \in G, ab = ac \Rightarrow b = c$ then we say that G is a left cancellative RA-semigroup

Let G be an RA-semigroup. If for all $a, b, c, \in G, ba = ca \Rightarrow b = c$ then we say that G is a right cancellative RA-semigroup

Let G be an RA-semigroup. If for all $a, b, c, \in G, ab = ac \Rightarrow b = c$, and also $ba = ca \Rightarrow b = c$, then we say that G is a cancellative RA-semigroup

Let G be an RA-semigroup. If for all $a, b, c, \in G, ab = ca \Rightarrow b = c$, and also $ba = ac \Rightarrow b = c$, then we say that G is a cross-cancellative RA-semigroup

2: SOME BASIC RESULTS ON RA-SEMIGROUPS.

2.1 Lemma : An RA-semigroup G satisfies medial law.

$$\text{i.e., } (ab)(cd) = (ac)(bd) \quad \forall a, b, c \in G.$$

Proof : Using right invertive law,

$$(ab)(cd) = d(c(ab)) = d(b(ac)) = (ac)(bd)$$

2.2 Lemma : If right identity 'e' exists in RA-semigroup then it is unique.

Proof : If possible there exists another right identity say f , then

$$f = fe \text{ and } ef = e \text{ and } f = fe = f(ee) = e(ef) = ee = e \Rightarrow f = e$$

2.3 Lemma : In an RA-semigroup with right identity, paramedial law holds.

$$\text{i.e., } (ab)(cd) = (db)(ca)$$

$$\text{Proof : } (ab)(cd) = (ab)((cd)e) = e((cd)(ab)) = e(b(a(cd))) = e(b(d(ca))) = e((ca)(db))$$

$$= (db)((ca)e) = (db)(ca).$$

2.4 Lemma : In an RA-semigroup with right identity e ,

$$ab = cd \Leftrightarrow ba = dc$$

$$\text{Proof : (i) } ab = cd \Rightarrow ba = d$$

$$ba = b(ae) = e(ab) = e(cd) = d(ce) = dc.$$

Similarly we can show that $(ba) = (dc) \Rightarrow (ab) = (cd)$

2.5 Lemma : If an RA-semigroup G contains a right identity the following law holds
 $\in G.$

$$(ab)c = (ac)b, \quad \forall a, b, c$$

$$\text{Proof : } (ab)c = (ab)(ce) = e(c(ab)) = e(b(ac)) = (ac)(be) = (ac)b.$$

3: ON COMMUTATIVITY OF RA-SEMIGROUPS

3.1 Theorem : An RA-semigroup G is a commutative semigroup iff the following law holds $\forall a, b, c \in G$.

$$a(bc) = (ba)c \text{ ---- (a)}$$

Proof : (i) Let the given condition (a) holds in G ,

$$\text{and } a(bc) = c(ba) \text{ ---- (b) (right invertive law)}$$

from (a) and (b), we have

$$(ba)c = c(ba) \Rightarrow G \text{ is commutative.}$$

$$\text{and } a(bc) = (ba)c = (ab)c \Rightarrow G \text{ is associative.}$$

$\therefore G$ is a commutative semigroup.

(ii) Let G be a commutative semigroup.

$$\text{then, } a(bc) = (ab)c = c(ab) = c(ba) = (ba)c \Rightarrow a(bc) = (ba)c$$

3.2 Theorem : An RA-semigroup with left identity is a commutative semigroup.

Proof : Let G is an RA-semigroup with left identity e .

$$\text{then, } ea = a$$

$$ab = a(eb) = b(ea) = ba \Rightarrow ab = ba \Rightarrow G \text{ is commutative.}$$

$$a(bc) = c(ba) = c(ab) = (ab)c \quad (\text{Since } G \text{ is commutative})$$

$$a(bc) = (ab)c \Rightarrow G \text{ is associative}$$

$\therefore G$ is a commutative semigroup.

3.3 Theorem: Let G be a RA-semigroup with right identity. If G is left alternative then G is a commutative semigroup.

Proof: G is an RA-semigroup

Let G is left alternative then,

$$aa.b = a.ab \quad \forall a, b \in G.$$

$$aa.b = a.ab = b.aa \Rightarrow a^2b = b.a^2$$

$$\text{Now replace } a \text{ by } e \text{ we have, } e^2.a = a.e^2 \Rightarrow a.e = e.a$$

$$\text{Since } e \text{ is the right identity in } G \text{ we have } a.e = e.a = a \Rightarrow e \text{ is the identity in } G$$

Now by right invertive law and identity in G we have,

$$ab = a(be) = e(ba) = ba \Rightarrow G \text{ is commutative}$$

and by commutativity and right invertive law we have,

$$a(bc) = c(ba) = c(ab) = (ab)c \Rightarrow G \text{ is associative}$$

$\therefore G$ is a commutative semigroup

3.4 Theorem : A commutative RA-semigroup is,

(i) Associative

(ii) Permutable

(iii) Self-Dual

(iv) Bi-commutative

(v) Alternative

(vi) Paramedial

(vii) Nuclear square

Proof: Let G is a commutative RA-semigroup

(i) Consider $a(bc) = c(ba) = c(ab) = (ab)c \Rightarrow a(bc) = (ab)c \Rightarrow G$ is associative

(ii) Let G be a commutative RA-semigroup, then

Consider $a(bc) = c(ba) = c(ab) = b(ac) = (ac)b \Rightarrow a(bc) = b(ac) \Rightarrow G$ is right permutable

similarly $a(bc) = c(ba) = c(ab) = b(ac)$ i.e., G is left permutable.

(iii) Consider $a(bc) = c(ba)$

By using commutativity on both sides we get,

$$a(bc) = c(ba) \Leftrightarrow (bc)a = c(ab) \Leftrightarrow (cb)a = (ab)c$$

Right invertive law $\Leftrightarrow$ Left invertive law. $\Rightarrow G$ is Self-Dual RA-semigroup.

(iv) Consider $a(bc)$ & $(ab)c$

Since G is commutative, we have

$$a(bc) = a(cb) \quad (\text{commutativity})$$

$$(ab)c = (ba)c \quad (\text{commutativity})$$

$$\Rightarrow G \text{ is Bi-commutative.}$$

(v) $a(ab) = b(aa) = (aa)b \Rightarrow G$ is left alternative.

$$a(bb) = b(ba) = b(ab) = (ab)b \Rightarrow G \text{ is right alternative}$$

$$\Rightarrow G \text{ is an alternative RA-semigroup.}$$

(vi) Consider $(ab)(cd) = (cd)(ab)$ (commutativity)

$$= (dc)(ba) \quad (\text{commutativity})$$

$$= (db)(ca) \quad (\text{medial law})$$

$$\Rightarrow G \text{ is paramedial}$$

(vii) since Commutativity $\Rightarrow$ Associativity we have,

$$a^2(bc) = (a^2b)c, (ab)c^2 = a(bc^2), (ab^2)c = a(b^2c). \quad \forall a, b, c, \in G \Rightarrow G \text{ is a nuclear square.}$$

3.5 Theorem : Let G be an RA-semigroup. Then G is a commutative semigroup if G satisfies any one of the following.

(i) G is slim RA-semigroup

(ii) G is left alternative

(iii) G is right alternative satisfying cross-cancellation

(iv) Idempotent and paramedial

(v) Left commutative with right cancellation

(vi) Right commutative with left cancellation

(vii) Self - dual with right identity

(viii) Left transitive

(ix) Right transitive

Proof: Let G be an RA-semigroup and let $a, b, c, \in G$

(i) Let G be a slim RA-semigroup. Then, $a(bc) = ac$

Consider $ab = a(bb) = b(ba) = ab \Rightarrow ab = ba \Rightarrow G$ is commutative.

(ii) Let G be a left alternative RA-semigroup

By left alternativity in G we have, $(aa)b = a(ab) \quad \forall a, b \in G$.

Using right invertive law on the right we get $(aa)b = b(aa) \quad \forall a, b \in G$.

$\Rightarrow G$ is commutative.

(iii) Let G is right alternative RA-semigroup satisfying cross-cancellation

Since G is right alternative we have, $(ab)b = a(bb) \quad \forall a, b \in G$.

Using right invertive law on the right we get $(ab)b = b(ba)$

using cross-cancellativity in G we have $ab = ba \quad \forall a, b \in G \Rightarrow G$ is commutative.

(iv) Let G be an idempotent RA-semigroup. Then $a^2 = a \quad \forall a \in G$.

Let G be paramedial then, $(ab)(cd) = (db)(ca)$

Consider $ab = (ab)^2 = (ab)(ab) = (bb)(aa) = b^2a^2 = ba \Rightarrow ab = ba \Rightarrow G$ is commutative

(v) Let G be a left commutative Ra-semigroup with right cancellativity

G is left commutative we have, $(ab)c = (ba)c \quad \forall a, b, c \in G$.

cancellativity in G we have $ab = ba \quad \forall a, b \in G \Rightarrow G$ is commutative

(vi) Let G be a right commutative using right RA-semigroup.

Since G is right commutative we have, $a(bc) = a(cb) \quad \forall a, b, c \in G$.

using left cancellativity in G we have $bc = cb \Rightarrow G$ is commutative.

A(vii) Let G be an RA-semigroup with right identity. Then $ae = a \quad \forall a \in G$.

Let G be self-dual then, $(ab)c = (cb)a$

Consider $ea = (ee)a = (ae)e = ae = a \Rightarrow eaa \Rightarrow e$ is the left identity $\Rightarrow e$ is the identity

Now $ab = a(be) = e(ba) = ba \Rightarrow ab = ba \Rightarrow G$ is commutative

(viii) Let G be a left transitive RA-semigroup

By left transitive condition in G we have, $bc = bb.bc$

$bb.bc = bb(bb.bc) \quad (\text{Since } bc = bb.bc).$

Using right invertive law on the right we get

$bc = bb(bb.bc) = bc(bb.bb) = bc.bb = cb \quad (\text{by left transitivity in } G)$

Thus $bc = cb \Rightarrow G$ is commutative.

(ix) Let G be a right transitive RA-semigroup

By right transitive condition in G we have, $ac = ac.aa = (a.ac)(a.aa)$

Using right invertive law on the right we get $ac = (c.aa)(a.aa) \quad (\text{by right transitivity in } G)$

$= ca \quad (\text{by right transitivity in } G)$

Thus $ac = ca \Rightarrow G$ is commutative.

In RA-semigroups always commutativity implies associativity.

Hence in all the above cases G is associative and hence G is a commutative semigroup.

3.6 Theorem: Let G be a left-cancellative RA-semigroup. Then G is transitively commutative.

Proof: Let G be an RA-semigroup. Let $a, b, c \in G$ such that $ab = ba$ and $bc = cb$.

By right invertive law in G we have,

$$a(bc) = c(ba)$$

Since $ab = ba$ and $bc = cb$ we have,

$$a(cb) = c(ab) \Rightarrow b(ca) = b(ac)$$

using left-cancellation we get, $ca = ac$

$$ab = ba \text{ and } bc = cb \Rightarrow ca = ac \Rightarrow G \text{ is transitively commutative}$$

3.7 Theorem: Let G be an RA- semigroup. Then G is transitively commutative if ,

(i) G is left transitive

(ii) G is right transitive

Proof:

(i) Let G be a left transitive RA-semigroup $\Rightarrow ac = ba.bc \quad \forall a, b, c \in G$

Let $ab = ba$ and $bc = cb$.

Now we use the above assumptions and right invertive law to show that $ac = ca$

Consider $ac = ba.bc$

$$\begin{aligned} &= ba.cb \quad (bc=cb) \\ &= b(c.ba) \quad (\text{right invertive law}) \\ &= b(a.bc) \quad (\text{right invertive law}) \\ &= bc.ab \quad (\text{right invertive law}) \\ &= bc.ba \quad (ab = ba) \\ &= ca \quad (G \text{ is left transitive}) \end{aligned}$$

$$ab = ba \text{ \& } bc = cb \Rightarrow ac = ca \quad \forall a, b, c \in G$$

$$\Rightarrow G \text{ is transitively commutative}$$

(ii) Let G be a right transitive RA-semigroup $\Rightarrow ac = ab.cb \quad \forall a, b, c \in G$

Let $ab = ba$ and $bc = cb$.

Now we use the above assumptions and right invertive law to show that $ac = ca$

Consider $ac = ab.cb$

$$\begin{aligned} &= ba.cb \quad (bc=cb) \\ &= b(c.ba) \quad (\text{right invertive law}) \\ &= b(a.bc) \quad (\text{right invertive law}) \\ &= b(a.cb) \quad (bc = cb) \\ &= cb.ab \quad (\text{right invertive law}) \\ &= ca \quad (G \text{ is left transitive}) \end{aligned}$$

$$ab = ba \text{ \& } bc = cb \Rightarrow ac = ca \quad \forall a, b, c \in G \Rightarrow G \text{ is transitively commutative}$$

3.8 Theorem: Let G be a RA- semigroup with the condition $a(bc)=ac$ for all a, b, c in G . Then G is,

- (i) Left commutative
- (ii) Right commutative
- (iii) Transitively commutative

Proof: Let G be an RA-semigroup

And let $a, b, c \in G$ such that $a(bc)=ac$

(i) To show that G is left commutative , we have to show $(ab)c = (ba)c$

For this consider $(ab)c$

Using right invertive law, medial law and slim groupoid property we show that G is left commutative.

$$(ab)c = (ab)(bb(c)) = c(bb.ab) = c(ba.bb) = c(b(b.ba)) = c(b(ba)) = (ba)(bc) = (ba)c$$

$(ab)c = (ba)c \Rightarrow G$ is a left commutative RA-semigroup

(ii) To show that G is right commutative , we have to show $a(bc) = a(cb)$

Using right invertive law, medial law and slim groupoid property we show that G is right commutative.

$$a(bc) = a(cc(bc)) = a(cb.cc) = a(c(c.cb)) = a(c(cb)) = a(cb)$$

$$a(bc) = a(cb) \Rightarrow G \text{ is a right commutative RA-semigroup}$$

(iii) Let $a, b, c \in G$ such that $a(bc)=ac$

and let $ab = ba$ & $bc = cb$

$$\text{Consider } ac = a(bc) = a(b(bc)) = a(c(bb)) = a(bb) = ab \text{ ----(1)}$$

$$\text{And } ab = ba = b(ca) = b(c(ca)) = b(a(cc)) = b(cc) = bc \text{ -----(2)}$$

$$\text{Again } bc = cb = c(ab) = c(a(ab)) = c(b(aa)) = c(aa) = ca \text{ -----(3)}$$

$$\text{From (1), (2) \& (3) } ac = ab = ba = bc = cb = ca \Rightarrow ac = ca$$

$$\Rightarrow G \text{ is transitively commutative RA-semigroup}$$

3.9 Theorem: Let G be an RA-semigroup with the identity $a(bc) = (ac)b \forall a, b, c \in G$. Then G is left commutative

Proof: G is an RA-semigroup with the identity $a(bc) = (ac)b \forall a, b, c \in G$.

$$\text{Consider } (ab)c = a(cb) \text{ (by the assumption } a(bc) = (ac)b \text{)}$$

$$= b(ca) \text{ (right invertive law)}$$

$$= (ba)c \text{ (by the assumption } a(bc) = (ac)b \text{)}$$

$$(ab)c = (ba)c \quad \forall a, b, c \in G \Rightarrow G \text{ is left commutative}$$

3.10 Theorem: Let G be (right commutative) RC-RA-semigroup. Then G is a commutative semigroup if,

- (i) G has right identity
- (ii) G is cancellative

Proof: G is a right commutative RA-semigroup

(i) Let e be the right identity in G

$$\text{Consider } ab = a(be) = a(eb) = b(ea) = b(ae) = ba \Rightarrow G \text{ is commutative}$$

$$G \text{ is commutative} \Rightarrow G \text{ is associative} \Rightarrow G \text{ is commutative semigroup.}$$

(ii) G is right commutative $\Rightarrow a(bc) = a(cb) \forall a, b, c \in G$.

by left cancellativity we have, $bc = cb \Rightarrow G$ is commutative

G is commutative $\Rightarrow G$ is associative $\Rightarrow G$ is commutative semigroup.

4 ANTI-COMMUTATIVITY OF RA-SEMIGROUPS.

4.1 Theorem : Let G be an anti-commutative RA-semigroup with right identity 'e'. Then ,

(i) G is quasi-cancellative.

(ii) G is unipotent

(iii) G is RA-3-band

Proof:

Let G be an anti-commutative RA-semigroup with right identity. Then, $\forall a, b, c \in G$ we have

$$a(bc) = c(ba) \quad \text{-----}(I)$$

$$ab = ba \Rightarrow a=b \quad \text{-----}(II)$$

$$(ab)c = (ac)b \quad \text{-----}(III)$$

$$ab = cd \Rightarrow ba = dc \quad \text{-----} (IV)$$

(i) Let $a^2 = ab \Rightarrow aa=ab \Rightarrow aa=ba \Rightarrow ab = ba \Rightarrow a=b$ (Since G is anti-commutative)

$$a^2 = ab \Rightarrow a=b$$

Similarly let, $b^2=ba \Rightarrow bb=ba \Rightarrow bb=ab \Rightarrow ba=ab \Rightarrow a = b$ (Since G is anti-commutative)

$$b^2 = ba \Rightarrow a=b$$

Hence G is quasi-cancellative

(ii) consider $a^2b^2 = aa.bb$

By medial law $a^2b^2 = ab.ab$

By (iv) $b^2a^2 = ab.ab = aa.bb = a^2b^2$

By anti-commutativity in G $b^2a^2 = a^2b^2 \Rightarrow a^2=b^2 \Rightarrow G$ is unipotent

(iii) Consider $a(aa)$

$$\text{by right invertive law} \quad a(aa) = aa.aa$$

$$\text{by (IV)} \quad (a.aa)a = aa.aa$$

again using right invertive law on the right, $(a.aa)a = a(aa)$

from anti-commutativity property $a.aa = a \Rightarrow G$ is RA-3-band.

4.2 Theorem : Let G be an anti-commutative RA-semigroup . Then ,

G is transitively commutative.

Proof: Let G be an anti-commutative RA-semigroup

And let $a, b, c \in G$ such that $ab = ba$ & $bc = cb$

Now we have to show that $ac = ca$

Since G is anti-commutative, $ab = ba \Rightarrow a = b$

$$\text{and} \quad bc = cb \Rightarrow b = c$$

$$a = b \text{ \& } b = c \Rightarrow a = c \Rightarrow ac = ca$$

$ab = ba$ & $bc = cb \Rightarrow ac = ca \Rightarrow G$ is transitively commutative.

G is anti-commutative $\Rightarrow G$ is transitively commutative

4.3 Theorem : Let G be an anti-commutative RA-semigroup . Then G is an RA-semigroup band if and only if G is locally associative.

Proof:

(i) Let G be a RA-semigroup band

$$\text{then } a^2 = a \quad \forall a \in G$$

clearly we have $a^2a = aa^2 \Rightarrow G$ is locally associative

(ii) Let G be locally associative

$$\text{then } a^2a = aa^2 \quad \forall a \in G$$

By anti-commutativity in G we have $a^2 = a \Rightarrow G$ is an RA-semigroup band

4.4 Theorem : Let G be an anti-commutative RA-semigroup. If G is paramedial then G is,

(i) Unipotent

(ii) Rectangular

Proof: Let G be an anti-commutative paramedial RA-semigroup

(i) Consider $a^2b^2 = aa.bb = ab.ab$ (medial law)

$$= bb.aa \quad (\text{paramedial law})$$

$$= b^2a^2$$

$$a^2b^2 = b^2a^2$$

By anti-commutativity of G , $a^2b^2 = b^2a^2 \Rightarrow a^2 = b^2$

$\Rightarrow G$ is unipotent.

(ii) Consider $(ab.ad)(cb.cd) = (aa.bd)(cc.bd)$ (medial law)

$$= (aa.cc)(bd.bd) \quad (\text{medial law})$$

$$= (ca.ca)(bd.bd) \quad (\text{paramedial law})$$

$$= (cc.aa)(bd.bd) \quad (\text{medial law})$$

$$= (cc.bd)(aa.bd) \quad (\text{medial law})$$

$$= (cb.cd)(ab.ad) \quad (\text{medial law})$$

$$\Rightarrow (ab.ad)(cb.cd) = (cb.cd)(ab.ad)$$

By anti-commutativity of G $(ab.ad)(cb.cd) = (cb.cd)(ab.ad) \Rightarrow G$ is rectangular

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Emerging Trends and Opportunities in Chemical Sciences & Biotechnology

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PREFACE

Chemistry and Biotechnology are complement to each other in addressing the essential needs of human beings-Water, Food, Health, Waste Management and Energy. Human diseases, for example, are treated by either small molecule drugs produced by chemistry or protein-based drugs produced by biotechnology, and environmental contaminants can be cleaned up either using chemistry or microbes. Whether a chemistry or biotechnology solution works best depends on the specific nature of the problem, and often both approaches to the problem are necessary for optimal resolution.

While technology generally aims to create tools to empower man, biotechnology aims to change man himself, to better fit him to the world. Simply put, biotechnology with the assistance of Chemistry is the application of advances made in the biological sciences, especially involving the science of genetics and its applications. Biotechnology has helped to improve food quality, quantity and processing. It also has applications in manufacturing, where simple cells and proteins can be manipulated to produce chemicals. But biotechnology is most important for its implications in health and medicine. Through genetic engineering – the controlled alteration of genetic material – scientists have been able to create new medicines, including interferon for cancer patients, synthetic human growth hormone and synthetic insulin, among others. In recent years, scientists have also attempted to employ the methods of genetic engineering to correct certain inherited conditions, and have been making great strides in their ability to manipulate genetic materials. These advances suggest the prospect of human control over the very genetic makeup of man, and thus the ability to manipulate our inherited traits. The consequences of man's growing power over human genetics are enormous, and they become ever more immediate each day. Many observers have suggested that just as the late 20th century has been the age of computer technology, so the early 21st century will be the age of biotechnology.

The deliberations from the expertise people in the field of Biotechnology and Chemistry made the National Seminar a fruitful one. The outcome that is the

recent advancement in the fields of Biotechnology and Chemistry will definitely cater the needs of academicians, researchers, scientists, industrial management and more particular to governmental agencies while formulating the public policies with regard to public health and environmental protection. This Seminar stands as a forum to exchange the expertise knowledge with the participants and all the Technical Sessions for two days motivated the students to go further studies in research. Biotechnology and Chemistry plays pivotal role in pharmaceutical sector which directly linked with human health. The forum felt the need of tremendous research in Biotechnology and Chemistry which should bring the medicine and treatment to the common man at his affordable prices.

This book is a collection of research and review articles presented at the National Seminar. The article covers various facets of Biotechnology and Chemistry and its allied fields. The contributors besides describing the present state of the role of Biotechnology and Chemistry and have provided constructive suggestions in enhancing the importance of the subject in green synthesis. Hope the literature contained in this book would definitely add substantial knowledge and opportunities to go for research for betterment of human life and to achieve Green World where the people live in the conditions of without deprivation of any in human and unhygienic conditions and also achieve all round personality development in all spheres of life.

We here with acknowledging our sincere gratitude to AP Commissionerate of Collegiate Education, Amaravathi, AP State Council of Higher Education, Hyderabad, University Grants Commission, SERO, Hyderabad, **Dr.N.Rangaswamy**, Principal, **Dr. P. Padmasree**, Vice Principal and College administration. Finally, I express my heart felt gratitude to **Dr.T.S.Shyam Prasad**, Lecturer in Political Science, Government College (Autonomous), Anantapuramu for his continuous patronage in bringing this volume.

Dr. V. Saleem Basha

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While it seems the spider silk idea has been put on the shelf for the time being, it is a technology that is sure to appear again in the future, once more information is gathered on how the silks are woven.

CONCLUSION

From all the facts that have been discussed above biotechnology is known to influence every aspect of human health. Biotechnology has offered modern medical devices for diagnostic and preventive purposes, which include diagnostic test kits, vaccines and radio-labeled biological therapeutics used for imaging and analysis. Malnutrition mainly arises due to the lack of essential nutrients and vitamins in food and ultimately results in death. Biotechnology has play a major role in eliminating these problems by producing nutrients enriched food such as Golden Rice, Maize, potato and soybean etc. Pollutants and untreated waste are a great hazard to human health and are potential cause of cancer. Biotechnology has evolved numerous strategies to biodegrade these pollutants by making use of microorganism. Precipitation of heavy metals and bioremediation of pollutants are the major advantages of biotechnology UNICEF and Organization.

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26. Role of Computers in Life Sciences- A Sudy

N. ERSHAD HUSSAIN

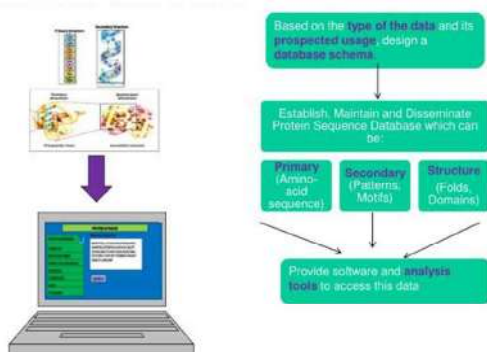
Dept. of Computers SKLNS Amrutavalli Mahila Degree Kalasala Kadiri, Anantapuram Dist. A.P

Computational biology

Computational biology, a branch of biology involving the application of computers and computer science to the understanding and modeling of the

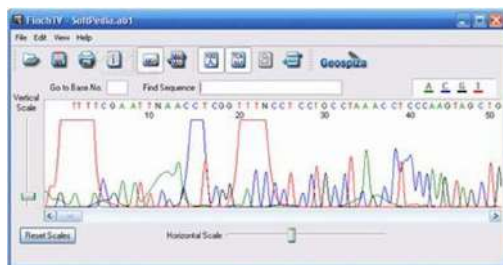
structures and processes of life. It entails the use of computational methods (e.g., algorithms) for the representation and simulation of biological systems, as well

as for the interpretation of experimental data, often on a very large scale.

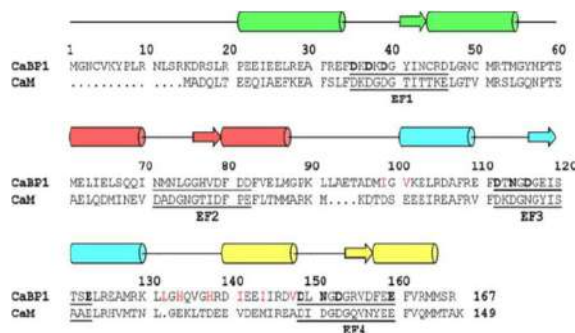


The beginnings of computational biology essentially date to the origins of computer science. British mathematician and logician Alan Turing, often called the father of computing, used early computers to implement a model of biological morphogenesis (the development of pattern and form in living organisms) in the early 1950s, shortly before his death. At about the same time, a computer called MANIAC, built at the Los Alamos National Laboratory in New Mexico for weapons research, was applied to such purposes as modeling hypothesized genetic codes. (Pioneering computers had been used even earlier in the 1950s for numeric calculations in population genetics, but the first instances of authentic computational modeling in biology were the work by Turing and by the group at Los Alamos.)

By the 1960s, computers had been applied to deal with much more-varied sets of analyses, namely those examining protein structure. These developments marked the rise of computational biology as a field, and they originated from studies centered on protein crystallography, in which scientists found computers indispensable for carrying out laborious Fourier analyses to determine the three-dimensional structure of proteins.



Starting in the 1950s, taxonomists began to incorporate computers into their work, using the machines to assist in the classification of organisms by clustering them based on similarities of sets of traits. Such taxonomies have been useful particularly for phylogenetics (the study of evolutionary relationships). In the 1960s, when existing techniques were extended to the level of DNA sequences and amino acid sequences of proteins and combined with a burgeoning knowledge of cellular processes and protein structures, a whole new set of computational methods was developed in support of molecular phylogenetics. These computational methods entailed the creation of increasingly sophisticated techniques for the comparison of strings of symbols that benefited from the formal study of algorithms and the study of dynamic programming in particular. Indeed, efficient algorithms always have been of primary concern in computational biology, given the scale of data available, and biology has in turn provided examples that have driven much advanced research in computer science. Examples include graph algorithms for genome mapping (the process of locating fragments of DNA on chromosomes) and for certain types of DNA and peptide sequencing methods, clustering algorithms for gene expression analysis and phylogenetic reconstruction, and pattern matching for various sequence search problems.



Beginning in the 1980s, computational biology drew on further developments in computer science, including a number of aspects of artificial intelligence (AI). Among these were knowledge representation, which

contributed to the development of ontologies (the representation of concepts and their relationships) that codify biological knowledge in “computer-readable” form, and natural-language processing, which provided a technological means for mining information from text in the scientific literature. Perhaps most significantly, the subfield of machine learning found wide use in biology, from modeling sequences for purposes of pattern recognition to the analysis of high-dimensional (complex) data from large-scale gene-expression studies.

Applications of computational biology

Initially, computational biology focused on the study of the sequence and structure of biological molecules, often in an evolutionary context. Beginning in the 1990s, however, it extended increasingly to the analysis of function. Functional prediction involves assessing the sequence and structural similarity between an unknown and a known protein and analyzing the proteins’ interactions with other molecules. Such analyses may be extensive, and thus computational biology has become closely aligned with systems biology, which attempts to analyze the workings of large interacting networks of biological components, especially biological pathways.

A Partially sequence genome

Biochemical, regulatory, and genetic pathways are highly branched and interleaved, as well as dynamic, calling for sophisticated computational tools for their modeling and analysis. Moreover, modern technology platforms for the rapid, automated (high-throughput) generation of biological data have allowed for an extension from traditional hypothesis-driven experimentation to data-driven analysis, by which computational experiments can be performed on genome-wide databases of unprecedented scale. As a result, many aspects of the study of biology have become unthinkable without the power of computers and the methodologies of computer science.

Distinctions among related fields

How best to distinguish computational biology from the related field of bioinformatics, and to a lesser extent from the fields of mathematical and theoretical biology, has long been a matter of debate. The terms *bioinformatics* and *computational biology* are often used interchangeably, even by experts, and many feel that the distinctions are not useful. Both fields fundamentally are computational approaches to biology. However, whereas bioinformatics tends to refer to data management and analysis using tools that are aids to biological experimentation and to the interpretation of laboratory results, computational biology typically is thought of as a branch of biology, in the same sense that computational physics is a branch of physics. In particular, computational biology is a branch of biology that is uniquely enabled by computation. In other words, its formation was not defined by a need to deal with scale; rather, it was defined by virtue of the techniques that computer science brought to the formulation and solving of challenging problems, to the representation and examination of domain knowledge, and ultimately to the generation and testing of scientific hypotheses.

Computational biology is more easily distinguished from mathematical biology, though there are overlaps. The older discipline of mathematical biology was concerned primarily with applications of numerical analysis, especially differential equations, to topics such as population dynamics and enzyme kinetics. It later expanded to include the application of advanced mathematical approaches in genetics, evolution, and spatial modeling. Such mathematical analyses inevitably benefited from computers, especially in instances involving systems of differential equations that required simulation for their solution. The use of automated calculation does not in itself qualify such activities as computational biology. However, mathematical modeling of biological systems does overlap with computational biology, particularly where simulation for purposes of prediction or hypothesis

generation is a key element of the model. A useful distinction in this regard is that between numerical analysis and discrete mathematics; the latter, which is concerned with symbolic rather than numeric manipulations, is considered foundational to computer science, and in general its applications to biology may be

considered aspects of computational biology.

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27. Biodiversity & Human Sustainability

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Biodiversity's important

Biodiversity reflects the number, variety and variability of living organisms. It includes diversity within species, between species, and among ecosystems. The concept also covers how this diversity changes from one location to another and over time. Indicators such as the number of species in a given area can help in monitoring certain aspects of biodiversity.

Biodiversity is everywhere, both on land and in water. It includes all organisms, from microscopic bacteria to more complex plants and animals. Current inventories of species, though useful, remain incomplete and insufficient for providing an accurate picture of the extent and distribution of all components of biodiversity. Based on present knowledge of how biodiversity changes over time, rough estimates can be made of the rates at which species become extinct.

Ecosystem services are the benefits people obtain from ecosystems. Biodiversity plays an important role in the way ecosystems function and in the many services they provide. Services include nutrients and water cycling, soil formation and retention, resistance against invasive species, pollination of plants, regulation of climate, as well as pest and pollution control by ecosystems. For ecosystem services it matters which species are abundant as well as how many species are present.

Biodiversity loss is an anxiety

Biodiversity provides many key benefits to humans that go beyond the mere provision of raw materials.

Biodiversity loss has negative effects on several aspects of human well-being, such as food security, vulnerability to natural disasters, energy security, and access to clean water and raw materials. It also affects human health, social relations, and freedom of choice.

Society tends to have various competing goals, many of which depend on biodiversity. When humans modify an ecosystem to improve a service it provides, this generally also results in changes to other ecosystem services. For example, actions to increase food production can lead to reduced water availability for other uses. As a result of such trade-offs, many services have been degraded, for instance fisheries, water supply, and protection against natural hazards. In the long term, the value of services lost may greatly exceed the short-term economic benefits that are gained from transforming ecosystems. Unlike goods bought and sold in markets, many ecosystem services are not traded in markets for readily observable prices. This means that the importance of biodiversity and natural processes in providing benefits to humans is ignored by financial markets. New methods are being used to assign monetary values to benefits such as recreation or clean drinking water. Degradation of ecosystem



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Study on Structural and Optical Properties of Ni and Mn Codoped TiO₂ Nanomaterials and Its Application in Visible Light Photocatalytic Activity of Indigo Carmine Dye

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ABSTRACT

To enhance the photocatalytic activity of TiO₂ in visible light, nickel and manganese codoped TiO₂ (NMTs) and undoped TiO₂ nanomaterials were synthesized by varying dopant concentrations using a solgel method. As prepared nano materials were characterized by using X-ray diffraction (XRD) and its results shows anatase and rutile mixed phase was observed for codoped catalyst samples. Rough morphology, irregular particle shape and elemental composition of catalyst were identified with scanning electron microscopy (SEM) and energy dispersive X-ray spectroscopy (EDX) respectively. The Fourier transform infrared spectroscopy (FT-IR) result revealed that the substitutional doping of Mn²⁺ and Ni²⁺ into TiO₂ lattice by replacing Ti⁴⁺ in TiO₂ lattice. This was confirmed by shifting of stretching frequencies of Ti-O-Ti from 569 cm⁻¹ – 608 cm⁻¹. The catalyst (NMT2) exhibits least band gap (2.7 eV), less particle size (6.5 nm) with high surface area (135.70 m²/g) when compared to undoped TiO₂ (3.2 eV, 18.3 nm, 64.09 m²/g), which were determined by UV-visible diffused reflectance spectroscopy (UV Vis-DRS), transmission electron microscopy (TEM) and Brunauer-Emmett-Teller (BET) respectively. Based on the characterization results the efficiency of codoped catalyst were exhibits better photocatalytic degradation of indigo carmine (IC). The results show that IC has degraded within 90 minutes at doping concentrations 1.0 wt% of Ni²⁺ ion and 0.25 wt% of Mn²⁺ ion in TiO₂ (NMT2) at an optimum reaction parameter pH-3, catalyst dosage 0.080 g/L and at IC dye concentration of 0.020 g/L.

1. Introduction

In the present-day scenario, most of the textile industrial discharges contains cosmogenic azo dyes having appreciable concentrations of materials with high chemical oxygen demand and suspended solids may posing adverse effects to both human and aquatic life. Moreover, the washed dyes colours released into the effluent interfere with the transmission of sun light into water bodies. This in turn inhibits the photosynthesis activity of aquatic biota besides direct toxic effects on biota. Indigo Carmine (IC), a blue synthetic dye, is used in textile industry for dyeing of fabrics [1,2]. Heterogeneous photocatalytic oxidation using semiconductors is an effective technique for air and water decontamination. TiO₂ is generally accepted as one of the most effective photo-induced catalysts and is frequently used to oxidize organic and inorganic compounds in air and water due to its strong oxidative ability and long-term photo-stability. TiO₂ is also a very common, non-expensive and non-toxic material [3]. It exists in three crystalline structures; anatase, rutile and brookite. Anatase and rutile belong to the large bandgap semiconductors with bandgap energies of 3.2 and 3.0 eV, respectively [3]. Anatase is basically the polymorph phase which has widely been used in photo-catalytic processes for de-pollution purposes. However, it has been indicated that combination of anatase and rutile are photo-catalytically more active than pure anatase or pure rutile phases of TiO₂ separately [4].

To address this problem many researchers attempted the doping of metal ions [5] an optimum concentration of the dopants favoured to control the crystallite size of nano metal doped TiO₂, decrease in bandgap and facilitate the formation of high specific surface area [6]. According to literature survey many reports illustrated that the doping of transition metal such as Mn and Ni [7] into TiO₂ lattice causes distortion of crystal structure and electronic structure due to interaction of d- orbitals of doped transition metal ions with Ti-3d orbital below the conduction band and reduce the band gap and electronic transition energies [8]. Moreover, transition metals can also suppress the e⁻/h⁺ recombination during

irradiation. The metal doped TiO₂ was obtained by dissemination of metal nano particles, into TiO₂ matrix. An appended benefit of transition metal doping like Mn, Cr, Ni, Cu [9,10] were improved the trapping of electron to inhibit the e⁻/h⁺ recombination during irradiation of light.

In the present investigation, among all the transition metals manganese and nickel were selected for the synthesis of Mn-Ni codoped TiO₂ by using solgel method. These metals are preferred because the presence of t_{2g} orbital of d is very close to conduction band by which the absorption shifted to visible region [8,11]. Manganese has the greatest potential in permitting significant optical absorption in the visible region, through the combined effects of narrow bandgap and the introduction of intermediate bands within forbidden gap [8]. In the Mn-Ni codoped TiO₂ Mn²⁺ and Ni²⁺ ions are easily replacing the Ti⁴⁺ in TiO₂ lattice because ionic radii of Ti⁴⁺ (0.068 nm) is similar with ionic radii's of Mn²⁺ (0.078 nm) and Ni²⁺ (0.072 nm) [12]. On other hand, the introduction of Ni ions in TiO₂ lattice can form heterojunctions between n-type TiO₂ and p-type Ni oxide dopant. The presence of p-n junctions can promote the separation of electron-hole pairs through the electric junction field and facilitate the interfacial charge transfer [13].

The synthesized samples were tested for its photocatalytic efficiency using a model pollutant indigo carmine. One of the most widely used dyes in the textile industry is IC or acid blue 74, which is also used as an additive in pharmaceutical tablets and capsules and for medical diagnostic purposes [1]. However, IC dye causes irritation to the gastrointestinal tract leading to vomiting and diarrhea. It may also cause irritation to the respiratory tract. Symptoms may include coughing and shortness of breath. IC containing effluents are generated from textiles, printing, cosmetics and plastic industries, etc., [14].

2. Experimental Methods

2.1 Materials

All the chemicals used in the synthesis process were reagent grade and used without further purification. N-butyl tetra ortho titanate (Ti(OBu)₄), manganese nitrate [Mn(NO₃)₂].6H₂O and nickel nitrate [Ni(NO₃)₂].6H₂O were obtained from E-Merck Germany and used as a precursors for

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titanium, manganese and nickel for preparing undoped TiO₂ and co-doped TiO₂ catalysts respectively. Indigo carmine dye was used as a model dye pollutant procured from High Media, India.

2.2 Synthesis of Nano Catalyst

Manganese and nickel co-doped nano titania were synthesized by sol-gel method [15,16]. In this process n-Butyl ortho titanate (20 mL) was added to 40 mL of ethanol and acidified with 3.2 mL of nitric acid taken in a 150 mL pyrex glass beaker (solution-A) and stirred for 15 min. In another beaker required weight as per the dopant weight percentage of Mn and Ni from its precursors with respect to titania weight percentage were taken and added 40 mL of ethanol and then 7.2 mL of deionised water for the purpose of hydrolysis process (solution-B). Then solution-B was added to solution-A drop wise under vigorous stirring. After complete addition of solution (B), a colloidal suspension formed and continues stirring for 90 min and kept for aging for 48 h. The obtained gel was dried in an oven at 70 °C and grounded in motor and pestle and calcined at 450 °C for about 5 h in a muffle furnace. Finally, it was cooled and ground to form homogeneous powder. For preparation of undoped TiO₂ was followed without addition of nickel and manganese precursors. Following the above procedure different Mn and Ni co-doped catalysts were prepared by varying weight percentages of Mn and Ni (0.25 wt.% - 1.0 wt.%) as shown in Table 1.

Table 1 Name assigned to different weight percentages of codoped TiO₂ catalyst samples

S.No.	Dopant (Transition metal) weight percentages in TiO ₂ (Wt%)	Name assigned to codoped TiO ₂ catalyst
1	1.00 Mn 0.25 Ni	NMT1
2	0.25 Mn 1.00 Ni	NMT2
3	0.50 Mn 0.50 Ni	NMT3
4	0.25 Mn 0.75 Ni	NMT4
5	0.75 Mn 0.25 Ni	NMT5
6	Nil	undoped TiO ₂

2.3 Experimental Techniques Used for Characterization of the Catalysts

The crystalline structure of photocatalysts were determined by powder X-ray diffraction (XRD) spectra taken (PAN Analytical) using anode Cu-WL 1 ($\lambda=1.5406$ nm) radiation with a nickel filter. The applied current and voltage were 40 mA and 40 kV respectively. The average crystallite size of anatase was determined according to the Scherrer equation using full width at half maximum (FWHM) data of the selected peak. X-ray photo electron spectroscopy (XPS) was recorded with a PH1 quantum ESCA microprobe system using the AlK α line of a 250W X-ray tube as a radiation source with the energy of 1253.6 eV, 16 mA x 12.5 kV and a working pressure lower than 1×10^{-8} Nm⁻². The fitting of XPS curves was analyzed with multipack 6.0 A software. The surface area and porosity measurements were carried out with a micrometrics Gemini VII surface area analyzer. The nitrogen adsorption/desorption isotherms were recorded 2-3 times to obtain reproducible results and reported by BJH surface/volume meso pore analysis. The micro pore volume was calculated using the Frenkel-Halsey-Hill isotherm equation. Each sample was degassed at 300 °C for 2 h. The size and shape of the catalyst were recorded with TEM using JEOL/JEM 2100, operated at 200 kV. The morphology and elemental composition of the catalyst were characterized using scanning electron microscope (SEM) (ZEISS-SUPRA 55 VP) equipped with an energy dispersive X-ray (EDS) spectrophotometer and operated at 20 kV. FT-IR spectra of the samples were recorded on a FT-IR spectrometer (Nicolet Avatar 360). The Diffuse reflectance spectra (DRS) of the catalyst samples were recorded with a Shimadzu 3600 UV-Visible-DRS Spectrophotometer equipped with an integrating sphere diffuse reflectance accessory, using BaSO₄ as reference scatter. Powder samples were loaded into a quartz cell and spectra were recorded in the range of 200-900 nm. The extent of IC degradation was monitored using UV-Vis spectrophotometer (Shimadzu 1601).

2.4 Determination of Photo Catalytic Activity of the Catalyst

The photocatalytic efficiency of the synthesized catalyst, Mn and Ni codoped nanotitania was determined by degradation of IC dye under visible light irradiation in the photocatalytic reactor [17]. A high pressure 400 W (35,000 lm) mercury vapour lamp with UV filter (Orieli, 51472) was used as a visible light source. The degradation procedure was performed by taking 100 mL of dye solution of required concentration (1-10 mg/L) containing sufficient amount of the catalyst in a 150 mL Pyrex glass vessel under continuous stirring placed about 20 cm away from the light source. The running water was circulated around the sample container to filter IR radiation and also to maintain constant solution temperature in the reaction. Before irradiation of the solution was stirred in dark for 30 min <https://doi.org/10.30799/jnst.239.19050209>

to attain adsorption – desorption equilibrium of IC dye on the catalyst surface. After visible light illumination 5 mL of aliquots samples were collected from the reaction mixture using millipore syringe (0.45 μ m) at different intervals of time to observe the change in IC dye concentration by measuring the absorbance at 609 nm using UV-visible Spectrophotometer. A pH meter (Elico Digital pH meter model 111E, EI) was used for adjusting and investigation of pH variation during the degradation process. The pH of the dye solutions was adjusted prior to illumination and during the degradation process by addition of 0.1 N NaOH / 0.1 N HCl to get required pH. The percent of degradation of IC dye was calculated from the following equation [16],

$$\% \text{ of Degradation} = A_0 - A_t / A_0 \times 100$$

where, A_0 is initial absorbance of dye solution before degradation and A_t is absorbance of dye solution at time t. The optimum reaction conditions are attained by varying the reaction parameters, such as effect of dopant concentration, effect of pH, catalyst dosage and initial dye concentration.

3. Results and Discussion

3.1 XRD Study

Fig. 1 shows crystallinity, specific surface area, and structural properties of manganese and nickel codoped TiO₂ of different phases in the XRD patterns of the samples obtained after calcinations at 450 °C. All diffraction lines are relatively strong, which indicating a high crystallinity for all samples. Further, the peak positions and relative intensities of the diffraction lines match with standard diffraction data for different TiO₂ phases, i.e. anatase and rutile NMT1 –NMT5, NMT3. The anatase phase was confirmed with the Joint Committee on Powder Diffraction Standard (JCPDS) file no. 21-1272. The peaks at $2\theta= 25.28, 37.81$ and 48.05° corresponded to the (101), (004), and (200) planes of anatase. While the peaks at $2\theta= 27.29, 44.10$ and 54.32 , corresponded to the (110), (101) and (220) planes of rutile structure with the JCPDS file no. 21-1276 [18]. The existence of rutile in the nanomaterial was readily discernible from its (110) diffraction peak located at 2θ of 27.29° in the XRD pattern, because no overlapping of this peak with any other peaks from anatase occurred. Anatase phase can be also easily identified from its (101) peak located at 2θ of 25.3° , as this peak doesn't overlap with any other peaks of rutile. This result clearly demonstrates that rutile and anatase coexisted in the samples NMT1–NMT3. Further the samples NMT4 –NMT5 and undoped TiO₂ shows anatase phase only. The X-ray diffraction patterns of anatase TiO₂ nanoparticles exhibited broad peaks, indicating small sizes of the nanoparticles at 450 °C calcination temperature while the sharp peaks indicated large sizes of the nanoparticles. The average crystallite sizes of the samples were determined by calculating the Debye-Scherrer equation by using high intensity of anatase (101) and rutile (110) diffraction peaks, the results were shown in Table 3. The XRD patterns of the samples exhibited similar diffraction peaks, indicating that the obtained samples were the TiO₂ nano material consisting of anatase and rutile nanoparticles.

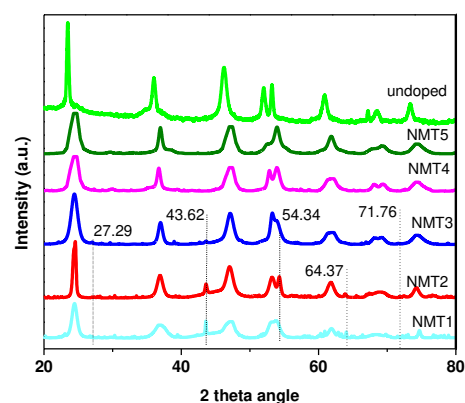


Fig. 1 XRD patterns of undoped and codoped NMTs catalysts

3.2 Scanning Electron Microscopy

The morphology and particle size of the catalyst play very important role in its photocatalytic activity [15] and were examined by the SEM. Fig. 2 shows that the SEM micrograph of the as prepared undoped and codoped NMT2 TiO₂ Nanoparticles. In the Fig. 2(a) undoped TiO₂ clearly revealed large particle size and Fig. 2(b) codoped TiO₂ shows small particle size, which leads to high surface area it correlates with BET results. The morphology has different shapes of grains with irregular

boundaries. Images of undoped TiO_2 (Fig. 2(a)) show randomly shaped and aggregated particles. HRSEM of 1.00 wt.% of Ni and 0.25 wt.% of Mn- TiO_2 (Fig. 2(b)) shows irregular tiny clusters composed of large numbers of nanoparticles with lower aggregation and better distribution. From the SEM images it can be inferred that aggregation is decreased greatly due to co-doping. The elemental composition of the prepared catalyst determined by the EDS detector was attached to a SEM shown in Fig. 2c. EDX analysis revealed that the presence of Ti, O, Ni and Mn elements.

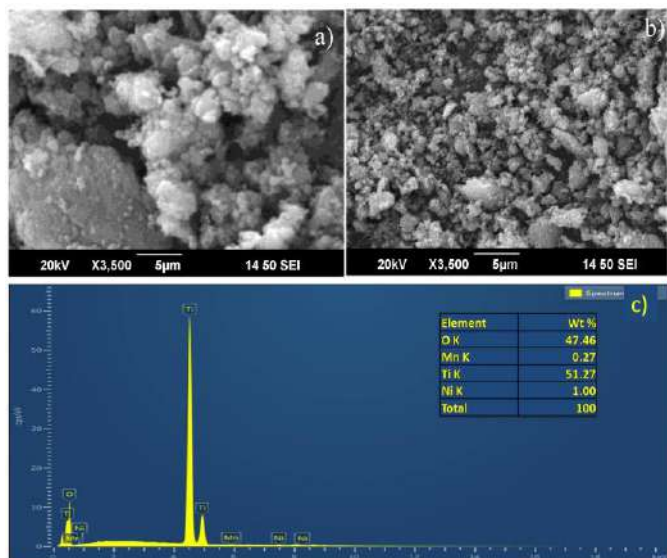


Fig. 2 SEM images a) undoped TiO_2 b) NMT2 codoped TiO_2 and c) NMT2 codoped TiO_2 EDX spectra

3.3 Transmitted Electron Microscopy Study

The particle size distribution was obtained by measuring the diameter of particles from representative TEM images. The TEM micrographs of undoped and codoped (NMT2) TiO_2 samples are shown in Figs. 3(a) and (b). From the images it is noticed that the particle size of NMT2 is smaller size compared to undoped TiO_2 . The Fig. 3c shows the catalyst particles lattice fringes with d spacing 0.33 nm corresponding to 101 planes of anatase phase of TiO_2 . The diffraction rings are observed (Fig. 3d) for codoped (NMT2) TiO_2 catalyst from SAED pattern is clearly reveals that no structural change of anatase TiO_2 was found, the planes are (101), (004), (200) and (211). Fig. 3(e) shows that the average size of the prepared nano particle is 6.5 nm, which was calculate from Gaussian fitting of the size histogram [19,20]. These results confirmed that the co-doping of Ni and Mn reduces the particle size of TiO_2 .

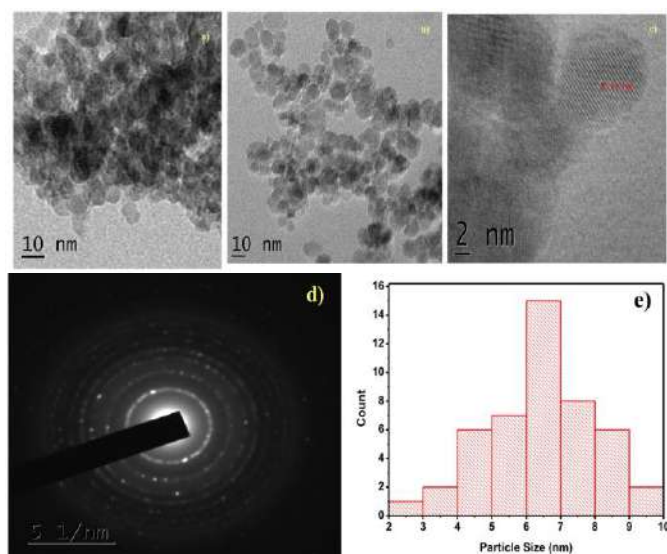


Fig. 3 TEM images a) undoped TiO_2 b) NMT2 codoped TiO_2 c) NMT2 codoped TiO_2 lattice fringes, d) SAED pattern of NMT2 and e) NMT particle size distribution

3.4 FTIR Characterization

Undoped and Ni^{2+} , Mn^{2+} codoped TiO_2 nano materials were identified by FT-IR spectra and were given in Fig. 4. The peaks appeared around at 3012 cm^{-1} , 3464 cm^{-1} , 1620 cm^{-1} – 1635 cm^{-1} [21] corresponding to stretching

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vibrations of OH belongs to Ti-OH on the surface and bending vibrations of adsorbed H-OH molecule. The strong absorption band around 569 cm^{-1} is due to stretching vibrations of Ti-O-Ti and Ti-O band in undoped TiO_2 which is in good agreement with previous studies [22]. From Fig. 4a it is seen that after codoping of Ni and Mn into TiO_2 lattice the stretching vibrations of skeletal Ti-O-Ti shifted to 569 cm^{-1} – 605 cm^{-1} indicated that Ni and Mn codoped in to TiO_2 lattice by substituting titanium [23]. Further, there is appearance of the band located at 1020 cm^{-1} for codoped TiO_2 indeed that Ni and Mn codoped into TiO_2 lattice.

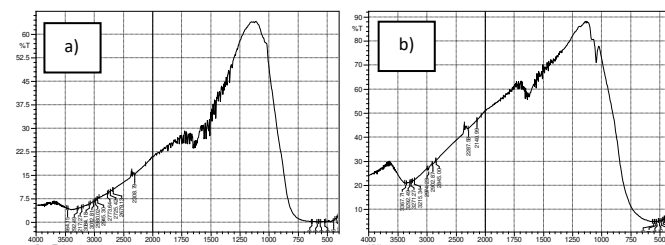


Fig. 4 FTIR spectra of a) undoped TiO_2 b) NMT2

3.5 UV DRS Study

The diffused reflectance spectra (DRS) of undoped and Ni,Mn codoped TiO_2 samples were given in Fig. 5 indicate that the absorption of the electromagnetic spectrum appeared at the visible region at about (400 nm–800 nm). NMTs (Ni and Mn) codoped samples shows remarkable decreases in band gap and extension of absorption edge towards visible light wave length (red shift). This is may be due to the formation of an extra energy level above the valance band by Ni 2p narrowing the band gap of TiO_2 [24].

This shift is associated with the doping as well as the formation of stable rutile phase of TiO_2 as illustrated in XRD. The inherent reason for red shift in the band gap is due to the change of the sp-d exchange interactions between the band electrons and the localized d-electrons of the Ni^{2+} ions [25].

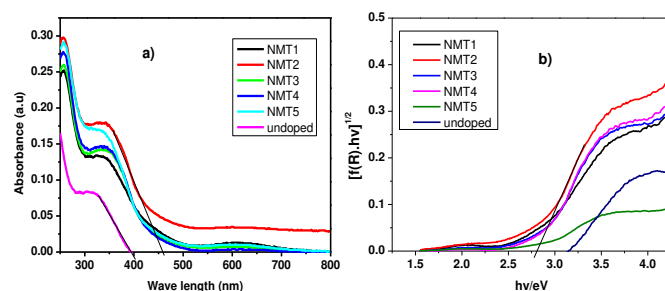


Fig. 5 (a) The DRS spectra of undoped and codoped TiO_2 with different weight % of Mn and Ni; (b) Tauc plots of the square root of the Kubelka-Munk function determining band gap energy values

The manganese ion incorporated into TiO_2 lattice and it distorts the surrounding environment which effects the conduction band through the interaction with Ti-3d orbital's which facilitate the suppresses the recombination of electron hole pairs extended the optical response energy [26]. Further it was supported by the calculated band gap energies of all the synthesized samples from the reflectance spectra using the Kubelka-Monk formalism and Tauc plot method [27] shown in Fig. 5(b). The undoped TiO_2 exhibited the band gap of 3.2 eV which is comparable with the literature value [28] and the codoped TiO_2 sample showing the band gap ranging from 2.7 to 3.01 eV. Among all the codoped samples NMT2 exhibiting less band gap energy (2.70 eV). Thus, the results indicated that all the codoped samples are visible light active and enhances the photocatalytic degradation efficiency due to formation of a greater number of photo generated electron/hole pairs. Further, when compared the band gap values of Mn and Ni single doped TiO_2 catalysts (which are obtained from literature value) the band gap of NMT2 catalyst is reduced and the values are given in Table 2 [29,30].

Table 2 The comparative band gap values of Mn and Ni single doped and Mn and Ni codoped TiO_2

S.No.	Doping elements	Catalysts Band gap energy (eV)	Reference
1	Mn	2.95	[28]
2	Ni	2.99	[29]
3	Undoped TiO_2	3.2	[27]
4	Mn and Ni	2.70	Present work

3.6 Brunauer-Emmett-Teller (BET)

The specific surface area and porosity of the mesoporous TiO₂ were investigated by using the N₂ adsorption and desorption isotherms before and after the calcination as shown in Fig. 6a. All the isotherms of samples reveal the stepwise adsorption and desorption branch of type IV curves, indicating the presence of mesoporous material having a three-dimensional (3D) intersection according to the IUPAC classification. A hysteresis loop with a stepwise adsorption and desorption branch is observed at wide range of pressure (P/P₀), and the surface area of NMT2 mesoporous TiO₂ calcined at 450 °C is 135.70 m²/g as shown in Fig. 6a. The undoped TiO₂ surface area is 64 m²/g as shown in Fig. 6a. This result indicates that the synthesized material has wider mesoporous structure. To analysis pore size and pore volume, the plots of the pore size distribution are investigated by desorption branch of the BJH method as shown in Fig. 6b. The average pore diameter of mesoporous TiO₂ calcined at 450 °C is 6.2 nm with relatively narrow pore size distribution. The pore volume of mesoporous TiO₂ is 0.22 cm³/g. However, undoped TiO₂ 10 nm pore size distribution is observed and 0.21 cm³/g pore volume is also counted. Such a physical properties of large surface area and high crystallinity with nanocrystalline aggregated is good candidate material for high photocatalytic activity. This is may be attributed that increased surface area favours the adsorption of the greater number of dye molecules on the surface of the catalyst and it enhances the degradation efficiency of the catalyst.

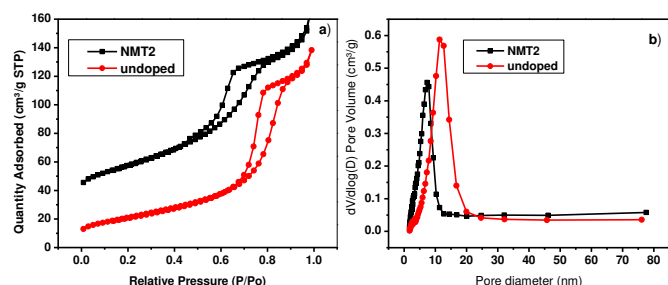


Fig. 6 (a) The N₂ adsorption-desorption isotherms and (b) pore diameter distribution curves of NMT2 codoped TiO₂

Table 3 The Results of crystallite size (XRD), Band gap (UV-Vis- DRS) and BET surface area

S.No.	Catalyst code no	Crystallite size (nm)	Band gap Energy (eV)	BET surface area analysis		
				Surface area (m ² /g)	Pore Volume (Cm ³ /g)	Pore Size (nm)
1	NMT1	7.35	2.74	113.41	0.22	7.3
2	NMT2	6.5	2.70	135.70	0.22	6.2
3	NMT3	7.31	2.78	114.06	0.22	7.3
4	NMT4	7.9	2.84	106.81	0.20	8.2
5	NMT5	8.50	3.0	88.87	0.20	9.3
6	undoped	18.3	3.20	64.09	0.21	10

3.7 Assessment of Photocatalytic Efficiency

To establish an optimum reaction parameter for efficient photocatalytic degradation of IC dye with NMT2 catalyst the experiments were carried out under visible light irradiation. The rate of degradation of dye was measuring its absorbance (at λ max - 610 nm) during the reaction at different intervals of time. Before proceeds for above process, the reactions are conducted to understand interdependency of the light, catalyst and dye. The first instance a fixed amount of dye solution was taken in a beaker and stirred for the solution 60 min in dark and exposed to visible light. In both the solution there is no decrease in the absorbance of the dye was observed. This indicated that only the visible light cannot degrade the dye. In the second instance both catalyst and dye were taken in a beaker and stirred for 60 min in dark and exposed to visible light. In dark condition slight decreases in the absorbance was noticed. These observations illustrated that in the dark reaction there is an adsorption of dye molecules on the surface of the catalyst was taken place. Hence, little decrease in the absorbance of dye was observed for the solution. In visible light these adsorbed molecules are gets degraded due to activation of the catalyst particles by expose of visible light. Hence, there is a drastic decrease in the absorbance of dye solution. This indicated that to get the degradation of the dye, light and catalyst are important factors to achieve complete degradation of the dye not only these two parameters (catalyst, Dye) but other parameters such as dopant concentration, pH of the solution, catalyst dosage and initial dye concentration are the required parameters to optimize these parameters, experiments were carried out for the degradation of IC dye by varying one of these parameters and other parameters kept constant.

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3.7.1 Effect of Dopant Concentration

The effect of dopant concentration of undoped and Ni, Mn codoped TiO₂ nano catalysts were studied for photocatalytic efficiency for degradation of indigo carmine at 10 mg/L, catalyst dosage 0.070 g/L and pH-4. The experiments results were drawn in Fig. 7. From the figure all the codoped samples shows better photocatalytic activity than that of undoped TiO₂ in visible light. But, NMT2 showed highest photocatalytic activity compared to other codoped samples. This is may be attributed that all the NMTs samples shows anatase and rutile phase with reduced bandgap and small particle size, which helps the highest rate of photo degradation of Indigo Carmine. Among all the codoped catalysts NMT2 having less band gap, it absorbs a greater number of visible light radiation by the catalyst particles and produces more e⁻/h⁺ which assist the high rate of degradation of IC.

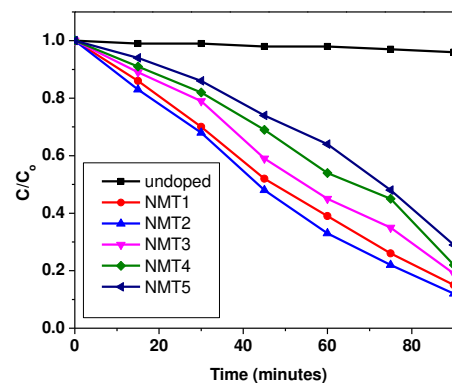


Fig. 7 Effect of dopant concentration on photocatalytic of codoped titania for rate of degradation of IC dye. Here, catalyst dosage 0.070 g/L, pH-4 and IC= 10 mg/L

3.7.2 Effect of pH

Solution pH is an important variable parameter in the evaluation of photocatalytic dye degradation efficiency of the catalyst in aqueous medium. In order to explore the effect of pH on the catalyst surface dark reactions were conducted without pH and with pH at 3, 4, 7 and 10. 5 mL of aliquots were collected every 10 min during the stirring and absorbance of dye solution was measured at 610 nm. Fig. 8a illustrates that the negligible adsorption was observed without pH, the curve observed is parallel to X-axis. From Fig. 8a at pH-3 the rate of adsorption of dye molecules were increased up to 24 min and later it become constant, this indicates that the dye molecules are adsorbed on the surface of the catalyst in a single layer, after that the adsorption may not take place. Hence, the curve becomes constant. At pH-3 the adsorption of dye molecules is very high. From Fig. 8a at pH-5 the adsorption decreases compared to pH-3 and no adsorption was observed at pH-10. At pH-3 the rate of adsorption is very high because in this dark reaction the addition of the solution order was changed as follows, catalyst solution was taken into the beaker and pH was adjusted by addition of 0.1 M HCl and stirred the solution for 15 min and the dye solution was added.

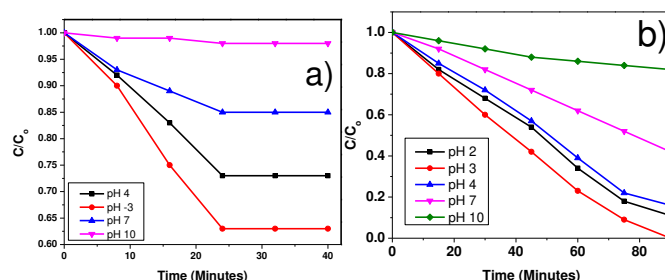
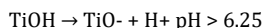


Fig. 8 a) Effect of pH in dark condition on the adsorption of IC dye, NMT2 Catalyst dosage 0.080 g/L, dye 20 mg/L b) The effect of catalyst dosage on the degradation of IC dye NMT2 catalyst, pH-3 and dye 20 mg/L

Due to the addition of the HCl solution in this order before addition of the dye solution to the catalyst surface becomes positive, which is ready for the electrostatic interaction with negative dye molecule [31]. The adsorption is very high at pH-3 up to 24 min. The effect of pH on the percentage of degradation of IC was studied by varying the pH from pH-2 to pH-10 as the adsorption of the dye on the catalyst surface is depends on the pH [32] and other parameters kept constant at catalyst dosage 0.080 g/L and initial dye concentration 10 mg/L with NMT2 catalyst. The experimental results presented in Fig. 8b indicated that at pH-3 the rate of degradation of IC was maximum. The rate of degradation of dye has to be interpreted in terms of electrostatic interaction between catalyst surface and substrate (dye) molecules. This is may be interpreted that if may

increasing the metal ion dopant concentration in the TiO₂ lattice the surface of the catalyst becomes more +ve due to formation of M-OH (M-OH= Ti-OH or Mn-OH) groups. At pH-3 more H⁺ ions are available which can attacks the OH groups of the M-OH groups and make the surface of the catalyst more +ve [33].



The presence of OH groups on the surface of the catalyst can be characterized by FT-IR OH stretching frequencies. Once the surface of the catalyst becomes +ve (at pH-3) the -ve dye molecules are electro statically interacted with +ve surface of the catalyst [34] and facilitate the reaction between OH radical, which produces at surface of the catalyst and adsorbed dye molecules. Hence, the rate of degradation increases.

3.7.3 Effect of Catalyst Dosage

A most appropriate catalyst concentration must be determined in order to avoid the catalyst wastage and provide the total absorption of photons. Hence, to obtain optimum catalyst dosage experiments were performed by changing the NMT2 catalyst concentration from 0.020 mg/L to 0.1 mg/L at fixed pH-3 and IC dye concentration 20 mg/L. From Fig. 9 the optimum catalyst dosage was found to be 0.080 mg/L which shows higher rate of degradation. At < 0.080 mg/L of catalyst dosage a moderate rate of degradation was observed due to a smaller number of catalyst particles are available for a greater number of dyes molecules. Further at > 0.080 mg/L of catalyst dosage the rate decreases even though a greater number of catalyst particles are available. This may be attributed that the catalyst dosage increases the turbidity of the solution, which retards the penetration of the light and limits the activation of the catalyst particles [35]. Hence, the rate of degradation decreases.

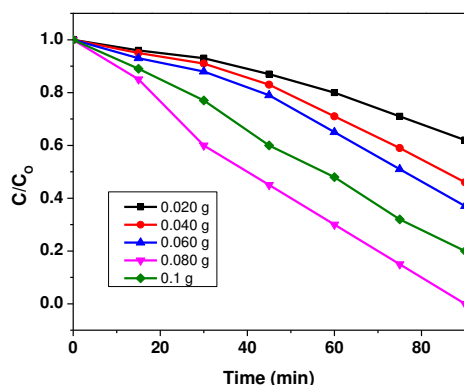


Fig. 9 Effect of NMT2 catalyst dosage, pH-3 and IC concentration 20 mg/L

3.7.4 Effect of Initial Dye Concentration

To study the effect of initial concentration of IC dye at a fixed weight of NMT2 catalyst dosage (0.080 mg/L) and at pH-3, the experiments were carried out with different concentrations of IC dye from 5 ppm to 25 ppm and results are presented in Fig. 10. These Results indicated that the rate of degradation of IC dye increased up to 20 ppm later decreases [36]. This can be explained by correlating with TEM and BET characterization results. The decreased particle size (6.5 nm) and high surface area (135.70 m²/g) the rate of dye molecules adsorbed on the surface of the catalyst increases which favours the close proximity with the •OH. It facilitates the reaction between •OH and substrate molecules and leads to high rate of degradation of IC dye.

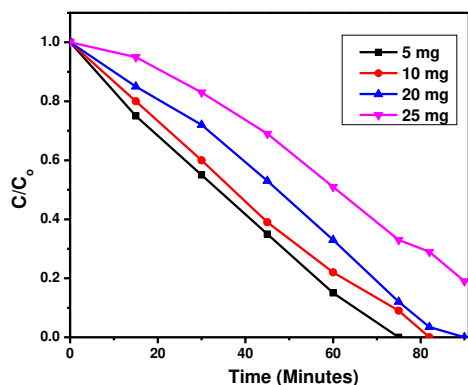


Fig. 10 IC initial concentration at pH-3, NMT2 catalyst concentration 0.080 g/L

<https://doi.org/10.30799/jnst.239.19050209>

4. Conclusion

In the present work we have successfully synthesized Ni²⁺ and Mn²⁺ co-doped TiO₂ (NMTs) nano catalysts were prepared by solgel method. All the codoped TiO₂ nano catalysts shows better photocatalytic activity than undoped TiO₂, it is experimentally proved. From the FTIR spectroscopic technique it is confirmed that Ni²⁺ and Mn²⁺ are incorporated into the TiO₂ lattice. Due to the incorporation of Ni²⁺ and Mn²⁺ into TiO₂ lattice the experimental results reveals that codoped catalysts (NMTs) shows smaller in size, larger in surface area and having less band gap values which are confirmed by XRD, BET, UV-vis DRS instrumental techniques respectively. Among all the codoped catalysts NMT2 (1.0 wt% Ni²⁺ and 0.25 wt% Mn²⁺) codoped TiO₂ nano catalyst was shows higher photocatalytic activity. This brings to form more electron capture traps, which provides high separation efficiency of photo generated carriers. Finally, the 1.0 wt% Ni²⁺ and 0.25 wt% Mn²⁺ codoped TiO₂ exhibiting the high photocatalytic activity for the degradation of 20 mg/L IC at pH-3 with 0.080 g/L catalyst weight.

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Photocatalytic Degradation of Allura Red by Mn-Ni co-doped Nanotitania under Visible Light Irradiation



Sankara Rao Miditana, Siva Rao Tirukkovalluri, Shaik Abdul Alim, Imandi Manga Raju

Abstract: Photocatalyst has been extensive interest because of it's new innovation to the reduce the contamination in the environment. A straight forward and economical procedure has been employed by sol-gel technique for the co-doping of Mn^{2+} and Ni^{2+} into TiO_2 . The co-doped and undoped photocatalysts were described by X-ray diffraction (XRD), Scanning electron microscopy (SEM), Energy dispersive X-ray Spectroscopy (EDX), Fourier transform infrared spectroscopy (FT-IR), UV-Visible Diffused Reflectance Spectroscopy (UV Vis-DRS), Transmission electron Microscopy (TEM) and Brunauer-Emmett-Teller (BET). The portrayal results shows that anatase and rutile mixed phase was observed for some co-doped nanocatalysts and the remaining catalysts exhibits anatase phase only. It was observed by FT-IR that the shifting of frequency of Ti-O-Ti in the catalysts was seen due to substitutional doping of Mn and Ni by replace Ti and O, further the photocatalysts shows rough morphology, irregular shape of particle with size (6.5nm) and having high surface area ($135.70 \text{ m}^2/\text{g}$), less band energy (2.7 eV). The photocatalytic action of these materials was assessed by the degradation of Allura red (AR) as a contaminant. The results shows that AR has degraded within 60 minutes at doping concentrations 0.25 Wt% of Mn^{2+} ion and 1.0 Wt% of Ni^{2+} ion in TiO_2 (NMT2) at an optimum reaction parameters pH-4, catalyst dose 0.070g/L and at AR initial dye concentration 0.010g/L.

Keywords: Manganese, Nickel, Allura red, Photocatalysis, Sol-gel method, co-doping, TiO_2

I. INTRODUCTION

The best compound materials gathering delivered on the planet is painting, pulp and textile ventures. During the processes of such industries pollutants enter to nature [1]. In this manner, material and painting businesses contaminations are a fundamental wellspring of the ecological natural defilements, so removal and transformation of them into innocuous mineral mixes is a significant issue. Then again, material and painting ventures are the most expending of water. Accordingly, in these ventures a lot of wastewater is coming out during different processes of industries.

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On the off chance that wastewater without purification enters to the earth, it tends to be influence water biological system with a wide range of techniques. Without a doubt, painting and its deterioration could be a noteworthy danger to the earth [2, 3]. So that, purification of wastewater is extremely fundamental before it is released to nature.

Different kind of physical and chemical techniques are utilized for this reason most significant of them is including; adsorption, reverse osmosis and precipitation methods.

These techniques just change the phase of contamination and they are focus on non-damaging procedures. In the current days water can be purified by the advance oxidation process (AOP). In this procedure, free hydroxyl radicals are utilized for debasement of contamination and transformation to innocuous mineral materials, for example, carbon dioxide, water, and mineral salts [4]. Disintegration of the intensity Of photocatalyst by utilizing titanium dioxide nanocatalyst go with UV light is among AOP that its utilization will extent [5]. Fundamental parameter for a semiconductor photocatalyst is that decrease the e-/h+ recombination in such way reduce the bandgap of semiconductor. Reduction ability of photo electrons by the low conduction band and the high level conduction band reduce the holes produced by the light. Notwithstanding appropriate energy bandgap for a semiconductor, it must be easy to produce, low cost, harmless for human beings and nature.

Heterogeneous photocatalytic oxidation utilizing semiconductors is a considerable method for air and water decontamination. TiO_2 is commonly acknowledged as one of the best photocatalyst and is regularly used to oxidize organic compounds in air and water because of its oxidative capacity and photo stability. TiO_2 is likewise a typical, non-costly and non-dangerous material [6]. Three crystalline structures are possible to the TiO_2 ; anatase, rutile and brookite. Anatase and rutile have a place with the huge bandgap semiconductors with bandgap energies of 3.2 and 3.0 eV separately [6]. Anatase is fundamentally the polymorph phase which has generally been utilized in photocatalytic process for de-contamination purposes. Compared to pure anatase or rutile, mixed phase of anatase and rutile is photocatalytically active [7]. Many researchers solved the problem by the doping of metal ions [8] an ideal concentration of the dopants favored to control the crystallite size of nano doped TiO_2 , reducing the bandgap favours to form high surface area [9]. As per the reports of literature survey represented that the doping of transition metal like Mn and Ni [10] into TiO_2 causes contortion of precious electronic structure because of collaboration of d-orbitals of doped change metal particles with Ti-3d orbital lower level of the conduction band and lessen the bandgap [11].

During the irradiation, metals also reduce the e-/h+ recombination. The metal doped TiO₂ was acquired by dispersal of metal nanoparticles into TiO₂ framework. An affixed advantage of metal doping like Mn, Cr, Ni, Cu [12-13] were improved the catching of electron to hinder the e-/h+ recombination during radiation of light.

In the present examination, Nickel and Manganese transition metals were selected for the synthesis of Mn-Ni co-doped TiO₂ by using sol-gel method. Presence of t_{2g} orbital of d of these metals is very close to conduction band that's why these metals are preferred [11, 14].

In the visible region Manganese has the best potential in allowing optical absorption, through this narrow the bandgap [11]. In the Mn-Ni co-doped TiO₂ Mn²⁺ and Ni²⁺ ions are easily replace the Ti⁴⁺ in TiO₂ lattice because ionic radii of Ti⁴⁺ (0.068nm) is similar with ionic radii's of Mn²⁺ (0.078nm) and Ni²⁺(0.072nm) [15]. On other hand, the presence of Ni particles in TiO₂ lattice can frame heterojunctions between n-type TiO₂ and p-type Ni oxide dopant. These p-n junctions are useful to separation of electron-hole through the electric field and encourage the interfacial charge move [16]. There exist different techniques for synthesis of titania nanoparticles like sol-gel process, electrochemical method, flame aerosol process, micro emulsion method, thermolysis, chemical vapor deposition, etc. [17]. Among every one of these techniques sol-gel strategy is frequently utilized and it offers the points of interest, exact command over the stoichiometry, low temperature preparation, high crystallinity and high immaculateness [18].

As prepared samples were tested for its photocatalytic capability by utilizing a model dye pollutant Allura Red (AR). AR is mostly used as coloring agent in food industry. Oxidizing and decreasing agents present in nourishments such as sugars, acids and salts, lead to some precariousness of the Allura red color, since coloring properties depends on the conjugated unsaturated framework of a molecule.

It has adverse toxic effects in reproductive system and neurobehavioral nature in animals and humans. And it is hypersensitive to asthma and skin rashes [19].

II. EXPERIMENTAL PART

A. Materials used :

Chemicals used in this method were reagent grade and used without any further purification. N-butyl tetra orthotitanate (Ti(OBu)₄), Manganese nitrate [Mn(NO₃)₂].6H₂O and Nickel nitrate [Ni(NO₃)₂].6H₂O were acquired from E-Merck Germany and used as a precursors for Titanium, Manganese and Nickel for getting ready undoped TiO₂ and co-doped TiO₂ nanoparticles separately. Allura red pollutant was used as a model pollutant from High media, India.

B. Synthesis of nanocatalyst :

By using sol-gel technique Manganese and Nickel co-doped nanotitania was prepared [20-21]. In this procedure n-Butyl orthotitanate (20mL) was added to 40 ml of ethanol and acidified with 3.2 ml of HNO₃ taken in a 150 ml pyrex glass measuring beaker (Solution-A) and then stirred for 15min. Mn and Ni dopent weights according to titania weight percentage were taken in another beaker and then add 40 ml of ethanol and after that 7.2 ml of 2D water to effective

hydrolysis process (Solution-B). Now mix the solution-B to solution-A slowly in dropwise manner with continuous stirring. After completion of mixing of solution-B sol was obtained on further vigorous stirring for 90 min and keeps mixing for 90 min and aged for 48h then form gel. The formed gel was dried at 70 °C and grounded it and calcined at 430 °C for about 5h in furnace. At long last homogeneous powder was obtained. Prepare the undoped TiO₂ in absence of dopants (Mn and Ni). Different weight percentages (0.25 Wt% - 1.0 Wt%) of Mn and Ni co-doped nanocatalysts synthesized by using above said procedure. Weight percentages of Mn and Ni are shown in Table 1.

Table.1: Name assigned to different of co-doped TiO₂ catalyst samples

S.No	Dopant (Transition metal) weight percentages in TiO ₂ (Wt%)	Name assigned to co-doped TiO ₂ Catalyst
1	1.00 Mn 0.25 Ni	NMT1
2	0.25 Mn 1.00 Ni	NMT2
3	0.50 Mn 0.50 Ni	NMT3
4	0.25 Mn 0.75 Ni	NMT4
5	0.75 Mn 0.25 Ni	NMT5
6	Nil	undoped TiO ₂

C. Experimental techniques used for characterization of the catalysts :

The crystalline structure of photocatalysts were detected by powder X-ray diffraction (XRD) spectra taken (PAN Analytical) utilizing anode Cu-WL 1 (λ=1.5406nm) radiation with a nickel channel. 40 mA and 40 kV were applied current and voltage respectively. Basing on the Scherrer equation using full width at half maximum (FWHM) crystallite size of anatase was predicted. The surface area and porosity of nanocatalysts were completed with a micrometrics Gemini VII surface area analyzer. The N₂ adsorption/desorption isotherms were recorded and noted by BJH surface/volume meso pore technique. By using Frenkel-Halsey-Hill isotherm equation pore volume was determined. Every catalyst was degassed at 300°C for 2 h. The size and geometry of samples were recorded with TEM utilizing JEOL/JEM 2100, worked at 200 kV. By the scanning electron microscopy (SEM) (ZEISS-SUPRA 55 VP) with energy dispersive X-beam (EDS) spectrophotometer, morphology and elemental composition of samples were predicted. FT-IR spectra of the nanocatalysts were recorded on a FT-IR spectrometer (Nicolet Avatar360). The Diffuse reflectance spectra (DRS) of the catalysts were recorded in the range of 200-900 nm with a Shimadzu 3600 UV-Visible-DRS Spectrophotometer using BaSO₄ as reference. The photocatalytic activity of AR dye was observed by the UV-Vis spectrophotometer (Shimadzu1601).

D. Experimental procedure to the determination of catalytic activity of nanocatalyst:

Efficiency of Mn-Ni co-doped nanocatalyst was determined by the degradation of AR pollutant under visible region [22]. Pressure of 400W (35,000 lm) mercury vapor light with UV filter (Oriol, 51472) was utilized as a noticeable light source.

The total degradation was processed by taking 100 mL of AR solution of particular concentration ($1-10 \text{ mgL}^{-1}$) containing adequate measure of the impetus in a 150 mL Pyrex glass vessel under vigorous stirring put around 20 cm away from the light source.

The running water was flowed around the nanocatalyst container to IR radiation and furthermore to keep up consistent solution temperature in the reaction. Before going to expose to radiation the dye solution stirred for 30 min in dark condition to adsorption – desorption equilibrium of AR on the surface of the catalyst.

After exposed to visible light 5 ml of aliquots tests were collected at various interims of time to watch the intensity of AR at 540 nm utilizing UV-vis Spectrophotometer. To observe the pH effect of solution pH meter (Elico Digital pH meter model 111E, EI) was used at the time of degradation process. To get required pH add 0.1 N NaOH/ 0.1 N HCl basing on the nature of testing solution. The percentage of degradation of AR pollutant was determined by the following formula [21].

$$\% \text{ of Degradation} = \frac{A_0 - A_t}{A_0} \times 100$$

Where, A_0 is starting absorbance of dye solution before debasement and A_t is absorbance at time t . The ideal conditions are achieved by differing the parameters of reaction like concentration of dopant, pH effect, dosage of catalyst and initial dye concentration and obtained results are discussed in section. IV.

III. RESULTS AND DISCUSSION

A. X-ray Diffraction study (XRD):

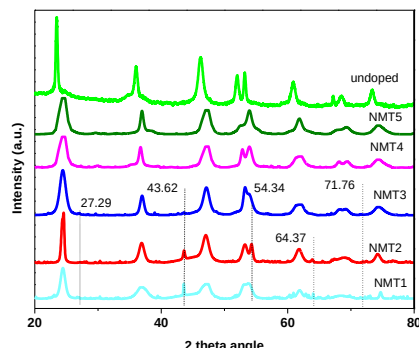


Fig.1. XRD patterns of undoped and co-doped NMT catalysts

Structural properties and crystallinity of Manganese and Nickel co-doped TiO_2 of various phases in XRD of nanocatalysts after calcination at 450°C was shown in Fig.1. All diffraction lines are generally rigid, which showing a high crystallinity for prepared catalysts. From the diffraction data it is found that anatase and rutile mixed phase is observed for NMT1, NMT2, NMT3 catalysts. The anatase stage was affirmed with the Joint Committee on Powder Diffraction Standard (JCPDS) record no. 21- 1272. Peaks are find at $2\theta = 25.28, 37.81, \text{ and } 48.05$ related to the (101), (004), and (200) planes of anatase. While the peaks at $2\theta = 27.29, 44.10 \text{ and } 54.32$, related to the (110), (101) and (220) planes of rutile structure with the JCPDS document no. 21-1276 [23]. The presence of rutile in the nanomaterial was promptly

perceivable from its (110) diffraction pinnacle situated at 2 theta of 27.29° in the XRD pattern, due to no overlapping of this peak with any other peak from anatase obtained. Anatase phase can be effectively recognized from its (101) peak situated at 2 theta of 25.3° , as this pinnacle doesn't cover with some other peaks of rutile. This outcome obviously shows that rutile and anatase coincided in the examples NMT1-NMT3. Further NMT4, NMT5 and undoped TiO_2 indicates anatase phase as it were. The crystallite sizes of prepared catalysts were predicted by the Debye–Scherrer equation by utilizing large intensity of anatase (101) and rutile (110) diffraction peaks, the outcomes were appeared in Table 3.

B. Scanning electron Microscopy & Energy dispersive Spectroscopy (SEM-EDX):

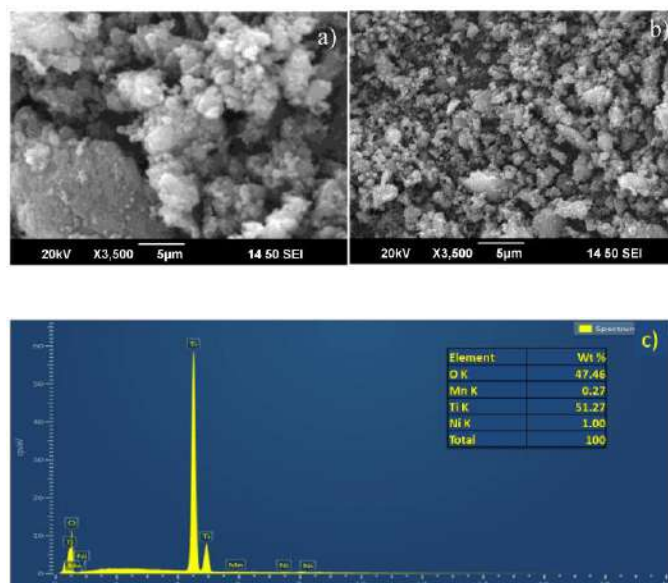


Fig.2. Sem images of a) undoped TiO_2 and b) NMT2 c) EDX spectra of NMT2

The morphology and size of the nanocatalyst assume significant job in its photocatalytic movement [20] and were tested by the SEM. Fig.2 shows that the SEM micrograph of the as prepared undoped TiO_2 and NMT2 nanocatalysts. In the Fig.2 (a) undoped TiO_2 clearly revealed large particle size and Fig. 2(b) co-doped TiO_2 shows small particle size, which leads to high surface area, correlated with BET results. The morphology has different shapes of grains with irregular boundaries. Pictures of undoped TiO_2 (Fig.2(a)) show irregular shapes and amassed particles. HRSEM of 1.00 wt% of Ni and 0.25 wt% of Mn– TiO_2 (Fig. 2(b)) indicates less agglomeration and dispersive nature when compared to undoped and rest of samples. SEM pictures reveals that due to codoping agglomeration was considerably diminished. The elemental composition of samples predicted by EDS detector, which was connected to a SEM appeared in Fig.2c. EDX investigation shows that the elements of Ti, O, Ni and Mn are present in the sample.

C. Transmission electron microscopy (TEM):

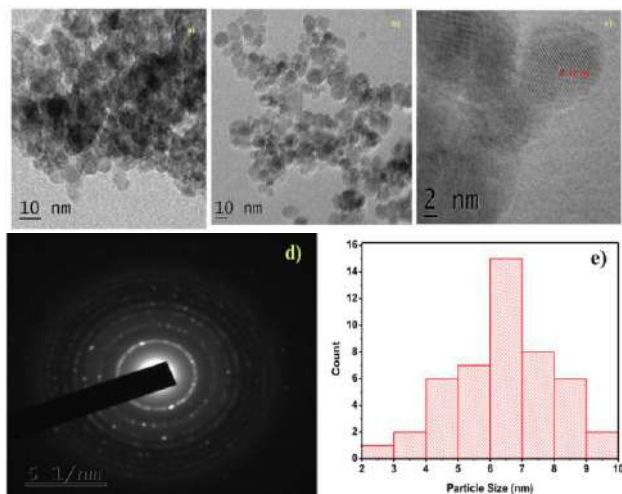


Fig. 3. TEM images of a) undoped TiO₂ and b) NMT2 c) NMT2 showing lattice fringes. d) SAED pattern of NMT2 e) NMT2 particle size distribution.

From the TEM images it was obtained that size distribution of particle by measuring the diameter of particles. The TEM micrographs of undoped and co-doped (NMT2) TiO₂ catalysts are appeared in Fig.3 (a) and (b). From the pictures it is seen that the molecule size of NMT2 is littler size when compared with undoped TiO₂. The Fig.3c demonstrates that catalyst particles lattice fringes with d spacing 0.33 nm related to 101 plane of anatase phase of TiO₂. SAED pattern indicates the no change is observed in structural arrangement of anatase TiO₂ (Fig. 3d) and the planes are (101), (004), (200) and (211). Fig.3(e) demonstrates that the average size of the nanocatalyst is 6.5 nm, which was compute from Gaussian fitting of the size Histogram [24-25]. These outcomes affirmed that the co-doping of Ni and Mn lessens the molecule size of TiO₂.

D. Fourier Transform –Infra Red Spectroscopy (FT-IR):

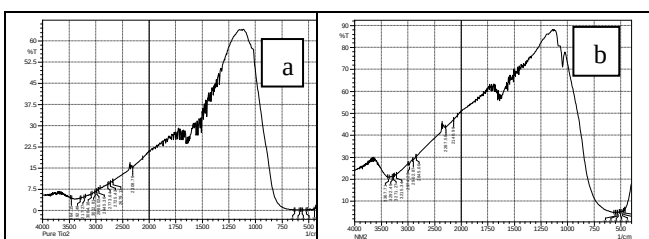


Fig.4. FTIR spectra of a) undoped TiO₂ b) NMT2

Undoped and Ni²⁺, Mn²⁺ co-doped TiO₂ nano materials were identified by FT-IR spectra and were shown in Fig.4. The obtained peaks at 3012 cm⁻¹, 3464 cm⁻¹, 1620 cm⁻¹ – 1635 cm⁻¹ [26] relating to extending vibrations of OH has a place with Ti-OH surface and bending vibrations of adsorbed H-OH. The solid assimilation band around 569 cm⁻¹ is because of extending vibrations of Ti-O-Ti and Ti-O band in undoped TiO₂ which is in great concurrence with past examinations [27]. From Fig.4a it is seen that in the wake of co-doping of Ni and Mn into TiO₂ the stretching vibrations of skeletal Ti-O-Ti moved to 569 cm⁻¹ to 605 cm⁻¹ demonstrated that Ni and Mn co-doped into TiO₂ by substituting Ti [28]. Further, there is appearance of the band located at 1020 cm⁻¹ for co-doped TiO₂ indicated that Ni and Mn are co-doped into TiO₂ lattice.

E. Ultraviolet-Visible Diffuse Reflectance Spectroscopic studies (UV-Vis-DRS)

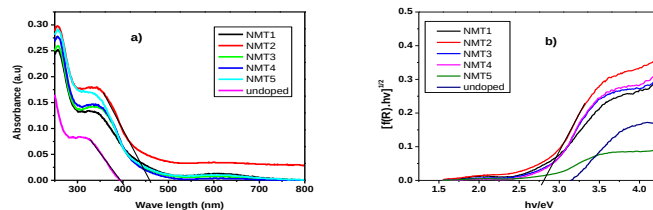


Fig. 5. (a) The DRS spectra of undoped and co-doped TiO₂ with different weight % of Mn and Ni (b) Tauc plots of the square root of the Kubelka-Munk function determining band gap energy values.

DRS spectral data of undoped and Ni, Mn co-doped TiO₂ nanocatalysts were shown in Fig.5, which shows that the assimilation of the electromagnetic spectra showed up at the visible region at around (400 nm–800 nm). NMTs (Ni and Mn) co-doped nanocatalysts gave the remarkable results in the bandgap and expansion of absorption edge towards Visible light wave length. This is might be because of the arrangement of an additional energy level over the valance band by Ni 2p narrowing the bandgap of TiO₂ [29]. This move is related with the doping just as the arrangement of stable rutile period of TiO₂ as represented in XRD. The inalienable explanation behind red shift in the bandgap is because of the difference in the sp-d cooperation between the band electrons and the restricted d-electrons of the Ni²⁺ particles [30].

The manganese particle joined into TiO₂ crystal and it contorts the encompassing condition which impacts the conduction band of TiO₂ through the collaboration with Ti-3d orbitals which encourage to restrict the recombination of electron-hole pairs and broadened the optical reaction vitality [31]. Further it was bolstered by the determined bandgap energies of all the samples from the reflectance spectra utilizing the Kubelka-Monk formalism and Tauc plot strategy [32] appeared in Fig. 5(b). The undoped TiO₂ displayed the bandgap of 3.2 eV which is similar with the literature value [33] and the co-doped TiO₂ catalysts gave the bandgap values from 2.7 to 3.01 eV. Among all the co-doped tests NMT2 showing less bandgap (2.70 eV). In this way the outcomes demonstrated that all the co-doped catalysts are visible active and increase the photocatalytic degradation because of increasingly number of electron/hole pairs. Further, when thought about the bandgap values of Mn and Ni single doped TiO₂ impetuses (which are gotten from literature) the bandgap of NMT2 catalyst is reduced and the values are shown in Table.2 [34-35].

Table: 2. The comparative band gap values of Mn and Ni single doped and Mn and Ni co-doped TiO₂

S.No	Doping elements	Catalysts Band gap energy (eV)	Reference No.
1	Mn	2.95	28
2	Ni	2.99	29
3	Undoped TiO ₂	3.2	27
4	Mn and Ni	2.70	Present work

F. Brauner-Emmett-Teller (BET)

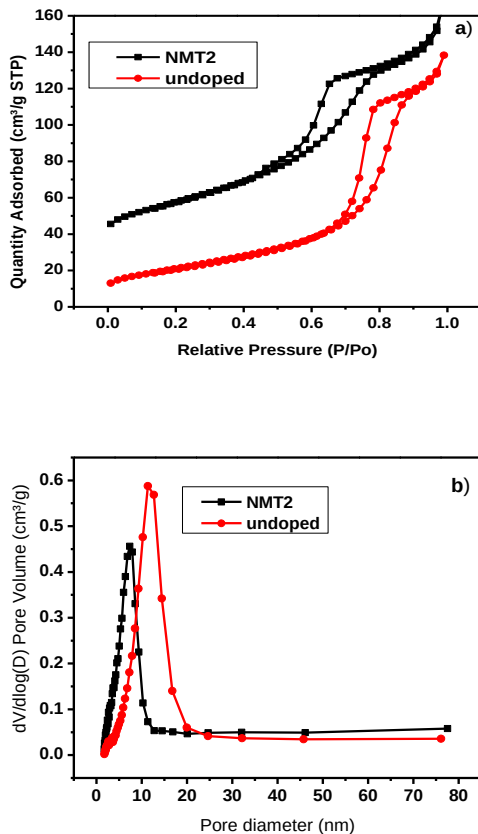


Fig.6. (a) The N_2 adsorption–desorption isotherms and (b) pore diameter distribution curves of NMT2 co-doped TiO_2

The particular surface area and porosity of the undoped TiO_2 and NMT2 were determined by utilizing the N_2 adsorption and desorption isotherms as appeared in Fig. 6a. Every one of the isotherms of synthesized samples indicates the stepwise adsorption and desorption part of type IV curves, demonstrating the mesoporous material having a three dimensional (3D) intersection as per the IUPAC order. A hysteresis loop with a stepwise adsorption and desorption branch is seen at wide range of pressure (P/P_o), and the surface area of NMT2 mesoporous TiO_2 calcined at $450^\circ C$ is $135.70\text{ m}^2/\text{g}$ as appeared in Fig.6a. The undoped TiO_2 surface area is $64\text{ m}^2/\text{g}$ as appeared in Fig.6a. This outcome shows that the material has more extensive mesoporous structure. To examination pore size and pore volume, the plots of the pore size appropriation are explored by desorption part of the BJH technique as appeared in Fig. 6b. The average pore diameter of mesoporous TiO_2 calcined at $450^\circ C$ is 6.2 nm with moderately thin pore size distribution. The pore volume of mesoporous TiO_2 is $0.22\text{ cm}^3/\text{g}$. Be that as it may, for undoped TiO_2 10 nm pore size appropriation is observed and $0.21\text{ cm}^3/\text{g}$ pore volume also considered. Such a physical properties of huge surface area and high crystallinity with nano crystalline collected is great material for high photocatalytic action. This expanded surface zone may favors the adsorption of the more number of color particles on the outside of the impetus and it increases the degradation strength of the impetus.

Table 3: The Results of crystallite size (XRD), Band gap (UV-Vis- DRS) & BET surface area.

S.No	Catalyst	Crystallite size (nm)	Band gap Energy (eV)	BET surface area analysis		
				Surface area (m^2/g)	Pore Volume (cm^3/g)	Pore Size (nm)
1	NMT1	7.35	2.74	113.41	0.22	7.3
2	NMT2	6.5	2.70	135.70	0.22	6.2
3	NMT3	7.31	2.78	114.06	0.22	7.3
4	NMT4	7.9	2.84	106.81	0.20	8.2
5	NMT5	8.50	3.0	88.87	0.20	9.3
6	Un doped	18.3	3.20	64.09	0.21	10

IV. Assessment of Photocatalytic effect of NMT2 catalyst by degradation of Allura Red (AR) dye:

To set up the ideal parameters for effective photocatalytic debasement of AR pollutant with NMT2 impetus the experiments were processed under visible light illumination. At 540 nm measure the degradation rate at different intervals. Initially the degradation process takes place in absence of light for 60 minutes to a particular amount of dye solution. Then after catalyst was added to the dye solution and exposed to visible light. These results reveals that in the absence of light the pollutant particles adsorbed to the surface of the catalyst and then when exposed to the visible light adsorbed molecules to surface are degraded. In visible light these adsorbed molecules are gets degraded due to activation of the catalyst particles by expose of visible light. Therefore the absorption of dye was diminished. This is clear evidence that light and nanocatalyst are responsible to complete degradation of dye. Not only these two parameters effect the degradation of dye but also other parameters like dopant concentration, pH effect, catalyst dosage and initial dye concentration are degraded the dye solution. Experiments carried out by varying the one of the above parameters and rest of parameters kept constant.

A. Effect of Dopant Concentration:

The impact of dopant concentration of undoped and Ni, Mn co-doped TiO_2 nanocatalysts were studied for photocatalytic effect for debasement of AR at 20 mg/L , impetus dosage 0.080 g/L and $\text{pH}-3$. The experimental values were drawn in Fig.7. From the figure all the co-doped catalysts shows preferred photocatalytic activity over that of undoped TiO_2 in visible region. Compared to other catalysts NMT2 exhibits better photocatalytic activity.

This is mainly due to the NMT2 having optimum parameters like high surface area, smaller in size.

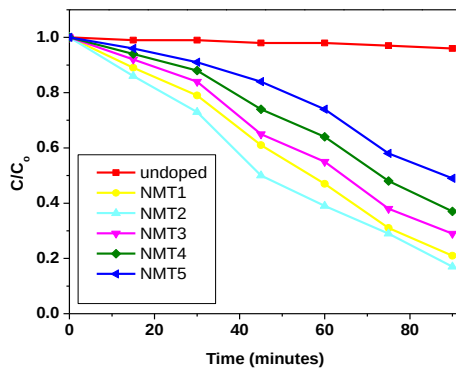


Fig.7. Effect of dopant concentration on photocatalytic of co-doped nanoitania for rate of degradation of AR dye. Here, catalyst dosage 0.080 g/L, pH-3 and [AR]= 20 mg/L
B. Effect of pH:

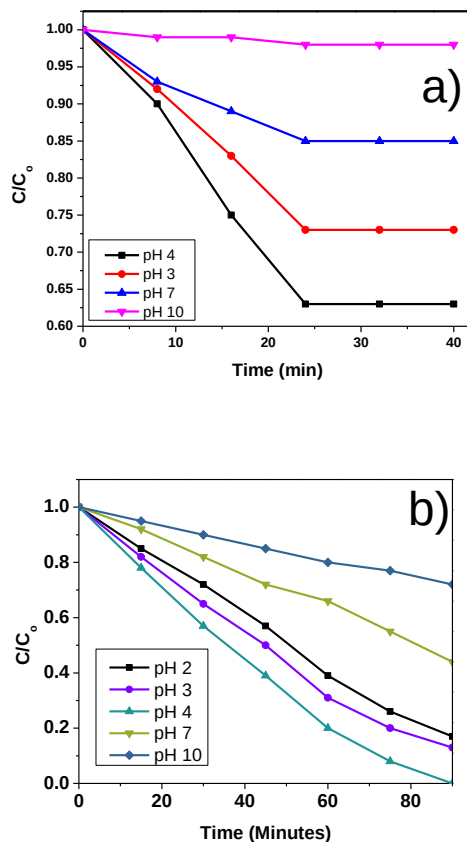
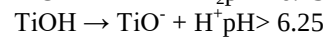
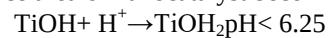


Fig.8. a) Effect of pH in dark condition on the adsorption of AR dye, here NMT2 Catalyst dosage 0.080 g/L, dye 20 mg/L b)The effect of catalyst dosage on the degradation of AR dye, here NMT2 catalyst dosage 0.080 g/L and dye 20 mg/L.

Effect of pH is plays significant role in the assessment of photocatalytic debasement of the impetus in aqueous medium. So as to investigate the impact of pH on the impetus surface dull responses were led without pH and with pH at 3, 4, 7 and 10.5 mL of aliquots were collected to every 10 min stirring and absorbance of solution of dye was estimated at 540 nm. From Fig. 8a at pH-4 the rate of adsorption of pollutant particles were expanded up to 24 min and later it become steady, this shows the color atoms are adsorbed on the surface of the impetus in a solitary layer, after that the adsorption may not occur. At pH-4 the adsorption of color atoms is extremely

high. From Fig. 8a at pH-2 the adsorption diminishes contrasted with pH-4 and no adsorption was seen at pH-10 (Fig.8a). At pH-4 the rate of adsorption is extremely high. This is due to in dark condition pH of the sample solution was adjusted by the addition of 0.1 M HCl and then stir for 15 min and then after mix the dye solution with sample solution. By the addition of HCl solution the total surface of nanocatalyst make as positive, which is favorable to the interaction with the negative poles of dye particles [36] the adsorption is exceptionally high at pH-4 up to 24 min. in this way effect of pH can be examined by differing the pH from pH-2 to pH-10 as the adsorption of the color on the impetus surface is relies upon the pH [37] and remaining parameters kept constant at impetus dosage 0.080 g/L and 20 mgL⁻¹ is taken as initial dye concentration with NMT2 impetus. The test results showed in Fig.8b reveals that at pH-4 AR gives best photocatalytic degradation rate. At pH-4 large number of H⁺ radicals are accessible which can replacethe OH of the M-OH groups and then surface area of nanocatalyst becomes more +Ve [38].



The presence of OH groups on the surface of the catalyst characterized by FT-IR OH stretching frequencies. Once the surface of the catalyst becomes +Ve (at pH-4) the -Ve dye molecules are electro statically interacted with +Ve surface of the catalyst [39] and facilitate the reaction between hydroxyl group, which produces at surface of the catalyst and adsorbed dye molecules. Hence, the rate of degradation increases.

C. Effect of catalyst dosage:

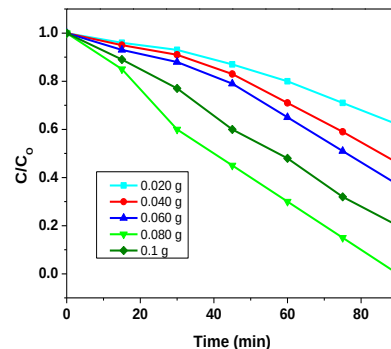


Fig.9. Effect of NMT2 catalyst dosage, here pH-4 and AR concentration 20 mgL⁻¹

Examine the catalyst at different catalyst dosage from 0.020 g/L to 0.1 g/L at constant pH-4 and the concentration dye 20 mgL⁻¹. From Fig. 9, 0.070 g/L was seen as best dosage to the degradation of pollutant molecules. At < 0.070 g/L of catalyst dosage a medium rate of degradation was observed due to less number of catalyst particles are present to large number of dyes particles. Further at >0.070 g/L of catalyst dosage the rate decreases even though the more number of catalyst particles are accessible. This was reveals that on the enhancement of catalyst dosage penetration capability of visible light into solution is decreased because of turbidity [40]. So that rate of degradation was reduced.

D. Effect of initial dye concentration:

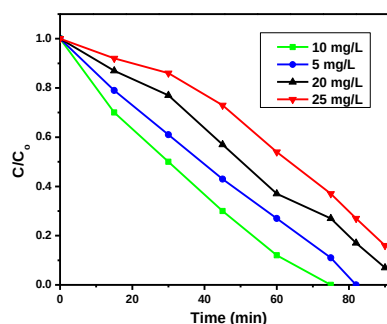


Fig. 10. Effect of AR dye initial concentration at pH-4, NMT2 catalyst concentration 0.070 gL⁻¹

This step was carried out at constant pH-4 and catalyst dosage 0.070 g/L by varying the AR dye concentration from 5 ppm to 25 ppm and the obtained reports are produced in Fig. 10. From the results it is found that up to 10 ppm, degradation considerably enhanced later on rate was diminished [41]. This can be clarified by associating with TEM and BET portrayal results. The diminished molecule size (6.5 nm) and high surface region (135.70 m²/g) the rate of dye particles adsorbed on the surface of the impetus builds which supports the closeness with the •OH. It encourage the reaction between •OH and substrate atoms and prompts high rate of debasement of AR dye.

V. CONCLUSIONS

In the current research work synthesized the Mn²⁺ and Ni²⁺ co-doped TiO₂ nanocatalysts (NMTs) by using sol-gel method. The photocatalytic activity of NMT2 is notable than compared to the remaining catalysts and undoped TiO₂, it was experimentally proved. By using various analytical techniques the photocatalysts were characterized. From the FT-IR technique it is proved that Mn²⁺ and Ni²⁺ were incorporated into crystal lattice of TiO₂. By this incorporation co-doped samples having the larger surface, smaller in size and less bandgap, which were confirmed by BET, XRD and UV-vis techniques respectively. Among all the prepared samples NMT2 (1.0 wt% Ni²⁺ and 0.25 wt% Mn²⁺) co-doped TiO₂ exhibited predominant photocatalytic activity compared to all other catalysts. It can be concluded that co-doping with transition metals is a promising route for enhanced photocatalytic degradation of pollutants.

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RA-semigroups that are L-R-cyclic Commutative Semigroups

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Abstract: A mapping $\cdot : G \times G \rightarrow G$ is a binary operation, and the pair $(G, \cdot)$ is named as a groupoid. Groupoid G with the right invertive law, $a.bc = c.ba$, $\forall a, b, c \in G$ is called as an RA-semigroup. RA-semigroup with the identity, $a.bc = c.ab = b.ac$, $\forall a, b, c \in G$ is called as L-cyclic RA-semigroup and RA-semigroup with the identity $ab.c = ca.b = bc.a$, $\forall a, b, c \in G$ is called as R-cyclic RA-semigroup.

In this paper we consider RA-semigroups which are alternative, flexible, self-dual, left permutable, nuclear square and idempotent with one of the properties like right identity, paramedial, left-cancellation, cross-cancellation. All the theorems in this section shows when the given RA-semigroup becomes L-cyclic, R-cyclic, commutative semigroup, and a distributive semilattice

Key words : RA-semigroup, L-R-cyclic RA-semigroup, Commutative semigroup, Distributive semilattice.

1.Introduction:

An algebraic structure midway between a groupoid and commutative semigroup appeared in 1972. M.A.Kazim and MD.Naseerudin introduced left almost semigroups as a generalisation of commutative semigroups. They have introduced the braces on the left of the ternary commutative law $abc = cba$ to get a new pseudo associative law, i.e., $(ab)c = (cb)a$. It is since then called left invertive law. A groupoid satisfying the left invertive law is called a left almost semigroup and is abbreviated as LA- semigroup. Similarly, groupoid satisfying the right invertive law, $a(bc) = c(ba)$ is called a right almost semigroup and is abbreviated as RA- semigroup. A groupoid has been called an almost semigroup if it is both an LA-semigroup and RA-semigroup.

Preliminaries :

Groupoid : A non empty set G with a binary operation $\cdot$ is called a groupoid if $a.b \in G$, $\forall a, b, c \in G$.

RA-semigroup: A groupoid $(G, \cdot)$ satisfying the right invertive law, $a(bc) = c(ba)$ $\forall a, b, c \in G$ is called an RA-semigroup

L-cyclic groupoid : A groupoid G is called L-cyclic if, $a(bc) = c(ab) = b(ca)$ $\forall a, b, c \in G$.

R-cyclic groupoid : A groupoid G is called R-cyclic if, $(ab)c = (ca)b = (bc)a$ $\forall a, b, c \in G$.

Right Almost semigroups with conjugates

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ABSTRACT : An algebraic structure midway between a groupoid and commutative semigroup appeared in 1972. M.A.Kazim and MD.Naseerudin introduced left almost semigroups as a generalisation of commutative semigroups. They have introduced the braces on the left of the ternary commutative law $abc = cba$ to get a new pseudo associative law, i.e., $(ab)c = (cb)a$. It is since then called left invertive law. A groupoid satisfying the left invertive law is called a left almost semigroup and is abbreviated as LA- semigroup. Similarly, groupoid satisfying the right invertive law, $a(bc) = c(ba)$ is called a right almost semigroup and is abbreviated as RA- semigroup.

G.I.MOGHADDAM and .PADMANABHAN in their paper "cancellative semigroups admitting conjugates" considered cancellative semigroup and conjugate of elements. Based on this in this paper we study some equational classes of RA-semigroups admitting conjugates.

Key words: RA-semigroup, cancellative semigroup, admits conjugates.

I.INTRODUCTION

While every subsemigroup of a group is cancellative, a famous theorem of A.I.Mal'cev shows that not every cancellative semigroup is embeddable in a group. In fact, Mal'cev gave an infinite set of necessary and sufficient conditions for the possibility of imbedding a cancellation semigroup into a group and proved that no finite set of such conditions would suffice. This calls for a finite set of sufficient conditions that would guarantee the group embeddability. Patterned after the classical quotient construction, Oystein Ore discovered the "principle of common left multiple" to embed a non-commutative domain into a division ring. Using this as backdrop, Mal'cev, B.H.Neumann and Taylor developed semigroup equivalents of nilpotent groups of class n and proved that the cancellative semigroups of nilpotent class n are embeddable in groups of same nilpotency class. After that G.I.MOGHADDAM, and R.PADMANABHAN studied some equational classes of enriched semigroups i.e., semigroups admitting conjugates and proved that all the valid group theory implications do carry over to the equational theory of semigroups admitting conjugates.

G.I.MOGHADDAM and .PADMANABHAN in their paper "cancellative semigroups admitting conjugates" considered cancellative semigroup and conjugate of elements. Based on this in this paper we study some equational classes of RA-semigroups admitting conjugates.

II. PRELIMINARIES

RA-semigroup: A groupoid $(G, \cdot)$ satisfying the right invertive law, $a(bc) = c(ba) \quad \forall a, b, c \in G$ is called an RA-semigroup

L-cyclic groupoid: A groupoid G is called L-cyclic if, $a(bc) = c(ab) = b(ca) \quad \forall a, b, c \in G$.

R-cyclic groupoid: A groupoid G is called R-cyclic if, $(ab)c = (ca)b = (bc)a \quad \forall a, b, c \in G$.

L-cyclic-RA-semigroup: An RA-semigroup is called a left cyclic (L-cyclic), if $a(bc) = c(ab) = b(ca) \quad \forall a, b, c \in G$.

R-cyclic-RA semigroup: An RA-semigroup is called a right cyclic (R-cyclic), if $(ab)c = (ca)b = (bc)a \quad \forall a, b, c \in G$.

RC-RA-semigroup: An RA-semigroup G is called right commutative RA-semigroup (RC- RA-semigroup) if for all $a, b, c \in G$, $a(bc) = a(cb)$.

LC-RA-semigroup: An RA-semigroup G is called a left commutative RA-semigroup (LC- RA-semigroup) if for all $a, b, c \in G$, $(ab)c = (ba)c$.

An RA-semigroup G is called a bi-commutative RA-semigroup (BC- RA-semigroup) if it is both LC- RA-semigroup and RC- RA-semigroup.

Alternative RA-semigroup: An RA-semigroup G is called left alternative RA-semigroup if it satisfies the identity, $(aa)b = a(ab)$. for all $a, b \in G$

An RA-semigroup is called right alternative RA-semigroup G if it satisfies the identity, $(ab)b = a(bb)$, for all $a, b \in G$

Self-Dual RA-semigroup: An RA-semigroup which satisfies left invertive law $(ab)c = c(ba)$ for all $a, b, c \in G$ is called Self -Dual RA-semigroup.

Nuclear square: An RA-semigroup G is called left nuclear square if $\forall a, b, c \in G$, $a^2(bc) = (a^2b)c$. Similarly S is called right nuclear square if $\forall a, b, c \in G$, $(ab)c^2 = a(bc^2)$ and middle nuclear square if $\forall a, b, c \in G$, $(ab^2)c = a(b^2c)$.

Right transitive RA-smigreoup: An RA-semigroup G is called right transitive if, $ab.cb = ac$ for all $a, b, c \in G$

Left transitive RA-semigroup: An RA-semigroup G is called left transitive if, $ab.ac = bc$ for all $a, b, c \in G$

Cancellative RA-semigroup: Let G be an RA-semigroup. If for all $a, b, c \in G$, $ab = ac \Rightarrow b = c$ then we say that G is a left cancellative RA-semigroup

Let G be an RA-semigroup. If for all $a, b, c \in G$, $ba = ca \Rightarrow b = c$ then we say that G is a right cancellative RA-semigroup

Let G be an RA-semigroup. If for all $a, b, c \in G$, $ab = ac \Rightarrow b = c$, and also $ba = ca \Rightarrow b = c$, then we say that G is a cancellative RA-semigroup

Let G be an RA-semigroup. If for all $a, b, c \in G$, $ab = ca \Rightarrow b = c$, and also $ba = ac \Rightarrow b = c$, then we say that G is a cross-cancellative RA-semigroup

Definition: Let G be an RA semigroup and $a, b \in G$. If there exists an element $c \in G$ such that $ab = bc$, then c is called conjugate of a by b and it is denoted by a^b . If for all elements a, b in G , a^b exists we say that G admits conjugates.

Therefore for any a and b in a cancellative semigroup G admits conjugates, a^b is unique and $ab = ba^b$.

III.RA-SEMIGROUPS WITH ADDITIONAL PROPERTIES WHICH ADMITS CONJUGATES

3.1 Theorem: Let G be a left alternative RA-semigroup then, G admits conjugates and further conjugates of an element a of G by any element of G is same which is equal to a .

Proof: Let G be a left alternative RA-semigroup.

(i) Let ' a ' be an arbitrary element of G .

By left alternativity in G we have, $(aa)b = a(ab) \quad \forall a, b \in G$.

Using right invertive law on the right we get $(aa)b = b(aa) \quad \forall a, b \in G$.

$\Rightarrow G$ is commutative.

Since G is commutative for any a, b in G we have $ab = ba$

i.e., a is a conjugate of a by b .

i.e., $a^b = a \quad \forall a, b \in G$.

Since a is the arbitrary element in G , G admits conjugates.

(ii) Since G is commutative, then for any a, b, c in G we have,

$ab = ba$ and $ac = ca \quad \forall a, b, c \in G$.

By part (i) we have $ab = ba \Rightarrow a^b = a$ and $ac = ca \Rightarrow a^c = a$

thus $a^b = a^c = a \quad \forall a, b, c \in G$.

The conjugate of an element a of G by any element of G is same which is equal to a

3.2 Theorem : Let G be a cross cancellative RA-semigroup. if G is right alternative then, G admits conjugates and further conjugates of an element a of G by any element of G is same which is equal to a .

Proof: Let G be a cross cancellative RA-semigroup. And let G be right alternative.

(i) Let ' a ' be an arbitrary element of G .

Since G is right alternative we have, $(ab)b = a(bb) \quad \forall a, b \in G$.

Using right invertive law on the right we get $(ab)b = b(ba)$

using cross-cancellativity in G we have $ab = ba \quad \forall a, b \in G$.

$\Rightarrow G$ is commutative.

Since G is commutative for any a, b in G we have $ab = ba$

i.e., a is a conjugate of a by b i.e., $a^b = a \quad \forall a, b \in G$.

Since a is the arbitrary element in G , G admits conjugates.

(ii) Since G is commutative, then for any a, b, c in G we have,

$ab = ba$ and $ac = ca \quad \forall a, b, c \in G$.

By part (i) we have $ab = ba \Rightarrow a^b = a$ and $ac = ca \Rightarrow a^c = a$

thus $a^b = a^c = a \quad \forall a, b, c \in G$.

The conjugate of an element a of G by any element of G is same which is equal to a

3.3 Theorem : Let G be a left cancellative RA-semigroup. If G is right commutative then, G admits conjugates and further conjugates of an element a of G by any element of G is same which is equal to a .

Proof : Let G be a left cancellative RA-semigroup. And let G be right commutative.

(i) Let ' a ' be an arbitrary element of G .

Since G is right commutative we have , $a(bc) = a(cb) \quad \forall a, b, c \in G$.

using left cancellativity in G we have $bc = cb \quad \forall b, c \in G$.

$\Rightarrow G$ is commutative.

Since G is commutative for any a, b in G we have $ab = ba$

i.e., a is a conjugate of a by b .

i.e., $a^b = a \quad \forall a, b \in G$.

Since a is the arbitrary element in G , G admits conjugates.

(ii) Since G is commutative, then for any a, b, c in G we have,

$ab = ba$ and $ac = ca \quad \forall a, b, c \in G$.

By part (i) we have $ab = ba \Rightarrow a^b = a$ and $ac = ca \Rightarrow a^c = a$

thus $a^b = a^c = a \quad \forall a, b, c \in G$.

The conjugate of an element a of G by any element of G is same which is equal to a

3.4 Theorem : Let G be a right cancellative RA-semigroup. If G is left commutative then, G admits conjugates and further conjugates of an element a of G by any element of G is same which is equal to a .

Proof : Let G be a right cancellative RA-semigroup. And let G be left commutative.

(i) Let ' a ' be an arbitrary element of G .

Since G is left commutative we have , $(ab)c = (ba)c \quad \forall a, b, c \in G$.

using right cancellativity in G we have $ab = ba \quad \forall a, b \in G$.

$\Rightarrow G$ is commutative.

Since G is commutative for any a, b in G we have $ab = ba$

i.e., a is a conjugate of a by b .

i.e., $a^b = a \quad \forall a, b \in G$.

Since a is the arbitrary element in G , G admits conjugates.

(ii) Since G is commutative, then for any a, b, c in G we have,

$ab = ba$ and $ac = ca \quad \forall a, b, c \in G$.

By part (i) we have $ab = ba \Rightarrow a^b = a$ and $ac = ca \Rightarrow a^c = a$

thus $a^b = a^c = a \quad \forall a, b, c \in G$.

The conjugate of an element a of G by any element of G is same which is equal to a

3.5 Theorem : Let G be an RA-semigroup with left identity then, G admits conjugates and further conjugates of an element a of G by any element of G is same which is equal to a .

Proof : Let G be an RA-semigroup with left identity. And let e be left identity in G

(i) Let ' a ' be an arbitrary element of G .

Since e is the left identity in G , we have $ea = a \quad \forall a \in G$.

Now consider $a.e$

Since e is the left identity $ae = a(ee)$

by using right invertive law on the right we get, $ae = a(ee) = e(ea) = ea = a$

$\Rightarrow e$ is the right identity

$\Rightarrow e$ is the identity in G .

Now for any ab in G , $ab = a(be)$ (e is the right identity)

$= e(ba)$ (e is the identity)

$= (ba)$

i.e., $ab = ba \quad \forall a, b \in G. \Rightarrow G$ is commutative.

Since G is commutative, for any a, b in G we have $ab = ba$

i.e., a is a conjugate of a by b .

i.e., $a^b = a \quad \forall a, b \in G$.

Since a is the arbitrary element in G , G admits conjugates.

(ii) Since G is commutative, then for any a, b, c in G we have,

$ab = ba$ and $ac = ca \quad \forall a, b, c \in G$.

By part (i) we have $ab = ba \Rightarrow a^b = a$ and $ac = ca \Rightarrow a^c = a$

thus $a^b = a^c = a \quad \forall a, b, c \in G$.

The conjugate of an element a of G by any element of G is same which is equal to a

3.6 Theorem: Let G be an RA-semigroup with the identity $a(bc) = (ba)c \quad \forall a, b, c \in G$ then, G admits conjugates and further conjugate of an element a of G by any element of G is same which is equal to a .

Proof : Let G be an RA-semigroup with the identity $a(bc) = (ba)c \quad \forall a, b, c \in G$

then by right invertive law, $c(ba) = (ba)c \quad \forall a, b, c \in G$

$\Rightarrow G$ is commutative

(i) Let ' a ' be an arbitrary element of G .

Since G is commutative, for any a, b in G we have $ab = ba$

i.e., a is a conjugate of a by b .

i.e., $a^b = a \quad \forall a, b \in G$.

Since a is the arbitrary element in G , G admits conjugates.

(ii) Since G is commutative, then for any a, b, c in G we have,

$$ab = ba \text{ and } ac = ca \quad \forall a, b, c \in G.$$

By part (i) we have $ab = ba \Rightarrow a^b = a$ and $ac = ca \Rightarrow a^c = a$

thus $a^b = a^c = a \quad \forall a, b, c \in G.$

The conjugate of an element a of G by any element of G is same which is equal to a

3.7 Theorem: Let G be an idempotent RA-semigroup. If G is paramedial then, G admits conjugates and further conjugate of an element a of G by any element of G is same which is equal to a .

Proof: Let G be an idempotent RA-semigroup. Then $a^2 = a \quad \forall a \in G.$

Let G be paramedial then, $(ab)(cd) = (db)(ca)$

$$\text{Consider } ab = (ab)^2 = (ab)(ab) = (bb)(aa) = b^2a^2 = ba$$

$$\Rightarrow ab = ba \quad \forall a, b \in G$$

$$\Rightarrow G \text{ is commutative}$$

(i) Let ' a ' be an arbitrary element of G .

Since G is commutative, for any a, b in G we have $ab = ba$

i.e., a is a conjugate of a by b .

i.e., $a^b = a \quad \forall a, b \in G.$

Since a is the arbitrary element in G , G admits conjugates.

(ii) Since G is commutative, then for any a, b, c in G we have,

$$ab = ba \text{ and } ac = ca \quad \forall a, b, c \in G.$$

By part (i) we have $ab = ba \Rightarrow a^b = a$ and $ac = ca \Rightarrow a^c = a$

thus $a^b = a^c = a \quad \forall a, b, c \in G.$

The conjugate of an element a of G by any element of G is same which is equal to a

3.8 Theorem: Let G be an RA-semigroup with right identity. If G is right commutative then, G admits conjugates and further conjugate of an element a of G by any element of G is same which is equal to a .

Proof: Let G be an RA-semigroup with right identity. Then $ae = a \quad \forall a \in G.$

Let G be right commutative, $a(bc) = a(cb)$

$$\text{Consider } ea = e(ae) = e(ea) = a(ee) = ae = a$$

$$\Rightarrow ea = a$$

$$\Rightarrow e \text{ is the left identity.}$$

$$\Rightarrow e \text{ is the identity}$$

$$\text{Consider } ab = a(be) = e(ba) = ba \Rightarrow ab = ba \quad \forall a, b \in G$$

$$\Rightarrow G \text{ is commutative}$$

(i) Let ' a ' be an arbitrary element of G .

Since G is commutative, for any a, b in G we have $ab = ba$

i.e., a is a conjugate of a by b .

i.e., $a^b = a \quad \forall a, b \in G$.

Since a is the arbitrary element in G , G admits conjugates.

(ii) Since G is commutative, then for any a, b, c in G we have,

$ab = ba$ and $ac = ca \quad \forall a, b, c \in G$.

By part (i) we have $ab = ba \Rightarrow a^b = a$ and $ac = ca \Rightarrow a^c = a$

thus $a^b = a^c = a \quad \forall a, b, c \in G$.

The conjugate of an element a of G by any element of G is same which is equal to a

3.9 Theorem: Let G be an RA-semigroup with right identity. If G is self-dual then, G admits conjugates and further conjugate of an element a of G by any element of G is same which is equal to a .

Proof: Let G be an RA-semigroup with right identity. Then $ae = a \quad \forall a \in G$.

Let G be self-dual then, $(ab)c = (cb)a$

Consider $ea = (ee)a = (ae)e = ae = a$

$\Rightarrow ea = a$

$\Rightarrow e$ is the left identity.

$\Rightarrow e$ is the identity

Now $ab = a(be) = e(ba) = ba \Rightarrow ab = ba \quad \forall a, b \in G$

$\Rightarrow G$ is commutative

(i) Let ' a ' be an arbitrary element of G .

Since G is commutative, for any a, b in G we have $ab = ba$

i.e., a is a conjugate of a by b .

i.e., $a^b = a \quad \forall a, b \in G$.

Since a is the arbitrary element in G , G admits conjugates.

(ii) Since G is commutative, then for any a, b, c in G we have,

$ab = ba$ and $ac = ca \quad \forall a, b, c \in G$.

By part (i) we have $ab = ba \Rightarrow a^b = a$ and $ac = ca \Rightarrow a^c = a$

thus $a^b = a^c = a \quad \forall a, b, c \in G$.

The conjugate of an element a of G by any element of G is same which is equal to a

3.10 Theorem: Let G be a cross cancellative RA-semigroup. if G is right nuclear square then, G admits conjugates and further conjugates of an element a of G by any element of G is same which is equal to a .

Proof: Let G be a cross cancellative RA-semigroup.

And let G be a nuclear square RA-semigroup.

(i) Let ' a ' be an arbitrary element of G .

Since G is left nuclear square. Then we have , $(a^2b)c = a^2(bc) \quad \forall a, b, c \in G$.

Using right invertive law on the right we get $(a^2b)c = c(ba^2)$

using cross-cancellativity in G we have $a^2b = ba^2 \quad \forall a^2, b \in G$.

$\Rightarrow G$ is commutative.

Since G is commutative for any a, b in G we have $ab = ba$

i.e., a is a conjugate of a by b .

i.e., $a^b = a \quad \forall a, b \in G$.

Since a is the arbitrary element in G , G admits conjugates.

(ii) Since G is commutative, then for any a, b, c in G we have,

$ab = ba$ and $ac = ca \quad \forall a, b, c \in G$.

By part (i) we have $ab = ba \Rightarrow a^b = a$ and $ac = ca \Rightarrow a^c = a$

thus $a^b = a^c = a \quad \forall a, b, c \in G$.

The conjugate of an element a of G by any element of G is same which is equal to a .

Remark : The above theorem also holds good for right, middle nuclear square RA-semigroups.

3.11 Theorem: Let G be a left transitive RA-semigroup then, G admits conjugates and further conjugates of an element a of G by any element of G is same which is equal to a .

Proof : Let G be a left transitive RA-semigroup. Then $ab.ac = bc \quad \forall a, b, c \in G$.

(i) Let ' a ' be an arbitrary element of G .

By left transitive condition in G we have , $bc = bb.bc$

$$bb.bc = bb(bb.bc) \quad (\text{Since } bc=bb.bc).$$

Using right invertive law on the right we get $bc = bb(bb.bc)$

$$= bc(bb.bb)$$

$$= bc.bb = cb \quad (\text{by left transitivity in } G)$$

Thus $bc = cb \Rightarrow G$ is commutative.

Since G is commutative for any a, b in G we have $ab = ba$

i.e., a is a conjugate of a by b i.e., $a^b = a \quad \forall a, b \in G$.

Since a is the arbitrary element in G , G admits conjugates.

(ii) Since G is commutative, then for any a, b, c in G we have,

$ab = ba$ and $ac = ca \quad \forall a, b, c \in G$.

By part (i) we have $ab = ba \Rightarrow a^b = a$ and $ac = ca \Rightarrow a^c = a$

thus $a^b = a^c = a \quad \forall a, b, c \in G$.

The conjugate of an element a of G by any element of G is same which is equal to a

3.12 Theorem: Let G be right transitive RA-semigroup then, G admits conjugates and further conjugates of an element a of G by any element of G is same which is equal to a .

Proof : Let G be a right transitive RA-semigroup. Then $ab.cb = ac. \forall a, b, c \in G$.

(i) Let ' a ' be an arbitrary element of G .

By left transitive condition in G we have , $ac = ac.aa = (a.ac)(a.aa)$

Using right invertive law on the right we get $ac = (c.aa)(a.aa)$ (by right transitivity in G)

$$= ca \quad (\text{by right transitivity in } G)$$

Thus $bc = cb \implies G$ is commutative.

Since G is commutative for any a, b in G we have $ab = ba$

i.e., a is a conjugate of a by b .

i.e., $a^b = a \quad \forall a, b \in G$.

Since a is the arbitrary element in G , G admits conjugates.

(ii) Since G is commutative, then for any a, b, c in G we have,

$$ab = ba \quad \text{and} \quad ac = ca \quad \forall a, b, c \in G.$$

By part (i) we have $ab = ba \implies a^b = a$ and $ac = ca \implies a^c = a$

thus $a^b = a^c = a \quad \forall a, b, c \in G$.

The conjugate of an element a of G by any element of G is same which is equal to a

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"THE BURNING MOONLIGHT": THE TRAGEDY OF AN UNEMPLOYED YOUTH

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Abstract: The paper throws the light on an unemployed youth in the novel *The Burning Moonlight* seems to be paradoxical. The novelist, Sita Devi Vasireddy presents the tragedy of an educated, unemployed youth in the novel. Chandra is a graduate. He is the son of a late retired clerk. He, the descendant of a middle class family, for generations together sold the house he got from his father as patrimony, in order to equip himself with a degree. Chandra was flabbergasted. He had hung his head in shame. He would not have become that serious in this matter, if had not seen Lakshmi and Krishna in the cinema hall. However it was his fault – it was his inability – it was his fate. His ears rang with the words of Lakshmi, especially the abuse "dud". A hand grenade burst in the middle of the road. He stood there looking at the bright red light. He was not starving. Now he was no more a Chandra (Moon) who shines with borrowed light as they say. He was not at all a 'dud' Chandra! Now He was Surya who is self – effulgent with a million billion rays! Comrade Surya!!". Chandra has become a naxalite. Not only Chandra but also so many youth like him. This the result of the rotten set up, the conditions of the country, the society The novelist, Sita Devi Vasireddy, has tried to outline in this novel as to why and in what kind of circumstances such a sort of social being like Chandra turns a revolutionary and the Moonlight burns, in a thought provoking way.

Keywords: tragedy, unemployed, revolutionary, moonlight burns etc

The title of the novel, **The Burning Moonlight** seems to be paradoxical. The novelist, Sita Devi Vasireddy presents the tragedy of an educated, unemployed youth in the novel. She brings home the point that under critical, unbearable situations a common man finds no way to get out of them but chooses the path of revolution. The novel presents the reasons that led to the transformation of frustrated unemployed youth into a naxalite – burning mellowing moonlight. In the Author's preface she writes:

"In these days, when the social being, the man in the society sees only counter-revolution everywhere and even in his dreams, I have tried to outline in this novel as to why and in what kind of circumstances such a sort of social being turns a revolutionary and when the moonlight burns"¹

Chandra is a graduate. He is the son of a late retired clerk. He, the descendant of a middle class family, for generations together sold the house he got from his father as patrimony, in order to equip himself with a degree. Chandra's father Gurunatham passed away bearing the unbearable troubles in his middle class family. When he was alive he felt that his son should never lead the life of a slave like him with a little education and wanted his son to pursue his studies in anticipation of seeing his son in a higher position. When Chandra got first rank in his examinations Gurunatham looked at him with a sense of complete satisfaction. His eyes swam in tears with delight. He asked his son to try for a job then. When Chandra wanted to study engineering Gurunatham encouraged him to get the application form. How could he study Engineering when he didn't have money even for the application form? He knew full well the state of affairs in his family. Involuntarily with a deep sigh he joined a long queue in front of Employment Exchange. Unlike him the other youth in the queue appeared like the ones who see the reality. He expressed his firm decision with his father that he was not going for Engineering. He killed his enthusiasm of yesterday.

He felt that it was foolish to think of running away from the reality. He should not try to stand in the space there. His feet should be on this ground even if it was hard, awful and gave comfort to his feet. He had got his name registered in the employment exchange and was ready to join the post of some clerk if at all it was available for him. His father wished that Chandra should not step into his shoes.

Saying so Gurunatham pressed his hand against his chest and that was the last night for him in this world. He did not, as usual, wake up with the dawn. He broke away from the earthly ties and took refuge in the lap of the eternal peace. The former NGO who had drawn only three months' pension, was no more. Later with the encouragement of the principal Chandra joined B.A., for which he mortgaged the house. He got six thousand rupees and deposited it in a bank and planned his two years future.

Three years had elapsed. A number of changes took place. Chandra ran out of the money he had borrowed pledging his house though he got his degree. His mother felt that he would become an officer soon but Chandra knew that a degree was not going to get him an officer's post. He felt pity for her innocence. Mother's ignorance was pitiable. How innocent she was! She thinks that joining a job was completely in his hands. Perhaps she fancies that he could go and occupy the chair whenever it pleased him.

Chandra saw no hope in his future. He found no employment. He saw some of his friends doing mean jobs and involved even in cheating. Educated youth! What a shameful act! But no way – no way to get their stomachs filled with some stuff. He remembered his friends. Anant who had taken to picking the pockets, Bhushan who was selling books, Thirumalaiah who had become fortune -teller and cheating the people, and Achari who was

cheating the people in the name of lottery of the portrait of Lord Venkateswara. All of them were doing some work for their livelihood. But he alone was doing nothing and was incapable of any such work. Chandra got a doubt whether he was an incompetent person? He was not even given the work of breaking stones. In search of some job he got entangled in a dangerous smuggling vehicle chased by the police. Knowing the fact, he jumped out of it saved himself.

Lakshmi, sister of Chandra was grown up to her marriage. She was in her youthful dreams. She felt that her life would be better after her brother getting a good job. Could he get a job? Could he get her married? Perayya, Chandra's maternal uncle, went after Chandra's family to give his daughter in marriage to Chandra. But things were completely different now. Who was ready to give his daughter to a jobless person? He controlled his daughter, Saraswathi not to go to Chandra's house though she wanted to marry Chandra. He warned his daughter one day that she should not the house for the jaunts in the neighborhood.

It was six months since Chandra had become a graduate. He was having his daily rounds to the employment exchange. Things in his house were getting from bad to worse. It was difficult to get loans for running the house. Starvations became a matter of routine. Utensils and other household articles were finding their into the pawn broker's shop.

Chandra found it difficult to get at least an interview from the employment exchange without giving a bribe to the officer. It was his fate that he had to sell his mother's mangalyams for paying the bribe money to the officer. His poor mother Santhamma felt that her son was going to get an officer's post tomorrow. She hurried away to the photograph of her dead husband and making obeisance to him, utters that their son is not going to become an officer that they are not fortunate enough to see him as an officer.

How ignorant she was! She did not know that it was not that easy to get even the L.D.C. post for which he had attended an interview. Things were worse. His younger sister who had come of age revolts against him when he beat her for wearing the dress purchased by her boy friend. When he insisted her on speaking the truth and lifted his hand to beat her she called him a dud and a useless fellow and so he cannot get a petty job for himself.

Chandra was flabbergasted. He had hung his head in shame. He would not have become that serious in this matter, if had not seen Lakshmi and Krishna in the cinema hall. However it was his fault – it was his inability – it was his fate. His ears rang with the words of Lakshmi, especially the abuse "dud". He felt in all the corners of his heart that he was a dud. He was a futile person who could not feed his mother and could not give proper clothing to his younger sister who had come of age. The thought did not even allow him to take a nap that night. He reflected to himself:

"I must, somehow, get a job. I should not show my face to my mother and sister until I become a man of some ability, some useful man who was gainfully employed, a man who is really a man."²

Chandra, making up his mind with a resolution, got down from his bed and disappeared in the dreadful darkness when his mother and his sister were sleeping. His mother Santhamma was so much distressed for her son going away leaving her alone. Her glasses were broken falling at some distance when she tried to get out of the house in a depressed mood and hit her leg against the wooden threshold and fell down. She was purblind now.

Lakshmi who had gone out in the morning returned home with her jacket torn, her hair disarranged, her bangles broken and with blood oozing from the cuts. Her looks suggest that she was on the brink of ruin. When she was asked what had happened to her by Saraswathi, her uncle Perayya's daughter, she was moving like a sleep-walker without a single word. On hearing her daughter's condition, Santhamma roared like a lioness! Yes, she was seduced. She lost her chastity.

Chandra was now scouring every inch of the city searching for his mother and sister who were missing. He stopped at a big hotel. A police van was stationed there and there was big crowd around the van. He lifted up his head above the crowd to see what was happening and found his own sister, Lakshmi's face in one among the four call-girls caught by the police when the other had raided a lodge. Yes, it was Lakshmi! His younger sister! Her sister in a police van! How terrible! He ran after the van and fell down unconscious. After someone had woke him up, he went to the court. He saw a young woman questioned by the lawyer embarrassingly and humiliatingly. She was not Lakshmi but a young woman like her. Perhaps his sister Lakshmi also might stand one day in the dock in this manner and answer similar questions. Tears were rolling down his cheeks.

Chandra saw a dead body on the pavement fully covered with a white cloth. Two boys in soiled clothes were asking for donations for performing the last rites of a dead woman. He saw his own mother in that destitute old woman. A woman, ripe in years, gave birth to children like himself, died with no one to care for her. He trembled with the thought that whether she was his mother. Even if she was his mother what could he do? Could he beg like them to perform the last rites for her now? He felt that he was a dud, a vain glorious fellow who could not even beg – a futile fellow who could not perform last rites for his dead mother. Though she was not his mother he reflected in this vein.

Chandra was terribly hungry. His bowels were getting twisted out of a cute hunger.

"Hunger! The scourge of hunger was the most terrible thing befalling all beings in this world. A mother unable to withstand this affliction sells her children. A woman commits adultery in order to satisfy her hunger. A man commits suicide unable to bear the hunger any longer."³

Chandra had seen reports in the newspaper about hunger deaths. He used to wonder whether hunger was really such a calamity as to cause the death of human beings. Now he

was experiencing it. He had not taken his meal for three days. He could not bear the torment of hunger which was killing him.

Two boys came to Chandra. They were holding buckets and brushes. One boy asked if Chandra was hungry and made the other boy bring some buns and tea. The boys had come to know about his hunger. For three days nobody had noted that he had been hungry. No one had enquired particularly whether he had his meal. Chandra, in his heart of hearts, thanked both of them. Chandra, while consuming the buns with zest, the boys eagerly watched at him. He took tea and leaned against the wall and dozed off for a few minutes. He was not even able to express his thanks immediately. They satisfied his hunger. Yes,

"The beast in his belly was pacified. It lay down motionless,"⁴

After some time he expressed his thanks to the boys. They came to know that Chandra was a graduate with no employment. One of the two boys asked him if he was willing to do some work they gave to him. Overwhelmed with joy he asked their names. They refused to tell him their names and said that they didn't know their real names and their names were given by their leader. If he joined them they would give him a new name. Though he didn't understand what they were saying, he showed his willingness to join them in the work of writing slogans on the wall like...

"Long live Revolution!"

"This bourgeois society has to be annihilated."

"Police high handedness... down... down!"

Chandra had now understood what they are up to. He paused and reflected for a moment. He was going to choose the path of revolution. That was the only way he had then. Hot blood had spurted in his brain. His eyes became blood red. Some new vigour entered his body. He resolved to take the path of revolution. He took the bucket and the brush in his hands and joined with them in the work. One of them said happily that his name was Comrade Surya! From then onwards and asked him to join them to write such slogans on the walls.

Chandra is no more Chandra (The Moon), now he is Surya (The Sun). He is brave. He is not a 'dud' now. He sees some bright light amidst the slogans written by him. He sees a brave new world in that light – all men are looking cheerful, attending their work and full of enthusiasm. No one is sad now. Everyone has some work to do. In that new world, bat-like men, who always seek darkness, were conspicuous by their absence. There were no leeches which suck the blood of the other creatures, and look swollen, black loathsome and lead a life which is abominable. If and when a leech is found, people there through some lime powder on it and force it to spew the sucked thing. They are thus made to cough up.

Chandra sees no trouble in that new world, may it be troublesome. Life, now, is not like one in the past. He sees in his vision his sister and sisters like his sister in that world

would need not sell their honour for their sustenance. They never do so. They don't have the need to so. His mother and mothers like his mother don't die there like destitutes and dogs. No dead bodies are found there on the pavements of the roads. No one commits suicide there owing to starvation and misery. There in that new world, one doesn't find red caps which from darkness, chase and shoot down a person who is bravely marching towards the light...

Now Chandra doesn't care for anything – Headlights, the sounds of the jeep and for any other thing. He doesn't run away from there. He is ready to confront any situation now.

"A gun was fired off!

A hand grenade burst in the middle of the road. He stood there looking at the bright red light. He was not starving. Now he was no more a Chandra (Moon) who shines with borrowed light as they say. He was not at all a 'dud' Chandra! Now He was Surya who is self – effulgent with a million billion rays! Comrade Surya!!"⁵

Chandra has become a naxalite. Not only Chandra but also so many youth like him. This the result of the rotten set up, the conditions of the country, the society The novelist, Sita Devi Vasireddy, has tried to outline in this novel as to why and in what kind of circumstances such a sort of social being like Chandra turns a revolutionary and the Moonlight burns, in a thought provoking way.

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TELUGU LITERATURE, HISTORY & CULTURE-A PERSPECTIVE

తెలుగు సాహిత్యం : చరిత్ర & సంస్కృతి - సమాలోచన

◆◆ Certificate ◆◆

This is to certify that Sri/Mrs/Ms./Dr./Prof. Nasreen Shahedi, Sec in History of

KVR Govt College for Women(A) Kurnool. has participated as Keynote Speaker /

Chairperson / Resource Person / Paper Presenter and has Presented a paper entitled "The Role of the Telugu

Press in Freedom Movement" in the Two Day International Seminar on "Telugu Literature, History &

Culture - A Perspective" held at KVR Govt. College for Women (A) Kurnool on 26th & 27th February 2020.

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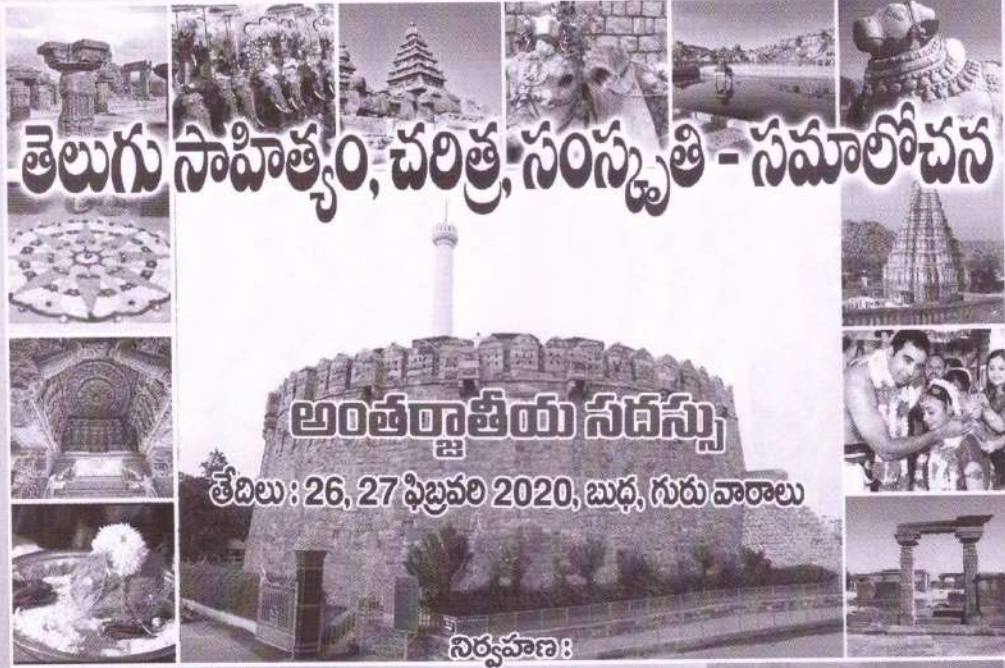


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The Role of the Telugu Press in the Freedom Movement

- *Nasreen Shahedi*, Lecturer in History, KVR Govt College for Women(A), Kurnool.

Introduction :

Napoleon the great, who shook the whole of Europe by his military might and lightning conquests, is reported to have remarked that "four hostile newspapers were more to be feared than a thousand bayonets." Writing about the role of newspapers in the American Revolution, David Ramsay made the significant observation that "the pen and press had a merit equal to that of the sword" in establishing American Independence. From the 18th century onwards the newspapers exerted a vital influence on the course of events in Europe, one such momentous event being the French Revolution Lord Macaulay, described the press as the "Fourth Estate of the Realm". Understood in its spirit rather than in its letter the familiarsaying, 'the pen is mightier than the sword, proves profoundly meaningful indeed.

The present undertaking is concerned with studying in some detail the part played by the Telugu periodicals and newspapers in India's nation-wide and protracted struggle for freedom from British colonial rule, which forms a momentous phase of her recent history. The two decades from 1885, the year of the founding of the Indian National Congress, witnessed the gradual consolidation of the forces of nationalism in India. The growth of the press in India as a force in the political, social and economic life during this period was in line with the traditions of the British press in England. Although political issues figured in the Telugu periodicals of

the day, they were not the focus of attention. The credit of being the first Telugu political news weekly goes to Andhra Prakasika, which was started in 1885 with A. Parthasarathy Naidu of Madras as its editor. Naidu was a staunch Congressman. Like Lokamanya Tilak, whom he followed, he was a fearless critic of the government. The paper boldly criticised the policies of the government, pointed out the lapses in administration, exposed corruption in the police and other departments and brought to light the atrocities of the soldiers. It waged many legal battles for justice and fair play. It had a good circulation and served the people for 45 years unbroken".

Gautami, the first Telugu daily paper of Rajahmundry started in 1908 by Sripada Krishnamurthy Sastri, criticised the British policies. Referring to an advertisement which wanted a Mussalman clerk for an acting post in the Chief Office of the Inspector General of Police, Madras, it comments that such an advertisement proceeding from such a high official of the government whose duty was to suppress all racial differences, would not only create prejudices between one race and another but also induce people to entertain doubts regarding the just the close of the 19th century saw a spurt of Telugu newspapers from various districts, some advocating social reforms, while others vehemently pleading for popularising simple Telugu, as a vehicle for conveying the new ideas and thoughts surging in the minds of men.

Thus Journalism in Telugu which had a humble beginning in 1885 had developed into a powerful instrument during the National Movement in India and played a vital role in India's Freedom Movement. As narrated about some of the Telugu Journals were started with the specific intention of propagating the spirit of nationalism among its readers. While some of the editors and proprietors used their journal for the propagation of nationalist spirit, some of the leaders in the nationalist movement became the founders and editors of new journals to propagate nationalist message.

The first session of the Indian National Congress was held at Bombay from December 1885. The first session of the Indian National Congress was closely related to the development of the Indian press because the founders and editors of some of the leading newspapers of the country were also prominent among the founders of the national political organisation.

The Telugu press became a powerful weapon in the hands of the intelligentsia and was the most effective exponent of popular grievances during this period. The writings in the nationalist Telugu papers were responsible for popularising the Vande Mataram movement in the Presidency. Swaraj, Krishna Patrika, Andhra Chandrika, Bala Bharati, Andhra Kesari, Desamata, Desabhimani and such prominent Telugu papers played an important role in preparing the minds of the people in favour of the national movement.

The press, especially Telugu press, ably supplemented nationalist literature in contributing to the growth of political consciousness among the people. Most of the newspapers

were crusaders against the foreign domination of the country. It was their mission to educate the people politically. They carried the doctrines of the great political thinkers of the West to the people. Such progressive ideas as liberty, democracy, self-government and nationalism were discussed and examined in their columns. They also criticised the misdeeds of the Government and exposed its wrong policies. They made the people conscious of their right to freedom, and fearlessly advocated popular causes.

Telugu Press and Vande Mataram Movement :

The partition of Bengal was a turning point in the history of Bengal and it caused reverberations throughout India. An agitation of unprecedented magnitude spread throughout Bengal demanding the reunification of Bengal provinces. The agitators used the weapons of boycott of foreign goods and promotion of and Swadeshi goods. The boycott of everything foreign naturally required the revival of indigenous industries to meet the demands of the people and it gave the impetus to the manufacture of Swadeshi goods. During the time of Vande Mataram movement, Krishna Patrika, Swaraj, Andhra Kesari, Akasvani, Desabhimani and Swarnalekha supported the swadeshi movement with great zeal and strongly advocated the boycott of foreign goods. Those papers considered swadeshi spirit as the panacea for all the existing evils in the country. They appealed to people to ignore the defects in the native goods and use them out of love for the country. People were asked to consider foreign goods as poisonous.

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Suryodaya Prakasika in an article to encourage the Swadeshi Movement on the regeneration of country manufacturers said that in former times many people in India earned their livelihood by their manufactures. The introduction of European goods into India dealt a death blow to the indigenous industries.

Krishna Patrika stressed the need to send deserving students to foreign lands by contributing money so that they could learn better techniques of manufacture. S.R. Mallady VenkataSubbarao, S.Ramaraao, G. Janaki ramayya, Alapathi Gopala Rao and D.S. Rao were sent to Japan to learn the technique of the manufacture of home made goods. The same journal wrote that the English destroyed native arts and taught servitude. It further wrote "knowledge has dawned on the country and the people are awakened and Swadeshi movement has flourished. It is certain that foreign trade will decline". The Telugu papers suggested not only the boycott of foreign cloth but also of foreign titles, schools, courts, legislative councils and even the Anglo-Indian newspapers. When the Madras Provincial Congress of 1908, which was dominated by the moderates, did not pass the boycott resolution, the

nationalist Telugu papers criticised the congress for its cowardice and supported boycott. Telugu newspapers underwent a change after Pal's visit. They wrote more boldly and freely on the meaning and significance of Vandemataram, on Swaraj and Swadeshi, boycott and national education.

Krishna Patrika wrote :

"The respect and the hospitality with which the people entertained him and the eagerness with which they listened to his speeches are not signs of a temporary rise of feeling but convey a special meaning underlying them all. They are the indications of a desire for independence and a longing for changes, lurking in the hearts of the people. The new spirit teaches a lesson to the westerners, who have a mania for extension of dominions and who wield terrible swords. The lesson will be taught not by arms, not by war, but by a bloodless sacrifice." The provincial conference which met at Kurnool under the presidentship of P.R. SundaraAiyar, a leading advocate of Madras, had the same unlively character about it. Krishna Patrika referred to the president's address and said that his statement that the East India Company was from the beginning working hard for the welfare of the country was contrary to facts.

Home Rule Movement :

The Lucknow session of the Congress was important since the two groups within the Congress had now been united again. world war I brokeout in 1914. In the Lucknow pact the Congress entered into an agreement with the Muslim League. Tilak, who had been released, was now a changed man. He felt that the Home Rule would be a first step towards the attain-

ment, Krishna Patrika, Swaraj, Andhra Kesari, Akasvani Deshabhimani and Swarnalekha supported the swadeshi movement with great zeal and strongly advocated the boycott of foreign goods. Those papers considered swadeshi spirit as the panacea for all the existing evils in the country. They appealed to people to ignore the defects in the native goods and use them out of love for the country. People were asked to consider foreign goods as poisonous.

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nationalist Telugu papers criticised the congress for its cowardice and supported boycott. Telugu newspapers underwent a change after Pal's visit. They wrote more boldly and freely on the meaning and significance of Vande Mataram, on Swaraj and Swadeshi, boycott and national education.

Krishna Patrika wrote :

"The respect and the hospitality with which the people entertained him and the eagerness with which they listened to his speeches are not signs of a temporary rise of feeling but convey a special meaning underlying them all. They are the indications of a desire for independence and a longing for changes, lurking in the hearts of the people. The new spirit teaches a lesson to the westerners, who have a mania for extension of dominions and who wield terrible swords. The lesson will be taught not by arms, not by war, but by a bloodless sacrifice. "The provincial conference which met at Kurnool under the presidentship of P.R. Sundara Aiyar, a leading advocate of Madras, had the same unlively character about it. Krishna Patrika referred to the president's address and said that his statement that the East India Company was from the beginning working hard for the welfare of the country was contrary to facts.

Home Rule Movement :

The Lucknow session of the Congress was important since the two groups within the Congress had now been united again. World War I broke out in 1914. In the Lucknow pact the Congress entered into an agreement with the Muslim League. Tilak, who had been released, was now a changed man. He felt that the Home Rule would be a first step towards the attain-

gained an impetus in the country. The Khilafat problem and the Hunter Committee's report had created new conditions in India. The people had in the British Parliament had been shattered after their 'shameless defence of the most inhuman acts of General Dyer'. Therefore, the papers said, the people now meant to help themselves by resorting to the policy of non-cooperation.

Andhra Patrika from Madras and Krishna Patrika from Machilipatnam, wrote strongly in favour of Gandhi's programme in its entirety, including the boycott of councils. They paid a high tribute to him and his methods and exhorted the people to follow his footsteps. They warmly appreciated 'the righteous principle of non-violence underlying it, and the spiritual power which formed the very soul of it, and commended it for the acceptance of the public.

Venkatesapatrika of Chittoor contrasted the Martial Law regime in Egypt and in India, and observed that "though there were many deaths in Egypt there were no massacres, instances of crawling, making people drink urine, and the outraging of women as in Jallianwalla Bagh".

Hitakarini was opposed to its application in regard to schools and taxes. Striking a different note Darbar of Guntur, Godavari Patrika of Rajahmundry and Nellore Patrika of Nellore disapproved the non-cooperation movement, observing that the boycott of legislative councils was fraught with very grave danger to the country's cause.

Nellore Patrika advised the Mussalmans of India to exercise self control and carry on constitutional agitation with redoubled vigour till a reversal or modification of the peace terms was

obtained. Panchanana of Sompeta and the Hitavadi of Masulipatnam also declared themselves against non-cooperation.

The Telugu press usually followed the trend of political thought in India, as shaped by the Indian National Congress, through the press, the platform, memorials and deputations, had failed to exercise the desired influence on the rulers. Andhra Patrika, Krishna Patrika, Hitakarini and Desabhimani took the lead and almost all the other Telugu papers followed in their wake, in impressing these ideals upon the attention of the public. A section of the Telugu press carried on a relentless campaign for Purna Swaraj or complete independence for the country right from 1925.

The nationalist Telugu papers vigorously and eloquently campaigned for the boycott of the Commission. Papers like Congress, Satyagrahi, Andhra Patrika and Krishna Patrika were in the forefront of this campaign. Satyagrahi under the heading "Duty" wrote: "The Simon

Commission should have the same fate as the Milner Commission of Egypt. With unity we must practise boycott. To enforce complete boycott is the duty of the Congress". Andhra Patrika consistently and effectively appealed to the people to boycott the Commission.

Salt Satyagraha and Civil Disobedience Movement :

The Lahore Congress session (1930) gave the call for "Purana Swaraj" and launched the civil Disobedience movement. It was also decided to celebrate 26th January, 1930 as the day of First Indian Independence. Gandhi started the Dandi march to break the Salt laws. There was an upsurge of enthusiasm every-

where. The Andhra Congress Committee appointed Konda Venkatappaiah as the dictator of the whole of Andhra, while each district had its own dictator assisted by a war council.

The nationalist Telugu press generally described the Salt Satyagraha as 'peaceful war' and the volunteers who participated in it are "peaceful soldiers", fighting a national war against the foreign government. These papers made an impact on the people during the Salt Satyagraha too, as before. Till the press ordinances were issued in 1930, the nationalist papers carried on much publicity for the movement and appealed to people to participate in it.

Wide publicity was given in the Telugu press to the entire programme of Salt satyagraha, the centres of civil disobedience and to the overwhelming number of volunteers pouring in from different places to participate in it. Zamindari Ryot published regular reports of the Mahatma's march to Dandi. Desabhandhu commented that Gandhi's march was observed from Heaven by Maharshis like Vyasa, poets like Kalidasa, emperors like Asoka, heroes like Sivaji and holy women like Savitri.

Grihalakshmi, a women's journal, wrote that women should take as much interest in national matters as men do. It also pointed out that the revival of nationalism in India should start at home.

The year 1934 was an exceptionally calm year. The suspension of the civil disobedience movement by Gandhi, his withdrawal from the leadership of the National Congress, last but not least, the press legislation altogether took the wind out of the sails of militant journalism

and created a spirit of docility. The docility brought in its wake, a strong streak of pessimism. Among the revived political

journals, Srisadhana Patrika of Anantapur deserves special mention. Years of tribulation seemed to have considerably toned down its vehemance. It is noteworthy that almost all the newly started Telugu journals, with the exception of Satyavani of Anakapalli were non-political and were devoted to the promotion of light literature marked by wit and humour and intended to act as a welcome relief to the public.

Quit India Movement :

By July 1942 Indian National Congress was convinced that the British government was not serious about coming to an honourable settlement about Indian problems and that it could not co-operate with the British in their war efforts. It however persuaded Gandhi to resume the leadership of the Congress and lead the people in the struggle for freedom. Even before the launching of the movement, many papers like Andhra Patrika had made it clear that there was no leader like Gandhi and that non-violence, advocated by him was the means to achieve independence.

Gandhi had already started writing in the Harijan suggesting "orderly and timely British withdrawal from India". This was in fact the fore-runner of the famous Quit-India resolution which was passed at Bombay by the All India Congress Committee on 8th August 1942.

Briefly stated, the items of the programme were defying prohibitory orders, picking salt, continuing openly to be members of unlawful associations, lawyers giving up practice, students to leave colleges, jurors and assessors not

to respond to summons, arranging labour strikes, picketing foreign concerns in trade and industry, pulling chains, to stop trains, travelling without tickets, cutting down toddy yielding trees, cutting telegraph and telephone wires, non-payment taxes excluding municipal taxes and picketing of troops.

Papers like Andhra Patrika, Krishna Patrika, Navasakti and Andhra Prabha (1937), spread nationalistic ideas to build up public opinion, in favour of the Quit India movement. During the time of the Second World War Prajamitra (Vijayawada), Swatantra (Madras) and Janawani strengthened the peasants' to ant feudal struggle. Sadhana and Akasavani (secret cyclostyled) from Anantapur propagated antiimperialist views. Prajasakti, Swatantra Bharat, Rahasyam, and Renadu, stimulated the people to make great efforts to make the British quit and thus free the motherland.

This period also saw the growth of the popular "paise" newspapers like Janmabhoomi, Navasakti, and Prajasakti, which were started to bring about awakening among the masses in general and the labour class in particular. Songs based on the socialist ideology, that people should awake and that they should all be equal sharers in the country's wealth were published.

Andhra Patrika published the inspiring speech delivered by Gandhi at A.I.C.C. session held in Bombay. The paper advocated that the 'Quit India' resolution to be accepted. Fur-

ther it reminded the people to follow strictly the policy of non-violence announced by Gandhiji during the Quit India Movement.

As soon as Gandhi, Azad and other members of the working committee were arrested. The Telugu papers, made a faithful report of this occurrence. In spite of the notice of the British government warning the editors and publishers of the papers reporting news of the agitation and publishing articles in favour of it, the Andhra Patrika continued to do so and criticised the government for issuing warnings. The paper reported from time to time the progress of the movement in the Andhra region and the meetings of protest held at various places.

Thus, the Telugu press facing serious hurdles from the government and its officials, continued its mission of liberating the country from the clutches of British rule. Though the tempo of the Quit India Movement was slackened by 1943 it was not totally abandoned till Gandhi practically called off the movement after his release from jail in May 1944. The Telugu press sustained the patriotic spirit of the people. With the Quit India Movement, it may be said that Indian freedom movement practically came to end. It is true that it took three more years to get an independence, but the British by this time realised that it was impossible for them to rule India any further. Hence, it started negotiation with Indian National Congress and paved the way for the Indian independence.

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PLAGUE MORTALITY AND CONTROL POLICIES IN COLONIAL SOUTH INDIA, 1900–47

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ABSTRACT Focused on colonial South India, this article presents and assesses detailed archival records of public health measures in response to plague outbreaks between 1900 and 1947. Starting in 1897 in the Madras Presidency, the colonial government strictly implemented anti-plague measures and introduced various health schemes and medical policies for plague prevention. However, despite partly vigorous government efforts, plague outbreaks could not be fully controlled. In the twentieth and twenty-first centuries, the plague remains among South Asia's most feared epidemics, with an outbreak in Surat in 1994 causing major havoc. Neither indigenous knowledge nor Western medical systems provided fully effective remedies regarding causation, cure and prevention of plague epidemics. Since the article gained new relevance in light of current struggles faced by India's public health system in handling the ongoing COVID-19 pandemic, some lessons from history emerge in the concluding discussion.

KEYWORDS: *COVID-19, epidemics, health, Madras Presidency, mortality, plague, public health, Western medicine*

Introduction

The research for this article was originally conducted as an archive-based study of how plague epidemics were ravaging colonial South India to examine what measures were undertaken to control these outbreaks. However, this historical work received new relevance in light of the ongoing COVID-19 pandemic and its enormous challenges to India's public health institutions. For the colonial period, the writings of David Arnold (1987, 1989, 1993) as masterpieces in the history of Indian medicine and public health focus mainly on smallpox as 'a disease of exceptional significance in nineteenth-century India' (Arnold, 1989: 45). His article on the Indian plague of

1896–1900 (Arnold, 1987) deals with an early phase of plague epidemics in Bombay, Calcutta and a few other parts of India, and does not even mention South India or the Madras Presidency.

Arnold (1987: 56) examines evidence of the plague in colonial India less as an epidemiological phenomenon and more as a commentary upon the developing relationship between indigenous elites, subaltern classes and the colonial state. During the early phase of this plague epidemic, apart from mounting mortality rates, the diseased body assumes specific medical, administrative and social significance. State efforts were directed towards its apprehension and control of victims' movements, but this caused contention between indigenous and colonial perceptions, practices and concerns. In the early years of plague outbreaks, colonial hegemony and ambivalent responses, part resistance and part emulation, were prevalent among India's subaltern classes (Arnold, 1987: 57). Then, as now in the current COVID-19 pandemic, dealing with the casualties and contact with infected bodies raise considerable concerns over pollution and spreading infections, yet some kind of official action that involves the general public becomes inevitable while devising control policies.

Throughout history, South Asia has been no stranger to sometimes massive epidemics (Arnold, 1993). Looking back briefly at earlier history, various epidemics affected the subcontinent from times immemorial, causing millions of deaths. Ancient medical texts on Ayurveda in Sanskrit, like the *Charaka Samhita* (Wujastyk, 2003) and *Sushruta Samhita* (Valiathan, 2007), contain references to epidemic diseases and their causation (Khan, 2013: 306; Ramana, 2002: 125). *Navanitakam* and *Astanga Sangraham* by Vagbhata also elaborated on medical practices and treatments of various diseases in India (Jaggi, 1981). During medieval times, various court chronicles, travellers' accounts and biographies described epidemic diseases and their pernicious effects. Enayatullah Khan (2013: 306) refers to a bubonic plague outbreak with heavy tolls among soldiers, witnessed by Ibn Battuta at Bidar, during the time of Muhammad-Bin-Tuglaq (1324–51). Khan (2013: 307) also mentions an outbreak in Gujarat in 1574–75, with a daily average of 100 cart-loads of dead bodies taken out of Ahmadabad alone, to be buried in pits. *Tuzuk-i-Jahangiri*, an autobiography in Persian of Mughal Emperor Muhammad Jahangir (1569–1627) mentions a disease called 'plague' (Jaggi, 1981). He also reported that from 1616 to 1618, a great pestilence spread across the Parganas (sub-districts) of Punjab, Lahore, Sirhind Doab, Delhi, Agra, Ahmadabad, and Kashmir (Khan, 2013: 307). At this early stage, the aetiology of the plague was not fully understood regarding modes of transmission, causes, appropriate measures, confinement of human bodies, physical examination, isolation, hospitalisation and medication, but indigenous medical practitioners, Hindu *vaids* and Muslim *bakims*, treated these diseases (Arnold, 1987: 59–60).

Earlier societal and official ways of handling the victims of the disease tended to be brutal, with little concern for what is now called human rights. If one plague-infected person died in a house, all members of the household were isolated and even risked being carried off (Jaggi, 1981). It is known that sixteenth and seventeenth-century India witnessed numerous epidemic diseases, with devastating effects on the

countryside. Like many colonial medical experts at the time, William Twining, Assistant Surgeon of the East India Company in Calcutta, argued that the harsh climate affected people's health, holding environmental factors and lack of sanitation responsible for most tropical diseases (Jaggi, 1981: 1–10). By the nineteenth century, the increasing occurrence of communicable diseases gave much impetus to the 'sanitary movement' (Gupta, 2005). The history of the plague in the nineteenth and early twentieth-century India provides valuable insights into a period that witnessed the growth of tropical diseases, affecting millions of people. It was even claimed that no other modern Indian epidemic has caused as much social disorganisation as various forms of the plague (Mushtaq, 2009).

While the word 'plague' has medieval connotations in terms of 'black death', and one would hesitate to refer to 'modern' pandemics in the same terms, both the plague and COVID-19 are highly contagious, spreading rapidly over wide geographical spaces, helped by mass travel already in colonial times. Both infections, in many cases, destroy the victim's immune system and since such epidemics potentially disrupt and ruin the life of millions of people, with vast local, regional and national economic and social consequences, this becomes a public health problem, requiring rapid action at various levels. This posed obvious challenges for the colonial state in India earlier and constitutes a mammoth task for current public health services. The generally advised preventive measures for both diseases are remarkably similar; too, like hand washing, social distancing or isolation and use of face coverings or masks. Provision of medication and various public health measures evidently involve different levels of public health services, and thus costs. In earlier times, very few infected people seem to have survived the plague and most patients would die on the second day of the attack (Nathan, 1898).

Anti-plague measures implemented by the colonial state pushed for adopting western medicines, including in due course antibiotics, which yielded some good results, as this article details by reference to archival records from South India. In the late nineteenth century, however, financial and political constraints discouraged the colonial state from greater medical intervention, since there was much initial public resistance especially towards vaccination, mainly due to social customs and religious sentiments (Arnold, 1987: 62–8).

After India's independence in 1947, the government continued strictly implemented anti-plague measures, introducing various health schemes and medical policies for plague prevention. That such latent challenges are by no means extinct was shown when, in late 1994, outbreaks of both bubonic and pneumonic plague occurred in Surat (Madan, 1995). This led around 300,000 migrant workers to flee the city, rapidly spreading the infections over five states. Though the official death toll of less than 100 was minimal, and by late September 1994 the outbreak was under control, such evidence shows that an alert and capable public health system is an absolutely essential component in addressing such epidemics and containing them as efficiently as possible. Whether for colonial administrators and staff earlier, or

current governments at various levels, the response to such major epidemics, therefore, cannot be official denial or non-action by public health authorities.

To examine the earlier responses to plague outbreaks in colonial South India, this article makes extensive use of archival records, which document earlier failures as well as achievements over many years in controlling plague outbreaks throughout South India. Such records and the evidence contained in them should not be discarded as irrelevant debris of history. All primary sources referred to in this article are collected from the Andhra Pradesh State Archives and Research Institute (APSARI) in Hyderabad and the Tamil Nadu State Archives (TNSA) in Chennai.

The article harvests archival evidence of the handling of plague epidemics in colonial South India, showing how such earlier challenges were addressed. Then, as now, non-action was not a viable option. After a brief section discussing the dissemination patterns of the plague in India, and especially in the Madras Presidency, the main body of the article examines in several parts the archival evidence of plague-related deaths between 1901 and up to 1951, providing much detail of how various plague epidemics were handled with varying success.

Transmission Patterns of the Plague

The plague was one of India's most feared epidemics and it is well-documented that the colonial government made specific efforts to contain outbreaks, though it could never completely control it. As a result, India suffered terribly throughout the colonial period (Klein, 1998). The gravity of this disease in earlier times can be gauged from preserved official records. In 1894, more than one lakh people died from the plague and in 1896, the reported death toll in India due to the plague was 1.3 million people (Klein, 1998: 734–46).

There are three types of plague: bubonic, septicemic and pneumonic. The latter form of bacterial infection seems most similar to COVID-19, whose virus attacks the lymph nodes and lung tissue. The main symptoms of the plague are headache, high fever, body pains and intensely hot skin, with patients feeling as if their body is on fire, accompanied by cough with deep and oppressive breathing problems, considerable pains in the chest and joints and about the navel, delirium, great anxiety and thirst. Both pneumonic plague and COVID-19 involve infections that spread invisibly and rapidly via small droplets produced by coughing and sneezing. The pneumonic plague manifests as a severe lung infection, transmitted directly from person to person when the plague bacillus is coughed out of diseased lungs and droplets cause bacterial infection through breathing or oral contact. Since even touching contaminated items of clothing or bedding and infected surfaces pose risks, comprehensive sanitary measures would be required to avoid contamination of entire neighbourhoods.

In India, the more prevalent form of spreading the disease was the bubonic plague, caused by the bacillus *Yersinia pestis*, initially transmitted by the bite of the rat flea

(Klein, 1998: 737). The fleas carried the plague bacilli, transmitted from local black rats as carriers, and ultimately transferred the plague to humans as alternate hosts (Hirst, 1953: 312, 388). The Indian Plague Commission believed that plague was an air-borne contagion transmitted from travellers to other humans. Rat fleas get attached to humans after abandoning rat carcasses for a new live host. A plague epizootic among rats sharply increases the number of flea attacks on people, since rats commonly nest in Indian huts and grain bins. Frequently, initial transmission was thus through contaminated food grains, due to black rats' activities in grain stores. Since this meant that rodent control became an evident remedy, this would pose challenges in certain parts of India, where some people worship rats. Associated with Lord Ganesha, they would be even fed in temples, such as the Karni Maata temple in Rajasthan, as an internet search instantly brings up. However, the documentary evidence from Madras Presidency certainly confirms evidence of mass killings of rats in efforts to contain the spread of the plague.

According to a monthly health journal written in Telugu in Colonial Andhra, the *Arogya Prakasika* of 1925 (pp. 15–6), the recommended precautionary measures include not to preserve any foodgrains in the house. The *Arogya Prakasika* of 1929 (p. 15) advised keeping any remaining food materials near rat holes, and to use rat traps, called *bone* in Telugu. The presence of rodents was crucial for prolonging plague epidemics, as observed by *Arogya Prakasika* in 1925. One wonders, however, to what extent such health-related writing, published from Madras by its Chief Editors Dr U. Rama Rao and U. Krishna Rao, would have any local impact among villagers, and to what extent it influenced government policies.

A bubonic plague epidemic broke out in Bombay in 1896, imported through commercial relations by steamships coming from Hong Kong (Kumar, 1998: 195). The same then happened in Calcutta in 1897, spreading to large parts of India within five years. The plague challenged the prosperity of one of British India's premier ports and administrative centres (Arnold, 1987: 60). The epidemic appeared often among merchants (*baniyas*), who were residing on port trust estates on land near the Bombay docks (Jaggi, 1981: 91). The slums of Calcutta and other ports provided ideal conditions for rapid spreading of infections (Kumar, 1998: 195). Klein (1998: 737) has argued that since Bombay as a major port of western India became the hub of a vast integrated logistics network, linking various commercial centres across India, the plague could spread widely. Then as now, migrant labourers carried the epidemic with them as railway passengers, literally from junction to junction, and from town to town within days (Klein, 1998: 737). Plague was also seen as a disease of darkness. Dirt and poor ventilation gave the bacillus its deadly impact (Klein, 1973: 652–7).

By 1899, the plague had appeared in many smaller towns and later extended into the countryside. Between 1896 and 1917, over 5.5 million people, according to a report in the *Andhra Patrika* of 1918, succumbed to the epidemic. Polu (2012) claims that from 1892 to 1940, over 10 million people succumbed to the plague in India. Klein (1998: 734–44) reported that from 1896 to 1920, the plague mortality was

1.87 million in Bombay Province and 100,000 in the Province of Madras. The Punjab had 2.64 million deaths, the United Provinces 2.35 million, and Bengal another million. Even Western medicine did initially not provide any effective remedies regarding its cure or prevention (Catanach, 1989: 149).

However, a Ukrainian microbiologist, Waldemar Haffkine (1860–1930), globally recognised as the pioneer of developing vaccines against cholera and bubonic plague, successfully tried out his inventions in India. The introduction of Haffkine's anti-plague inoculation in 1897–98 sparked off many rumours concerning its nature, purpose, and effects (Arnold, 1987: 72). Fear about hospitals and the practices of surgery, post-mortems and vaccination gave rise to widespread opposition to public health measures (Arnold, 1987: 75). Compulsory inoculation was advised, however, and doctors and administrators made good efforts to persuade local people to take up immunisation voluntarily (Arnold, 1987: 83). In due course, the colonial state received middle-class support and cooperation, as the higher and middle-class castes gradually overcame their doubts about western medicine and began to show greater acceptance of hospitals and inoculation during the early plague years (Arnold, 1987: 90).

Plague Mortality and Preventive Measures in the Madras Presidency

As noted, trading classes like Baniyas and Marwaris unwittingly contributed to plague transmissions. The Report of the Bombay Plague Committee for 1897–98 commented that Baniyas took the plague to the Deccan, where it became known as the 'Marwadi Sickness'. They also carried it to parts of Khandesh, where it is called the 'Baniya Disease'. Hindu traders, mostly from Gujarat, spread the disease to Karachi and Mandvi in Cutch (Arnold, 1993: 210). Various travelling communities and traders brought the plague to Southern India, particularly Madras, which had good commercial contacts with traders and business communities elsewhere and was also a major port city (Arnold, 1993: 210–1). In 1898, Hinganghat, Wardha and Nagpur in the Central Provinces were affected by a plague epidemic, which spread in August 1898 from Hubli and Bangalore to Guntakal junction in the Ananthapuram district of Madras Presidency. From there it moved further into Bellary, Salem and Kurnool districts and led to a plague attack throughout South India by December 1898. In his autobiography, Achanta Lakshmi Pati (1973: 53–4) recalled the history of this plague in Madras Presidency in 1898. He also detailed the implementation of vaccination systems for the prevention of epidemics in many parts of the country.

The plague was majorly responsible for the high mortality rate in India, particularly in the Madras Presidency. A map showing the districts of the Madras Presidency is taken from Madras (1939: 99).

Table 1 gives data on the plague mortality from 1900 to 1920 in the Madras Presidency. While these death figures vary, they are shockingly high in some years.

Table 1 shows no particular pattern of plague deaths recorded in the period between 1901–2 and 1920–1. In some years, there was somewhat lower mortality,

Districts of the Madras Presidency



Source: Report on the Madras Administration 1937–38, The Superintendent, Government Press, Madras, 1939, p. 99.

Table 1 **Plague Deaths in Madras Presidency Between 1901 and 1921**

Year	Plague deaths	Year	Plague deaths	Year	Plague deaths
1901–02	3,035	1908–09	3,358	1915–16	3,889
1902–03	10,795	1909–10	3,844	1916–17	11,498
1903–04	13,291	1910–11	4,867	1917–18	24,708
1904–05	20,125	1911–12	15,185	1918–19	12,859
1905–06	5,788	1912–13	6,651	1919–20	5,645
1906–07	898	1913–14	5,130	1920–21	14,652
1907–08	2,872	1914–15	5,102	Total	1,74,192

Source: The author (from various *Reports on the Administration of Madras Presidency for the Years 1901 to 1921*, mainly Report [1911, 1912, 1913, 1920, 1921, 1922]).

without explanations. Tracing infected people posed major challenges. Since many victims sought to evade detection and maybe self-isolated or concealed themselves, they escaped the recorded data on mortality, so that the numbers of actual deaths are likely to have been higher than the official figures. The Report on deaths in 1903 discusses the situation in different areas, noting that the infected districts were Ananthapur, Bellary, Coimbatore, Kurnool, the Nilgiris, North Arcot, Salem, South Canara and also the Central districts of the Presidency. The government's policy to combat the disease varied little from earlier approaches adopted on the plague's first appearance in the Presidency (Sanitary Commissioner, 1903: 89). In 1904, at the all-India level, registered deaths were 1,143,993. Locally, the death rate was highest in Bellary, compared to the other nine districts affected. Specific problems arose in implementing local plague policies due to conflicts between local judges (*munsifs*) and sanitation coolies (Sanitary Commissioner, 1904).

The 1898 plague outbreak in Madras Presidency was initially principally confined to districts bordering on Mysore, Hyderabad and the Bombay Presidency. Since the spread of the epidemic was thought to occur mainly through infection from travelers, a system of issuing passports was used to enforce surveillance of contacts. For instance, at the inspection station of Jalarpet, 120 plague-infected people were removed from trains (Sanitary Commissioner, 1901). Since the study of these cases indicated that the infection was brought from territories beyond the control of the Government of Madras, no material change was made in this surveillance policy (Sanitary Commissioner, 1902: 84). Notably, this looks like an early precursor of current containment policies in the COVID-19 pandemic, maybe even involving basic attempts to trace contacts.

By 1905–6, the colonial government incurred increased public expenditure for setting up some laboratories in different parts of the country. A Central Research Institute was created at Kasauli in Himachal Pradesh, though very few factories for producing vaccines and sera were established. There was little progress in research in these facilities (Kumar, 1998: 204), as the scientific community of India looked to the metropolis, where work on tropical diseases had been undertaken. Harrison (1994) has claimed that anti-plague drives facilitated medical research work in India. However, in the Madras Presidency, many government plans for more extensive laboratory networks remained on paper.

Between 1906 and 1910 less deaths were registered, connected to the fact that millions of rats were killed (Harrison, 1994: 157). Travel restrictions in the Presidency, including the necessity of a passport for travelling on certain routes, somewhat reduced transmission rates, according to the Madras Plague Proceedings of 1905 (Sanitary Commissioner, 1905). There was a slight increase in deaths in 1910 due to the decline of vaccinations. Even re-vaccinations failed, partly blamed on the abnormal summer heat, with 84 deaths recorded among persons who had been previously inoculated. Such failures of revaccination affected trust among Indians in the western medical systems (Report, 1911).

The 1911 Census of India blamed overcrowding, bad town planning, poor sanitary arrangements and ill-ventilated houses for the spread of the plague. While in many rural districts of Punjab and the United Provinces, high death rates were reported, in Madras Presidency, with 15,185 deaths in 1911 (Table 1), the disease remained prevalent throughout the year. It affected Bellary, Coimbatore, North Arcot and Salem, as well as municipal towns like Tirupattur, Coimbatore and Bellary (Report, 1912). A critical report of the Madras Drainage Committee (Report, 1913) argued that ineffective and incomplete drainage systems failed to dispose of solid excrement, while waste left for collection in the streets had become 'poisonous dust' that would increase plague infections. The functioning of public health officials was, however, often ineffective, as their powers and sanctioned funds were inadequate for improving sanitation in the Province (Report, 1913:15–9). The Second All India Sanitary Conference, held at Madras in 1912, reiterated in its report (Proceedings, 1913) that unhygienic conditions and poisoned foodgrain were mainly responsible for plague epidemics. The Conference repeated calls for improving water supplies and argued that inspection of foodgrain and supply of drugs could help control the plague (Proceedings, 1913: 290–6). Such calls and reality continued to diverge widely.

In 1914 and 1915, plague deaths decreased (Table 1), but mortalities remained high in Bellary and in municipal towns, with Tirupattur suffering the most (Sanitary Commissioner, 1914: 113). In 1917, the highest mortality in the first two decades of the twentieth century was recorded, with 24,708 deaths from 13 districts in the Madras Presidency (Table 1). The casualties were again highest in Bellary, followed by Anantapur, Coimbatore, Salem, and North Arcot. Again, even patients previously inoculated with anti-plague vaccine died from the severity of the epidemic. The impact of the First World War and the failure of western medical systems were seen as possible causes for the highest death tolls in 1917 (Klein, 1973: 642–5). The general health of the Presidency during the year was very unsatisfactory, attributed to two chief causes, the severe economic distress and consequent lowering of people's resistance to infection and a widespread influenza (Report, 1920: 96–7; Sanitary Commissioner, 1917). During 1916 and 1917, Pandit Gopalacharyulu, an Ayurveda practitioner in the Presidency, started a public awareness campaign on plague, its mode of spreading and methods of protection. His advertisement in the *Andhra Patrika* of 18 February 1916 assured people not to fear plague since his organisation would provide good Ayurvedic treatment, as he supplied medicine, not only in India, but also in Burma and Ceylon. This was clearly a mixture of public service and business development.

The period from 1917 to 1921 again recorded higher death rates from the plague, except for 1919–20 (Table 1). During this period the conditions were unfavourable to agriculture and food grain prices increased. Food grain shortages necessitated imports from Burma and Bengal, leading to a marked rise of infections from contaminated imported grains (Report, 1921: 11, 92). The colonial government took

further preventive measures to contain the plague during these years. The number of rats destroyed added up to 2,623,486 since the beginning of this operation in July 1898. Yet mortality was heaviest in 1921, with 14,652 deaths (Table 1), even though eight districts remained completely immune to the disease (Report, 1922: 92). Many plague victims were identified only near the end of their illness and were almost moribund when hospitalised. During 1921, telegraphic reports of first cases of plague were discontinued under Government Orders (G.O.) by the government (G.O. No. 330, Public Health (P.H.) 1 March 1922), while Ayurvedic doctors like Pandit Gopalacharyulu continued to advertise their services, as in *Andhra Patrika* of 7 January 1920. Overall, between 1871 and 1921, India experienced what Klein (1973) has described as the 'woeful crescendo of death'. The death rate of 41.3 per thousand of the population in the 1880s rose to 48.6 per thousand in the decade of 1911–21 (Arnold, 1989: 199–200).

Developments in Plague Mortality from 1922 to 1942

Various later reports of the Director of Public Health in Madras show that while the plague mortality rate declined over time, and only 51 cases of plague were registered in 1945, plague outbreaks continued to cause concern throughout the 1940s. The most striking change in mortality patterns was the increase in cholera deaths and a decrease in plague-related deaths (Arnold, 1989). The statistical data of several reports characterised the period from 1920 to 1947 as 'unhealthy'. In the 1920s, many people still resisted preventive measures concerning plague, so that Mysore, Bombay, Hyderabad and Bellary districts always faced difficulties in controlling outbreaks (Annual Report, 1924). While the government introduced a policy of destroying imported foodgrains contaminated with plague virus, this control system was not accompanied by paying government compensation to affected traders. Fearing loss of money as well as business, many traders did not cooperate, which then increased the spread of plague because infected foodgrains came into the market (Annual Report, 1924). Table 2 continues a varied picture over the two decades, though compared to Table 1 the casualty figures are generally much lower.

Table 2 shows that the total number of plague-related deaths in 1922 and 1923 were still high in the Presidency, but tailed off thereafter. In 1922, Coimbatore district emerged as one of the plague-spots in the Presidency, especially Pollachi, Udampet and Dharapuram taluks, and Pollachi and Dharapuram municipalities. From Dharapuram, the infection spread to Palni taluk in Madura district. In 1923–24, Salem district was considered the most dangerous part of the Presidency, with Salem town itself reporting 680 deaths (Annual Report, 1924: 176–82). Coimbatore and Periyakolam taluks were also seriously affected and the latter was responsible for over half of the total district's mortality. District Health Officers confirmed that Madura, Sholavandan and Periyakolam were prone to plague outbreaks. Sixteen districts registered plague deaths, but 96 per cent of the total mortality occurred in

Table 2 **Plague Deaths Between 1922 and 1942**

<i>Year</i>	<i>Plague deaths</i>	<i>Year</i>	<i>Plague deaths</i>	<i>Year</i>	<i>Plague deaths</i>
1922	9,153	1929	1,801	1936	615
1923	12,110	1930	1,459	1937	1,127
1924	3,922	1931	1,073	1938	1,155
1925	2,011	1932	1,561	1939	324
1926	2,143	1933	2,591	1940	1,159
1927	2,457	1934	2,358	1941	1,726
1928	2,106	1935	645	1942	701
Total deaths					52,297

Sources: The author (from Annual Reports of the Director of Public Health and Annual Administrations Reports). For 1922 to 1924, Annual Report (1924: 17) and Annual Report (1925). For 1925–9, Report (1925, 1931) and Annual Report (1931a: 15). For 1930–42, the Annual Reports on the Administration of Madras Presidency for the Years 1930–42 were used (Annual Report, 1931a, 1932, 1936, 1937, 1939, 1942).

Madura (4858), Coimbatore (3888), Salem (1818) and Bellary (1090) in 1923. In Ramnad district, plague cases were almost solely confined to the Nadar community of Aruppukottai. Tuticorin was also severely affected, as the infection was brought into the town from Madura.

During the latter half of 1923, the plague spread in a virulent form into Hyderabad. In the Presidency, fifteen rural towns recorded 529 deaths from plague as against 43 towns with 1,220 deaths in 1923. Towns with high death rates were Sholavandan, Kottur, Aruppukottai, and Kumbam. Twenty-two deaths from pneumonic plague occurred in Naduvattam in Ponnani taluk. The Cumbum valley and the Travancore hills are also mentioned as plague hotspots, because of cool and moist conditions, but also due to large grain centres that attracted rats and fleas. Grain trade routes are explicitly identified as disease-spreading centres by the Director of Public Health in Madras in 1923. The salaries of qualified plague inspectors and temporary sanitary inspectors were provided from provincial funds. The Public Health Board recommended that plague supervisors are not necessary. The government accepted this recommendation and directed that, with effect from 1 March 1923, this class of officers should not thereafter be employed, since qualified plague inspectors were appointed, at a monthly pay of ₹60/- (G.O. No. 232, P.H. of 8 February 1923). It is not possible to establish direct links, but plague infections continued in several parts of South India.

The breakdown of 3,922 deaths in 1924 (Table 2), one of the lowest figures on record in the Presidency for some time, shows that 14 districts and 21 municipalities were infected. Coimbatore, Madura and Salem districts were responsible for

83 per cent of all deaths in the Presidency and four municipalities (Periyakolam, Salem, Pollachi and Dharapuram) accounted for 74 per cent of all plague deaths in the entire municipal areas (G.O. No.1951, P.H. 21 September 1925). In Madura district, 20,516 persons were inoculated and a rat killing campaign was carried out in railway stations. Because of local people's continued resistance to preventive measures and its exposure to infection from three sides, namely Mysore, Bombay and Hyderabad, Bellary district still presented difficult problems regarding plague control. Half-hearted rat trapping was never successful, as rats are cunning animals. It was claimed that much money and energy were wasted because it was erroneously believed that de-ratting can be left to sweepers and coolies. Construction of rat-roofs for all grain go downs in the Presidency's main grain centres was not adopted due to financial constraints (Annual Report, 1924).

According to the Reports of Health Officers during 1925–29, Mysore state was the focus of infections, with deaths from plague increasing slightly from 2,044 in 1925 to 2,143 in 1926. Over 75 per cent of these deaths were registered in Bellary, Coimbatore and Salem districts. Another epidemic broke out in Ramnad district in late 1925 (Report, 1927: 183). Private practitioners or Sub-Assistant Surgeons were employed as plague Inspectors during such emergencies. Unfortunately, the government passed orders that such private practitioners will be paid only ₹60/- per month, a counter-productive measure causing staff shortages (G.O. No.1492, P.H. 20 July 1925). Instructions aimed at preventing the spread of plague outside the Presidency town of Madras were issued for a further year from 15 July 1925 (G.O. No.1421, P.H. 9 July 1925), but these anti-plague measures were again not carried out vigorously and negligible numbers of rats were destroyed. Rat-proofing of all grain and cotton warehouses was still not undertaken and danger spots of plague were not identified in time (Annual Report, 1925).

During these years, Mahatma Gandhi started the Sarvodaya movement with the aim of protecting village public health (Pati, 1973: 296). In view of the COVID-19 pandemic, an article originally published in Gandhi's journal *Indian Opinion* on 16 January 1905 has now been reproduced (Gandhi, 2020). Intriguingly, this shows the Mahatma's hands-on responses to a plague outbreak in South Africa, where he had become involved with 23 pneumonic plague victims of Indian origin, working in a gold mine outside Johannesburg (Kant & Bhargava, 2019: 28). While 21 of these men and a nurse appointed to care for them died, rigorous hygiene and luck helped Gandhi and his colleagues, including a brave doctor, William Godfrey, to survive. Concerned that the plague might be used to introduce new anti-Indian restrictions, Gandhi was fighting plague and prejudice. His basic advice related to cleanliness, use of disinfecting fluids and avoidance of lavish feasts. Importantly, he urged those who had come in contact with a plague patient not to conceal this, but rather to have their clothes and belongings decontaminated. This incident enhanced Gandhi's faith in his hygiene strategies and also strengthened his scepticism regarding the efficacy of brandy as a medicine (Kant & Bhargava, 2019: 29).

In 1920s South India, prominent preventive measures including rat destruction, sun-disinfection of grain, use of cyanogas, calcium cyanide used as an effective rodenticide, and the cleaning of houses, drains, grain stores and railway stations were adopted in the Presidency (G.O. No. 1453, P.H. 30 August 1923). Plague regulations for areas beyond the presidency town of Madras were extended from time to time (G.O. No. 2329, P.H. 13 August 1942). The districts of Ganjam, East Godavari, Nellore, Bellary, Madura and Chenglepet had been free from plague due to effective relief measures, as outlined earlier, in the 1920s. But in 1927, they faced fresh infections, with Bellary and Madura recording more than 85 per cent of the total mortality. While six municipal towns recorded 181 deaths, seven rural towns registered 440 deaths in 1927. It was proposed to commence a rat-flea survey of the six or seven main infected places in the Presidency (Report, 1929: 167). Similarly, in 1928, Hindupur which had long been free of plague, suffered new infections, affecting a total of 12 municipalities during the year. In 1929, the epidemic was particularly severe in the districts of Bellary, Salem and Madura, with 160, 574 and 461 deaths respectively, accounting for nearly 92 per cent of the total mortality in the Presidency. Also in 1929, a pneumonic plague epidemic occurred in Lalaikkal, a hamlet of Hoogana Palli in Hosur taluk of Salem district. Within two weeks, 29 deaths occurred among a small population of 150. No other area in the Presidency reported this type of dangerous plague (Annual Report, 1931b: 166).

Standard preventive measures to combat the plague were inoculations and evacuation of infected areas. Sun disinfection of grains was carried out in several districts, 50,768 inoculations were performed, and rat trapping and baiting were an ongoing activity. The Indian Research Fund Association paid for investigations on a plague outbreak in the Cumbum valley in 1932, which caused a large death toll (Annual Report, 1932). That year, a conference involving the Directors of Public Health of Bombay, Mysore, Madras and the Assistant Director of the King Institute at Guindy near Madras, discussed strategies for coordinated efforts to combat the plague (Report, 1934: 157).

During the third quarter of 1932, the disease was conspicuously absent from Northern India, but its incidence rose in Bombay, Mysore, the Central Provinces, Burma and Madras, as reported in Parliament in London (India, 1985 [1932]). Plague epidemics continued to hit Bellary, Madura, Coimbatore and Salem in 1933 and 1934. After encouraging experiments in Cumbum Valley, fumigation by cyanogas was extended to rural Bellary, where death rates had remained particularly high (Report, 1935: 157). During 1934, pneumonic plague re-appeared in North Arcot and Chittor districts (Report, 1936: 170). Meanwhile, experiments were initiated by a certain Dr. Chitre to test immunity to plague in rats from different regions where the disease had occurred in epidemic form. An accurately measured test dose of '*B-Pestis*' was used for this experiment. A batch of rats from Madras, highly susceptible to plague, was contrasted with a batch of rats resistant to plague from Bombay. This investigation showed that the percentage of deaths from plague in the inoculated rats

displayed a general correspondence to the aggregate incidence of plague in the area from which the rats were obtained (Annual Report, 1936: 197).

In 1934, at all-India level reported plague cases rose to 103,271, the mortality rate increased in Hyderabad state, the United Provinces, Punjab and the Bombay Presidencies (India, 1985 [1935]). However, the entire Madras Presidency recorded only 645 plague deaths in 1935 (Table 2), the lowest figure since the plague's advent in the Presidency 38 years earlier (Madras, 1938: 173–4). The disease was mostly confined to localities bordering the Mysore plateau and the Cumbum Valley. The significant decrease in mortality was clearly related to strict government methods of evacuation, inoculation, isolation, disinfection and rat destruction. A total of 84,243 anti-plague inoculations were performed and extensive cyanogas fumigation of rat burrows was carried out, with great success. Local bodies encouraged fumigation measures and sanctioned half the costs. As a result, 219,315 rat burrows and 6,374 cracks in mud walls in 31,927 houses in 27 localities were fumigated. 8,358 rats, 10,474 house mice and a fair number of other rodents, 17 snakes and 11 bats were caught during the cyanide fumigation (Annual Report, 1937: 16–7). Plague research was conducted at different places, but lack of consistency in government policy led to a revival of the epidemic in several areas of the Presidency. The 1,127 deaths in 1937 (Table 2) were spread over seven districts and eight municipalities. Madras, Salem and the Nilgiris accounted for 84 per cent of the total plague mortality. The Nilgiris, which had remained plague-free for 15 years, got re-infected in 1937 (Madras, 1939: 97–8).

The government scheme of originally experimental cyanogas fumigation was now extended to all plague-affected areas, with very satisfactory outcomes. A new scheme was sanctioned for a temporary hospital in the Cumbum Valley, experimenting with an anti-plague serum developed at the Haffkine Institute in Bombay (G.O. No. 2916 P.H, 16 August 1939). This yielded such good results that only one death was registered in Bellary district, synchronised with decreasing rat populations in five villages due to fumigation. Significantly, in areas where fumigation was not used, plague mortality continued. Worst affected was Hosur taluk in Salem, from where the infection spread to Krishnagiri and Dharmapuri taluks and the Cumbum Valley, with 35 villages reporting infections (Annual Report, 1939).

After the Government of Madras formally took up the 'Fumigated with Cyanogas Scheme' (Madras, 1941: 79–80), more villages were fumigated. Special attention was now paid to the bionomics of fleas and destruction of rats and fleas in thatched roofs. A further government scheme was sanctioned for treating plague victims in local hospitals. As a result, in 1939, the lowest ever mortality from plague since 1898 was recorded, with only 324 deaths (Table 2). A total of 277,921 inoculations were administered and further plague research was conducted at Cumbum Valley with grants from the Madura District Board, the Indian Research Fund Association and the Travancore government. Picketing stations were opened where plague-infected commodities and personal effects of passengers were now fumigated with cyanogas

(Annual Report, 1942: 21–2). The government sanctioned ₹45,900/- for cyanogas fumigation in the infected areas (G.O. No. 1308, P.H. 27 March 1941), quite a large sum at that time.

Developments Between 1943 and 1951

Table 3 shows that plague mortality in the Madras Presidency continued to be fairly high until 1947, mainly due to socio-economic conditions of austerity during the Second World War. From 1940 to 1947 there was a revival of significant plague infections in various taluks. The eastern parts of Bellary district, which had been plague-free for about 23 years, suffered re-infection, causing about 70 per cent of the Presidency’s total mortality in 1941 (Table 2) and many more deaths in the following years.

During this most difficult period, which also saw the subcontinent’s Partition of 1947, there was a widespread lack of reliable water supply, protective vaccinations and environmental hygiene in the whole subcontinent. Plague mortality declined gradually, mainly due to intensive cyanogas fumigation of huts, houses, godowns and other commodities in numerous infected areas, and there were no new cases after such fumigations (Annual Report, 1946: 7–9), which again killed large numbers of rodents and some other animals. 300,000 plague inoculations were administered in Madras Presidency during this time and the government now ordered that all local boards and municipalities should insist on constructing rat-proof godowns as a condition precedent to granting licences for traders (Madras, 1946: 121–2). Observation stations were opened at the outskirts of infected localities, where all articles likely to harbour rats or rat-fleas were fumigated before they were allowed to be transported anywhere. Such surveillance certainly reduced plague outbreaks in the Presidency.

Overall thus, in colonial South India, starting in 1897 in Madras Presidency, albeit with many delays and tribulations, the government strictly implemented anti-plague measures and introduced various health schemes and control policies. In due course, major measures became the inspection of ships and trains as well as intending and actual passengers, subjecting suspected plague victims to detention and segregation. Plague regulations under the Epidemic Diseases Act of 1897 were strengthened

Table 3 **Plague Deaths 1943–51**

<i>Year</i>	<i>Plague deaths</i>	<i>Year</i>	<i>Plague deaths</i>	<i>Year</i>	<i>Plague deaths</i>
1943	4,885	1946	2,254	1949	150
1944	1,738	1947	2,718	1950	38
1945	1,644	1948	916	1951	51

Source: The author (from Report [1955] for the 1943 data and Madras [1942, 1943 and 1946] for all other data).

by appointing plague inspectors, as well as daily and monthly plague reports sent by Collectors to the Director of Public Health. Control measures focused on removal of infected items, rat destruction especially at infected railway stations, and the systematic clearing of garbage to improve general cleanliness of dwellings and their surroundings. The establishment of separate plague hospitals, connected to the development of plague vaccines, mass inoculations, segregation of plague patients and evacuation procedures were important steps. Sun disinfection of contaminated food grains and clothing, frequent checking of grains and especially cyanogas fumigation became standard control measures. Permanent preventive measures by the colonial government also included control over the location of trades and industries which attract rats, construction of rat-proof and rat-free granaries (G.O. No. 1146, P.H., 10 July 1926: 2–21). Effective propaganda methods such as lectures, lantern slides, cinema shows, health-related songs, dramas and skits gave good results (G.O. No. 1130, 19 March 1939: 27–31). Consequently, the plague had almost disappeared in the whole of Madras state by 1953, with only nine attacks and six deaths from plague in that year, as against 23 attacks and 12 deaths recorded in 1952 (Madras, 1954).

India's government later also introduced Dichlorodiphenyltrichloroethane (DDT) treatment, which replaced cyanogas, with good results. Recognising the public health needs, despite awareness that such treatment has poisonous side-effects, more efficient control policies were developed, and sufficient health staff was appointed (Madras, 1954: 43). Prophylactic treatment of endemic areas with DDT, which also worked well in malaria control, was adopted and the Epidemic Diseases Act of 1897, which continued to give officials special powers to enforce containment, was strictly implemented. It is gratifying to read the records of excellent progress achieved in plague control by the early 1950s (Report, 1955: 16–9).

Concluding Discussion

This article was originally conceived as an archive-based historical research to contribute to ongoing academic discourses about the tensions caused in local colonial scenarios of South India between modern western medical interventions and the resistance of colonial subjects to such interventions and control measures. Meanwhile, though, the almost unspeakable realisation that the ongoing COVID-19 pandemic looks rather like a new form of plague hit home, and has affected this concluding discussion.

Among several terrible epidemics that ravaged colonial Indian society in the first half of the twentieth century, the spread of various forms of the plague, also in South India, was promoted by certain social and environmental problems. Early reports from Madras Presidency about how the colonial state handled plague outbreaks, found in immensely rich regional archives, provide important illustrations of the vacillations and policy failures involved in control policies, before more effective processes and remedies were developed and applied. In due course, the colonial

government made some pioneering efforts to introduce various health and medical policies, which yielded good results with lasting long-term effects, felt especially after the independence of India. The initially unfocused phase of anti-plague measures soon gave way to the colonial state's push for adopting western medicines in efforts to reduce infections and mortality figures. The greater spread of hospitals and inoculation programmes, despite much initial resistance and distrust, later somewhat mitigated the ongoing local problems. Regarding plague prevention, western medicine gradually almost succeeded in elimination of the plague.

This article has clearly shown that when faced with dangerous epidemics like the plague, or indeed now COVID-19, denial or downplaying the risks posed by an aggressive epidemic cannot be a viable strategy either at the private or the public level. The detailed archival evidence of local struggles in colonial South India between about 1900 and 1947 to contain plague epidemics and outbreaks has documented the inescapable demands for a synergy of private responsible action, together with considerable, increasingly focused engagement by the public health sector, however rudimentary this may have been in colonial India. Given the known root causes of plague epidemics, measures had to include the mass killing of rats and other rodents to eliminate the sources of infections, including rat fleas. In late nineteenth century South India, however, not everyone pulled together to act, as it would now be called, in the wider public interest when it came to controlling plague outbreaks. The narrow interest of some entrepreneurs who continued to sell contaminated food grains was one stumbling block. The initial fears and distrust of uneducated local people about inoculation and especially segregation, caste barriers and the grave nature of plague itself, all helped the spread of sporadic plague epidemics and their periodic re-appearance over several decades.

In earlier times, despite partly vigorous government measures, plague outbreaks could not be fully controlled, however. More recently, too, outbreaks have flared up from time to time, as seen in 1994 in Surat (Madan, 1995). Outbreaks of dengue fever and chikungunya, which are not covered here, but should at least be mentioned, refer to different manifestations of highly dangerous and contagious diseases with similar symptoms as the plague. Presently, faced with the COVID-19 pandemic in India, common people, health authorities at various levels and the central state, now the largest democracy in the world, are again seen struggling to contain the disastrous spreading of a new type of infection that causes many deaths and has already brought massive social and economic turmoil.

The earlier experiences of handling such challenges, managed in pre-democratic times by a foreign colonial power, indicate that then, as now, some firm, focused action is absolutely essential, otherwise such dangerous epidemics will completely escalate out of control. Outbreaks of the plague may have been confined only to certain areas, yet often spread easily in the past. As this article has shown, after some initial complications, an increasingly firm grip over the plague was achieved. Currently, India does not have decades to work out how to handle the imminent

challenges of COVID-19. As new research demonstrates (Kummitha, 2020), various methods of interventions into people's freedom of movement are inevitable to contain the spread of such a pandemic. But control methods based on isolation are clearly insufficient by themselves, more so in crowded twenty-first century South Asia. The worrying similarities between plague outbreaks in colonial South India and the current pandemic suggest that to avoid further huge casualties, re-infections and further waves of the COVID-19 pandemic, everyone has to act responsibly, a tough private as well as public challenge, focused on local needs and measures. While it seems unwise to wait for, or rely on, state-driven control policies, a new sense of civic responsibility may become a new component of post-pandemic life, again not unfamiliar in light of what the people of the Madras Presidency—and their rulers at that time—began to learn in the early decades of the twentieth century.

Today, pandemics are not a brilliant chance to polish the profile of leader figures, rather they require hard work, in locally focused action, very much in the way the archival resources of early twentieth century Madras Presidency, as shown here, have documented. There needs to be responsible leadership at the centre, endorsing firm controls, where necessary. But at the crucial local and individual levels, which will of necessity be less well documented, if at all recorded for posterity, apart from good luck, finding an appropriate balance between alert monitoring, watchfulness and engaged commitment to prevent the spreading of pandemics, as Gandhi's example shows, could make and mark the difference between becoming part of mortality statistics and survival.

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Socio-Economic Empowerment of Rural Women through Self-Help Groups: A Study

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Abstract

Original Research Article

The empowerment is the process of obtaining basic opportunities for marginalized people, either directly or indirectly by the government, NGOs and non-marginalized people in the society. In recent years, the rural women are gaining empowerment with the support of various developmental programs initiated for the women development from time to time. One of the important program for women development and empowerment is the Self-Help Groups (SHGs) in the country as a whole. With the help of SHGs, the rural women are gaining income and employment opportunities. With the income generation and asset creation through Self-Help Groups, they are empowered socially, economically, educationally, politically and psychologically in the society. The SHGs in several parts of the country have achieved success in bringing the women to the major stream of decision making. The SHGs in our country have become a source of inspiration for women's welfare and formation of SHGs is a viable alternative to achieve the objectives of rural development and to get community participation in all rural development programs which in turn is providing women empowerment in all aspects. The present study is focused on empowerment of women through SHGs with a basis of before and after the SHG programs in the study area.

Keywords: Women Empowerment, Self-Help Groups, Decision Making, Awareness, Rural Women, Savings, Spending Money, Gram Sabhas, Political Participation, Income Generation, Expenditure.

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INTRODUCTION

The Empowerment is a set of measures designed to enhance the autonomy and self-determination among the individual as well as communities enable them to focus their interests in a self-confidential manner by acting their own determination. The empowerment is the process of obtaining basic opportunities for marginalized people, either directly by those people, or through the help of non-marginalized others who share their own access to these opportunities. The empowerment includes actively thwarting attempts to deny those opportunities. It also includes encouraging and developing the skills for self-sufficiency with a focus on eliminating the future need for the welfare in the individuals or of the group of communities. Empowerment is one of the main procedural concerns when addressing human rights and development. In simple terms, empowerment means giving power or authority to an individual.

Gender Empowerment

The gender empowerment is the empowerment of people of any gender. While conventionally, the aspect of it is mentioned for empowerment of women, the concept stresses the distinction between biological sex and gender as a role, also referring to other marginalized genders in a particular political or social context. In the present days, the gender empowerment has become an important one for discussion in the concept of development and economics. Entire Nations, communities and groups can benefit from the implementation of various programs and policies that adopt the notion of women empowerment. The Human Development and Capabilities Approach, The Millennium Development Goals, and other credible approaches or goals point to empowerment and participation as a necessary step, if a country is to overcome the obstacles associated with poverty and development. Gender empowerment can be measured through the Gender Empowerment Measure, or the GEM. The GEM shows women's participation in a given nation, both politically and economically. GEM is calculated by tracking the share of seats in parliament

held by women, of female legislators, senior officials and managers and of female profession and technical workers, and the gender disparity in earned income, reflecting economic independence. Then, it ranks the countries given this information. Other measures that take into account the importance of female participation and equality includes the Gender Parity Index (GPI) and the Gender Development Index (GDI).

Empowerment of Women

The Empowerment of women is gaining ground and an added significance in the Indian context owing to their profusive participation in developmental activities. Gandhiji stated that women are companion of men gifted with equal mental capacities. She has a right to participate in the minute details of the activities of man and she has the same right to freedom and liberation of man. Women Empowerment has become a subject of growing importance around the world in contemporary times. The concern is seen at different levels and circles which includes governments, bureaucracy, NGOs, academicians and other researchers who have been concentrated on the empowerment of women in various aspects from time to time. As India strives towards equal rights, a change in the perceptions of men and women is needed to reduce gender disparity.

The empowerment of women has been extensively debated and written about all over the world. Sociologist Dhruba Hazarika has rightly said that empowerment of women means equipping them to be economically independent, self-reliant in addition to providing positive self-esteem to face any difficult situation. Women should be equipped enough to participate in any development process. Women in Indian society have come a long way from the days of being worshipped as goddesses to being molested and harassed—gruesome domestic violence cases, acid attacks and rapes. Over the years, a steady rise in the adversities faced by Indian women and girls has taken place. The Indian constitution grants certain constitutional and legal privileges to women pertaining to equality and fundamental rights, some special provisions were also introduced to strengthen the process of providing equal status to women. The empowerment doesn't have a straightforward definition because it means something different to everyone. Keshab Chandra Mandal wrote that female empowerment could be defined in five categories such as social, educational, economic, political and psychological empowerment.

Social Empowerment of Women

The social empowerment might be one of the most prominent forms of empowerment shown in the mainstream media. It strengthens women's social relations and their positions in social structures, giving them more of a purpose outside of the home. Their contributions to society are recognized and valued as

opposed to look down upon simply because it was a woman's creation. Social empowerment also fights back against discrimination, no longer letting people of different disabilities, races, ethnicities, religions, or genders be walked over by what's considered, normal.

Educational Empowerment of Women

Education is a crucial part of growing and developing, but there are still places in the world that deny education to girls. This takes away a fundamental skill everyone has the right to knowledge. Without a proper education for all, gender empowerment isn't possible. Education puts everyone on equal footing and lets young girls have access to what their rights and duties are. Not only that, obtaining knowledge can boost self-confidence, self-esteem and make girls self-sufficient. It also gives them access to the development of social, political, intellectual and religious consciousness and can discourage the growth of bigotry, narrow-mindedness, superstition, intolerance and so on.

Economic Empowerment of Women

People say money can't buy happiness, but being at an economic disadvantage can take away access to becoming empowered. Being poor, landless, deprived, or oppressed doesn't allow access to resources that those in good financial standings do. Closing this gap would allow everyone to have equal footing and women in particular would gain a more significant share of control over the material, human, intellectual and financial resources.

Political Empowerment of Women

Having a voice in politics can be substantial in letting a group's view be pushed into the light of mainstream media and that's no different for advocating women's rights. The political involvement of women, implies the decentralization of power and authority in the deprived, oppressed, and powerless people who have not been able to participate in the decision-making process and the implementation of policies and programs of both government and organizations as well as familial and societal matters. In other words, having political influence would not only give a voice to those who haven't had a voice in how things are governed, but it would also allow the possibility of policies and programs being put into place that would work with these discriminated groups.

Psychological Empowerment of Women

Psychological empowerment aligns with social empowerment. It transgresses the "traditional and patriarchal taboos and social obligations" and lets women go beyond what's expected of them in society. This can build self-confidence, help women to recognize their self-worth and gives them the chance to take control of their income and body. All five of these categories intertwine with one another, but it's equally important to consider them separately as well. Each

group has different main goals they're aiming for, so trying to focus on them as a whole would be unbeneficial ultimately. Knowing what work has to be put into these five categories of employment can provide a boost in the right direction and allow empowerment not just for women, but eventually for all. The SHGs are playing a crucial role in achieving all the above categories of empowerment by the rural women in India.

Self-Help Groups (SHGs) and Women Empowerment in India

The year 2001 had been declared by the Government of India, as 'Women Empowerment Year' to focus on a vision where women are equal partners like men. Because, the Constitution of India Grants equality to women in different fields of life. In the past, the situation of women was miserable in the society and even women were not ready to undertake any task due to many reasons like fear, shyness, male dominance in the society and purda system among the women in some communities, but time has been changed now. Women of today are not like the early days. Now, they are willing to come forward and want more socio-economic independence as they expecting their own identity, achievements, equal status in the society and greater freedom.

In this situation, the Government of India has provided Self Help Groups (SHGs) to them so that proper attention should be given to their economic independence through self-employment, entrepreneurial development and well-being that finally leads to its contribution. SHGs have been emerged as a powerful instrument in order to alleviate poverty and gaining empowerment of women in the rural India. SHGs through the network of Commercial Banks, Co-operative Banks, Regional Rural Banks, NABARD and NGO's has been largely supply driven and a recent approach in the provision of financial services to the poor and further upgrading their status in the society. In this way, SHGs are playing a significant role to reduce rural poverty and to promote rural savings along with provision of gainful employment opportunities among the rural women community.

The Women Self Help Groups in several parts of the country have achieved success in bringing the women to the major stream of decision making. The SHGs in our country have become a source of inspiration for women's welfare and formation of SHGs is a viable alternative to achieve the objectives of rural development and to get community participation in all rural development programs. SHG is also a viable organized set up to disburse micro credit to the poor women and hopeful them together into entrepreneurial activities. To alleviate the poverty and to empower the women, the micro-finance, Self-Help Groups (SHGs) and credit management groups have also on track in India. Self Help Group (SHG) is a small voluntary

association to form a group. It is informal and homogenous group of not more than twenty members.

SHGs consist of maximum 20 members, because, any group having more than 20 members has to be registered under Indian legal system. That is why it is suggested to be informal to keep them away from bureaucracy, corruption, unnecessary administrative expenses and profit motive. In fact, it is a home grown model to eradicate poverty which simultaneously works to empower and shape the lives of its members in a better way. Groups are expected to be homogenous so that the members do not have conflicting interest and all the members can participate freely without any fear. Self-Help Groups (SHGs) movement has triggered off a soundless revolution in the rural credit delivery system in India. SHGs have proved as an effective medium for delivering credit to rural poor especially for rural women for their socio-economic empowerment.

The empowerment by way of involvement in SHG can bring changes and enhancement in the living conditions of women. The underlying principle of SHGs is to afford to the poorest of the poor and to achieve empowerment. The SHG is a procedure by which a large group of women i.e. 10–20, with common objectives are facilitated to come together voluntarily to participate in the development activities such as saving, credit and income generation thereby ensuring economic independence among them. The SHG phenomenon definitely brings group awareness among women, sense of belongingness, adequate self-confidence. In fact, what she cannot achieve as an individual, can accomplish as a member of group with sufficient understanding about her own rights, roles, civil liberties and responsibilities as a dignified member of society on par with men. When she becomes a member of SHG, her sense of public participation, enlarged horizon of social activities, high self-esteem, self-respect and fulfillment in life expands and enhances the quality of status of women as participants, decision makers and beneficiaries in the democratic, economic, social and cultural spheres of life.

The experiences of SHGs in various countries have been achieving great success as an effective plan and approach in recent years. Group-oriented efforts in the form of Micro-credit groups in different countries of Latin America, Africa and Asia are examples of current self-help efforts. The Grameen Groups in Bangladesh, Local Self-Help development efforts-harambee in Kenya, Tontines or Hui with 10 to 15 members involved in financial activities through cash or kind in Vietnam, Self-Help efforts through credit unions, fishermen groups, village-based banks, irrigation groups etc., in Indonesia, the SHGs in countries like Thailand, Nepal, Sri Lanka and India are successfully proving forms of micro-credit groups or SHGs.

As a group-oriented model, SHG in India is a mechanism for women development to bring in individual and collective empowerment. Now, women in India are mobilized to protest against domestic violence, rising prices, legal inequity, rape, child marriage, domestic violence etc. In this way, it aims to empower women with various forms of power. Several factors and strategies have been provided by the SHGs that have made a positive contribution to the empowerment of women. These are full support and timely advice for balancing family and business responsibilities, leadership, experience in decision making and discussions on social issues. Women who joined in these groups enable themselves to face their household poverty through self-employment started at the initiative of SHGs. So, it is necessary to assess their role in empowering the women in rural India.

REVIEW OF LITERATURE

The available studies, reports and records have been reviewed in the following pages. According to Mohanan [1], the Self-Help scheme to help poorest of the poor must at the heart of the new strategy to combat poverty. Puhazhendhi [2], observed the functioning of SHGs, relating to its performance, sustainability, empowerment of women, economic impact on the members, future potentials etc. The emerging trends are leading to positive direction of empowerment of members and promotion of micro finance.

Gurumurthy [3], observed that SHG is a viable alternative to achieve the objectives of rural development and to get community participation in all rural development programs. SHG is a viable organizational setup to disburse micro credit to the rural women for the reason of making them entrepreneur and encouraging them to enter into entrepreneurial tricks. Vijayanthi [4], attempts to explain the procedure of women empowerment and find out the levels of awareness creation, decision making, empowerment among women from SHGs formed under Comprehensive Community Development Programme implemented in five slum areas of Chennai.

Bhatia and Bhatia [5], through little case studies highlighted that recovery of SHGs is higher than other credit extended to borrowers. Moreover, involvement of SHGs had helped the bank branches in recovery of old dues. They observed that there have been appreciable changes in the living standards of the SHG members in terms of ownership of assets, increase in savings and borrowing capacity, income generating activities and income levels as well. Mishra *et al.*, [6], studied the impact of SHGs on income and employment generation among the beneficiaries identified the main constraints and problems faced by the groups and suggested measures for overcoming these problems in Faizabad district of eastern Uttar Pradesh.

According to Veluraj [7], the Nobel Scholar and Indian Economist Amartya Sen spoken in his words that, unless women have empowerment, issues like literacy, health and population explosion will remain unresolved problems of the developing countries. In India, the mainstream of the women still continue to perform their traditional roles in the household and in agriculture. Seibel and Kumar [8], revealed that SHGs in Karnataka paved the way for empowerment of women who are increasingly involved in community development programs and local politics. SHGs have potential to prevent social evils such as child marriage, child labour, and dowry and prevent harassment of women. K. Jothy [9], examined SHGs under the women development program. On the basis of indicators relating to districts covered, growth of SHGs and members, percentage of SC/ST members, growth of savings and growth of internal lending and internal rotation. The study ended with policy measures to overcome shortcomings.

V. M. Rao [10], maintain that a review of the genesis and development of SHGs in India reveals that the existing formal financial institutions have failed to afford finances to landless, marginalized and disadvantaged groups. The origin of SHGs could be treated to mutual aid in Indian village community. SHGs encourage savings and promote income generating activities through small loans. Bharat Dogra [11], presented in his article, Women Self Help Groups, that almost all these women are from poor families, mostly from dalits and backward classes, while the increase in income is important. It is not the only part of these SHGs which is emphasized.

Krishnaiah [12], studied Self Help Groups in Andhra Pradesh and observed that as a result of group formation, women were able to diversify their activities by undertaking non-farm and animal husbandry related activities. He fulfilled that repayment of loans by the groups is very high because of peer pressure, members are known to each other and they are aware of the credit worthiness of members and the good performance of repayment from members to groups and groups to banks helped to get higher loans subsequently. Sivaramakrishnan [12], has disclosed in his article, Poverty Alleviation through Self Help Groups, that the poverty levels have reduced from 56.44 per cent of India's population in 1973-74 to 37.27 per cent in 1993-94. The IX Five Year Plan document envisages reducing rural poverty in the country from a level of 30.55 per cent during 1996 to 9.64 per cent by 2006 and further to 4.31 per cent by 2011.

Leelavathy [13], has expressed in her paper, 'SHG is a creamy layer for Women's social status' that the SHGs remove the curse of money lenders. SHGs are the ladder for upliftment of the down-trodden economically and socially. She has also pointed out that the SHGs are taking up construction work for their

hamlets like laying of roads, closing down of liquor shops, contributing to the rehabilitation works and management of their village affairs. Kour [14], suggested that the state agencies should formulate SHGs and finance them on strict criteria for income generation and poverty alleviation and overall development. Sivachithappa [15], pin-pointed that SHG- based micro-finance and bank linkage program has better outreach and positive impact on poverty.

Latha Krishnan [16], analyzed the formation and functioning of SHGs and the impact on the socio-economic status of underprivileged women. A pre-tested structured schedule was administered to collect the primary data from 350 SHG members and 30 animators. The study revealed that women come together as SHGs as they were able to get hassle-free and timely loans to meet emergence needs with thrift. Team spirit was acting as a binding factor to bring unity and cohesiveness among the group members. The SHG approach, apart from generating incremental income, helped them to upgrade the economic and social status along with a sense of recognition contributing to the process of empowerment.

Munian A [17], observed that the SHG Bank linkage approach is found to be an effective instrument by which very poor people can access hassle free formal credit without any collateral security and simultaneously improve their thrift habits. The approach also contributes to a social empowerment of the women. Pandey and Rini Roberts [18], examined the impact of participation in SHGs on the empowerment of women in Chamarajnagar district of Karnataka using personal narrative method. The authors recommended that it is necessary to provide a convergence of inputs, ensuring a proactive involvement of women in the program, changing social norms and perceptions and anchoring with wider movements of social change. Sahu Lopamudra and Singh [19], made a community based qualitative study in Pondicherry. It is found that the women SHG members have gained respect and trust in society and were able to plan for the future of their families. Authors observed that SHGs played a very important role in Women empowerment and should be promoted for economic development of the country.

Vijayalakshmi, Gowda, Jamuna, Ray, & Sajjan [20], found that SHGs are improving the standard of living of poor families. Appropriate strategies for empowerment of SHG women were addressed through organizing appropriate trainings both on and off-campus, including higher level trainings, follow-up activities, providing relevant leaflets and folders, exposures besides recognizing and encouraging women to come forward and take up processing and of linger millet products value addition and income generating activities. Dhanalakshmi and Rajini [21], looks at the literature around the SHG movement in India. It

examined the historical background of Self Help Groups in Indian context. It reviews the literature on the subject of empowerment process in relation to a Self Help Group as well as related literature.

Ramakrishna *et al.*, [22], observed that SHGs are formed for addressing their common problems. They make regular savings habit and use the pooled savings for the benefit of their members through a structured process of essential financial intermediation like prioritization of needs, setting self-determined terms for repayment and keeping records. Kappa Kondal [23], conducted a study on women empowerment through Self-Help Groups in Gajwel Mandal of Medak district in Telangana. The major findings of the study reveals that there is a positive impact of Self Help Groups on Women empowerment in Gajwel Mandal of Medak district. In the light of the above literature review on the SHGs and its impact on rural women empowerment, the present study has its important to assess the impact of Women Self Help Groups on its members in terms of socio-economic empowerment. The findings of the study may be useful for policy imperatives and smooth functioning of SHGs.

Objectives of the Study

The major objectives of the present study are as follows:

- To examine the impact of SHGs on the social empowerment of rural women.
- To analyse the impact of SHGs on the economic empowerment of rural women.
- To assess the impact of SHGs on the educational empowerment of rural women.
- To explore the impact of SHGs on health empowerment of rural women.
- To explain the impact of SHGs on the political empowerment of rural women.
- To suggest the suitable measures for the strengthening of SHGs and for the socio-economic empowerment and development of rural women.

Methodology of the Study

For the purpose of the present study, Tanakallu Mandal of Kadiri revenue division in Ananthapuramu district of Rayalaseema region in Andhra Pradesh has been selected. From the selected Mandal, six revenue villages have been selected. From each revenue village, 20 sample SHG women have been selected on simple random sampling basis. This altogether covers, one revenue Mandal, six revenue villages and 120 SHG women members from various categories.

RESULTS AND DISCUSSIONS

To analyse the impact of Self-Help Groups on the empowerment of rural women before and after establishment of Self-Help Groups method has been adopted. The different kinds of empowerment among

the sample SHG rural women have been examined as follows.

- Social Empowerment
- Economic Empowerment
- Educational Empowerment
- Health Empowerment, and
- Political Empowerment

Social Empowerment of Rural Women through SHGs

The social empowerment means equal status, participation and power of decision making at the household level and at the community level as well as

in all spheres of life. The social empowerment of women enables them to participate in decision making process in democratic institutions and at individual level. The social empowerment refers to enhanced status in the family and community, participation in decision making, access to government offices, freedom to travel anywhere on need based, group identity and increased awareness on society. According to Goel [24], the social empowerment of women refers to create an enabling environment through various affirmative development policies and programs for the development of rural women.

Table-1: Changing Indicators on Social Empowerment of Rural Women through SHGs

Changing Indicators	Before SHG		After SHG	
	Yes	No	Yes	No
Sharing Feelings Confidently with Others	37 (30.83)	83 (69.17)	76 (63.33)	44 (36.67)
Gained Confidence and Self Esteem	46 (38.33)	74 (61.67)	86 (71.67)	34 (28.33)
Fight Against Injustice and Inequality	32 (26.67)	88 (73.33)	78 (65.00)	42 (35.00)
Respectful Treatment from Family Members	45 (37.50)	75 (62.50)	82 (68.33)	38 (31.67)
Respectful Treatment from Society	34 (28.33)	86 (71.67)	91 (75.83)	29 (24.17)
Receiving by Officials in the Govt. Offices	28 (23.33)	92 (76.67)	89 (74.17)	31 (25.83)
Visiting Outside the Village Independently	36 (30.00)	84 (70.00)	93 (77.50)	37 (30.83)
Attending for Markets Independently	31 (25.83)	89 (74.17)	91 (75.83)	29 (24.17)
Domestic Violence	67 (55.83)	53 (44.17)	40 (33.33)	80 (66.67)
Increased Mobility	41 (34.17)	79 (65.83)	85 (70.83)	35 (29.17)

Source: Field Survey Data, Figures in Parentheses Indicates Percentages to their Total

In the process of creating empowerment among the rural women in India, the Self-Help Groups concept has been established in the country. Through the involvement of rural women in SHGs, they earning money and this supports for social empowerment among the rural women. The following Table-1 presents the changing indicators of rural women on the social empowerment before and after their involvement in the activities of SHGs in the study area. It reveals that out of 120 sample SHG women, only 30.83 percent opined that before joining in SHGs, they shared their feelings confidently with others as against 61.67 percent opined that there is no improvement in sharing their feelings confidently with others. On the other side, 63.33 percent of the respondent SHG women opined that after joining in SHGs, there is an improvement in sharing their feelings with others and 36.67 percent expressed that there is no improvement in sharing their feelings as a women in the society.

It may also noticed that, 61.67 percent expressed their feelings that before joining in SHGs, they can't gained confidence and self-esteem and 38.33 percent said that before SHG also they gained confidence and esteem. After joining in SHG activities, 71.67 percent of sample respondent women have gained confidence and self-esteem and 28.33 percent have not yet gained confidence and self-esteem. It shows that

before joining in SHGs, only 26.67 percent were fight against injustice and inequality and the remaining 73.33 percent were unable to fight against injustice and inequality. On the other, after joining in SHG activities, 65 percent of sample SHG women have been fighting against injustice and inequality against the women in the society.

It amy also observed that, only 37.50 percent of sample women opined that before joining in SHGs, they received respectful treatment from family members and the remaining 62.50 percent expreseed that due to poor income from them, they were not received respectful treatment from their family members. However, after joining in SHGs, 68.33 percent of SHG women opined that they received respectful treatment from their family members and only 31.67 percent expressed that they have not been received respectful treatment from family members. Before joining in SHGs, only 28.33 percent of sample women were received respectful treatment from society and 71.67 percent were neglected by the society in giving respectful treatment to the rural women. On the other, after joining in SHGs, 75.83 percent of SHG women opined that they received respectful treatment from the society and only 24 percent expressed that they have not received respectful treatment from society.

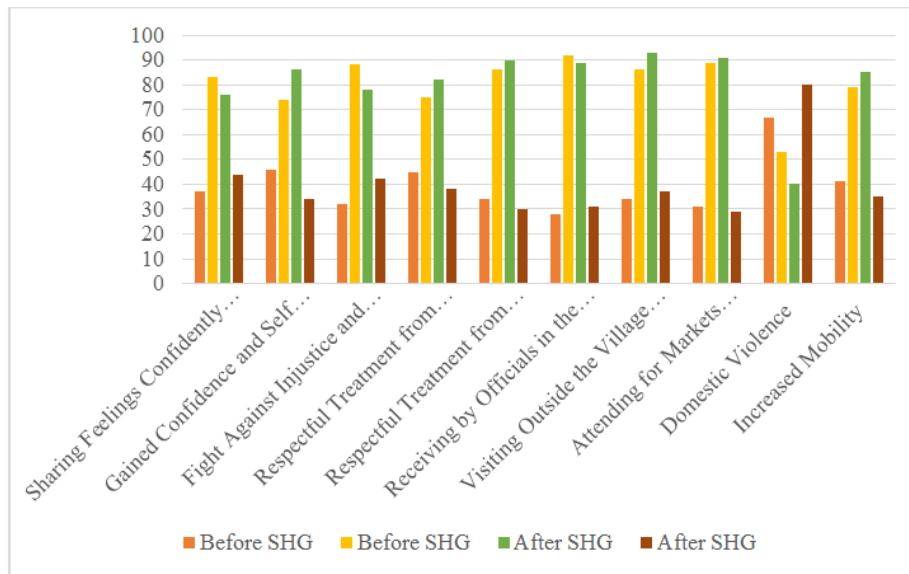


Diagram-1: Changing Indicators on Social Empowerment of Rural Women through SHGs

It shows that out of 120 respondent SHG women, about 23 percent of them opined that before joining in SHGs, receiving by government officials is satisfactory and the remaining 77 percent opined they have not received respectfully from government officials whenever they approached them. As against this, after joining in SHGs, 74.17 percent of women SHG members opined that they received respectful treatment by government officials as and when they approached for their works in the offices. It may also noticed that before joining in SHGs, only 30 percent of sample rural women were visited outside the village for their personal works and 70 percent of sample SHG women informed that they have not been visited outside the village independently. After joining in SHG activities, 77.50 percent of SHG women visited outside the village independently and the remaining 22.50 percent expressed that they are accompanied by their husbands during the visit of outside the village.

It reveals that before joining in SHGs, only 25.83 percent of rural women were attended the markets independently and 74.17 percent of women accompanied by their husbands to attend the markets. As against this situation, after joining in SHGs, a majority of 75.83 percent of SHG women expressed that they are attending to the markets independently to purchase the foodgrains and other domestic appliances. It reveals that before joining SHG activities, 55.83 percent of rural women were faced the domestic violence in the family and 44.17 percent expressed their feelings that they have not been faced any domestic violence. After joining in SHG programs, only 33.33 percent of rural women are suffering with domestic violence and the remaining 66.67 percent informed that

they have not been facing any domestic violence after joining in SHGs. Out of 120 sample women households under study, 65.83 percent of women informed that there is no improvement in the increased mobility among the SHG women, and after joining in SHGs, 70.83 percent of sample SHG rural women expressed that there is an improvement in the increased mobility among them. The changing indicators on the social empowerment of women is diagrammatically presented in diagram 1.

Economic Empowerment of Rural Women through SHGs

To achieve the gender equality and sustainable development, there is a need for economic empowerment of women as they are key contributors to the economies as producers of food, managers of natural resources and as entrepreneurs and employees. Inclusive and sustainable development around the world, leaving no one behind, is the overarching vision of the United Nation's 2030 Agenda. Gender equality and women's economic empowerment are central to realization of this vision, yet gender gaps around the world remain in large, pervasive and persistent. Women's economic empowerment is the right and smart thing to do. Women's rights are human rights case for gender equality is incontrovertible. The human development, economic and business gains from empowering women are substantial. Through the SHG activities, the rural women are earning additional income and are becoming economically empowered in the society and in the family. The Table-2 presents the data on the changing indicators of economic empowerment of sample SHG women, before and after they joining in SHGs.

Table-2: Changing Indicators on Economic Empowerment of Rural Women through SHGs

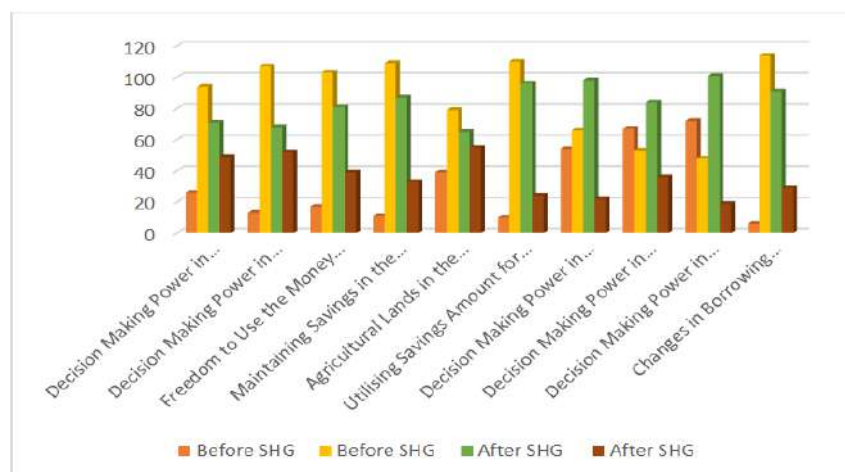
Indicators	Before SHG		After SHG	
	Self-Decision	Decision Taken Jointly by Husband and Wife	Self-Decision	Decision Taken Jointly by Husband and Wife
Decision Making Power in Utilising household Income	26 (21.67)	94 (78.33)	71 (59.17)	49 (40.83)
Decision Making Power in Taking Loans	13 (10.83)	107 (89.17)	68 (56.67)	52 (43.33)
Freedom to Use the Money for Personal Needs of SHG Women	17 (14.17)	103 (85.83)	81 (67.50)	39 (32.50)
Maintaining Savings in the Name of SHG Women	11 (9.17)	109 (90.83)	87 (72.50)	33 (27.50)
Agricultural Lands in the Name of SHG Women	39 (32.50)	79 (65.83)	65 (54.17)	55 (45.83)
Utilising Savings Amount for the Need of SHG Women	10 (8.33)	110 (91.67)	96 (80.00)	24 (20.00)
Decision Making Power in Purchase of Home Appliances	54 (45.00)	66 (55.00)	98 (81.67)	22 (18.33)
Decision Making Power in Purchase of Cloths	67 (55.83)	53 (44.17)	84 (70.00)	36 (30.00)
Decision Making Power in Purchase of Cosmetics	72 (60.00)	48 (40.00)	101(84.17)	19 (15.83)
Changes in Borrowing Capacity of SHG Women	07 (5.83)	113 (94.17)	91 (75.83)	29 (24.17)

Source: Field Survey Data, Figures in Parentheses Indicates Percentages to their Total

It reveals that before SHG activities in the study area, out of 120 sample SHG women respondents, 21.67 percent have taken a self-decision in utilizing the household income to meet the family needs and against this, 78.33 percent of sample SHG rural women have not taken an independent decision, but taken a decision on spending household income jointly with their husbands. It shows that here the husbands' role is more in taking a decision in utilizing the household income for their family needs. On the other side, after joining in SHGs, the same rural women have empowered to take a decision in utilizing income. It reveals that 59.17 percent of SHG rural women have taken independent decision in utilizing the household income as against 40.81 percent of the SHG women have taken a decision jointly with their husbands.

It may also observed that before joining in SHGs, the decision making power of rural women in taking loans is poor with 10.83 percent of rural women,

but 56.67 percent of rural women have taken an independent decision in taking loans for various purposes of their family. Before joining in SHGs, 89.17 percent of respondent SHG women have jointly with their husbands have taken a decision in taking loans and after joining in SHGs only 43.33 percent are jointly taken decisions in taking loans. It shows that after joining in SHGs the rural women have an empowerment in taking decision on receiving loans from various sources. It shows that before joining in SHGs, only 14.17 percent of sample women have a freedom to use money for their personal needs and 85.83 percent have taken a decision with their partners in utilizing money for the personal needs of the women. Out of 120 sample women, after joining in SHGs, 67.50 percent of women have a freedom in spending money for their personal needs as they are earning money from SHG activities. Only 32.50 percent of sample SHG women have taken a joint decision along with life partners on spending money for personal needs.

**Diagram-2: Changing Indicators on Economic Empowerment of Rural Women through SHGs**

It may also noticed that before joining in SHGs, only 9.17 percent of sample SHG women have taken decisions independently on savings as against 90.83 percent have taken decisions along with their husbands or the head of the family only. After joining in SHGs, a majority of 72.50 percent of SHG women have taken self-decision in managing savings from their income and only 27.50 percent of SHG women still depends on their husbands for saving of money from their earnings. It reveals that before joining in SHG activities, only 32.50 percent of rural women have agricultural lands in their name and after joining in SHGs, 54.17 percent of women have an ownership of land in their names. Out of 120 sample women under study, before joining in SHGs, only 8.33 percent of rural women have a liberty in spending the savings amount for their personal needs as against 91.67 percent of them depends on family members to spend the saved money for their personal needs. After joining in SHGs, 80 percent of sample women have an empowerment of taking independent decision in utilizing the savings for their personal needs and only 20 percent are depending on husbands to take a decision to spend the savings amount for personal needs.

As shown in Table-2, before joining in SHGs, 45 percent of sample women have a decision making power in purchase of home appliances and the remaining 55 percent depends on their husbands to take a decision to purchase home appliances. On the other side, after joining in SHG activities, 81.67 percent of sample SHG women have taken self-decision in purchase of home appliances and only 18.33 percent are depending on family members to take a decision to purchase home appliances. Out of 120 sample SHG respondents under study, before joining in SHG activities, 55.83 percent of women have a decision making power in purchase of cloths and against this, 44.17 percent depends on family members to take a decision to purchase cloths. After joining in SHGs, 70 percent of sample SHG women have taken self-decision in purchase of cloths and the remaining 30 percent of

sample SHG women have jointly taken a decision to purchase cloths for them and their family members.

It may also noticed that, before joining in SHGs, 60 percent of women have self-decision making power in purchase of cosmetics and 40 percent have taken a decision jointly with their husbands. After joining in SHGs, 84.17 percent of sample women have taken self-decision in purchase of cosmetics and only 15.83 percent have taken a decision jointly with their partners in purchase of cosmetics. Out of 120 Sample SHG women under study, only 5.83 percent of SHG women opined that before joining in SHGs, they have no borrowing capacity and 94.17 percent informed that their family members have taken a self-decision to borrow the money. After joining in SHGs, 75.83 percent of SHG women have self-decision in borrowing money and only 24.17 percent of SHG women have jointly taken a decision to borrow the money for family needs. The diagram 2 is diagrammatically illustrates the decision making power on economic activities by SHG women before and after joining in SHGs under study.

Health Empowerment of Rural Women through SHGs

The health empowerment can be defined as a process in which patients understand their role, knowledge and skills by their health care provider to perform a task in a healthy environment. The health empowerment puts the person in the heart of services. It is about designing and delivering health and social care services in a way, which is inclusive and enables the individual to control their health care needs. Women with greater agency are more likely to have fewer children, more likely to access health services and have control over health resources. The SHGs creating awareness among its women members on health care. Due to health awareness form the SHGs, the rural women are taking care their health and consulting doctors frequently. The changing indicators on health empowerment of rural women before and after joining in SHGs is presented in Table-3.

Table-3: Changing Indicators on Health Empowerment of Rural Women through SHGs

Indicators	Before SHG		After SHG	
	Yes	No	Yes	No
Frequent Consultation with Doctors	48 (40.00)	72 (60.00)	77 (64.17)	43 (35.83)
Decision Taken to Adopt Family Planning	58 (48.33)	62 (51.67)	83 (69.17)	37 (30.83)
Vaccination	89 (74.17)	31 (25.83)	104 (86.67)	16 (13.33)
Access to Health Services	51 (42.50)	69 (57.50)	91 (75.83)	39 (32.50)
Sanitary Facilities	37 (30.83)	83 (69.17)	95 (79.17)	25 (20.83)
Taking Nutritious Food	34 (28.33)	86 (71.67)	87 (72.50)	33 (27.50)

Source: Field Survey Data, Figures in Parentheses Indicates Percentages to their Total

It is observed that, before joining in SHG, only 40 percent of respondent SHG women were frequently consulted the doctors for medical treatment and the remaining 60 percent of sample women living in rural areas were occasionally consulted the doctors for treatment. After joining in SHG activities, 64.17 percent

of sample SHG women are frequently visiting the hospitals for their medical treatment. It may also noticed that before joining in SHG, out of 120 respondent women, 48.33 percent were taken an independent decision to adopt family planning methods and 51.67 percent were followed the instructions of

family members to adopt the family planning methods. As against this, after joining in SHG programmes in the

study area, 69.17 percent of the sample SHG women were taken self decision to adopt family planning.

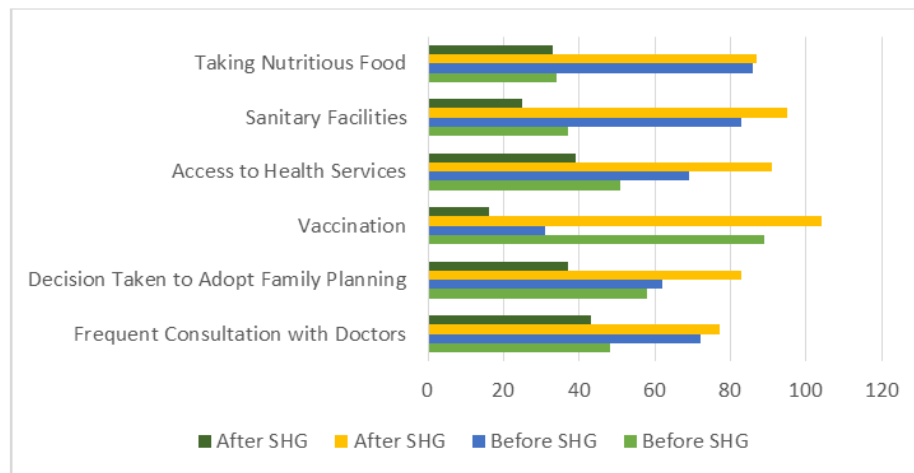


Diagram-3: Changing Indicators on Health Empowerment of Rural Women through SHGs

It may also observed that, before SHG, 74.17 percent of sample women have taken vaccination independently and the remaining 25.83 percent have undertaken vaccination with the help of others. On the otherside, after joining in SHG activities, 86.67 percent of sample women have taken self- decision to take the vaccination and the remaining through the suggestion of family members or not taken the vaccination for some one. Access to health services are necessary to maintain good health condition. It is observed that before joining in SHG, 42.50 percent of rural women have accessibility to health services and 57.50 percent have no accessibility to health services. After joining in SHGs, 75.82 percent of SHG women respondents have accessibility to health services and the remaining 32.50 percent have no accessibility to health services.

It reveals that before joining in SHG activities, only 30.83 percent of the rural women have cleaning and sanitary facilities at their homes and 69.17 percent of the respondent women have not been properly followed the cleaning and sanitary arrangements at their houses. After joining in SHGs, 79.17 percent of SHG women are maintaining proper cleaning and sanitary facilities and a few of them (20.83 percent) have no proper cleaning and sanitary facilities. Before joining in SHG, 71.67 percent of rural women have not been taken nutritious food to maintain good health and only 28.33 percent have taken nutritious food. After joining in SHG, the SHG officials were educated the rural women on the importance and necessity of the nutritious food. Based on the creation of awareness by SHGs, now 72.50 percent of the sample rural women are taking nutritious food. The changing indicators on health empowerment of rural women before and after the SHG, is diagrammatically shown in diagram 3.

Educational Empowerment of Rural Women through SHGs

Education is a milestone for women empowerment as it enables the women to respond to the challenges, to confront their traditional role and change in their life style. The education helps a woman to understand her rights to equal treatment on par with man in the society. Women can be empowered only when they are literate and educated. The education is the key to unlock the golden door of freedom for development. Of Indian women today, the female literacy levels according to 2011 literacy rate has been 65.46 percent as against male literacy rate of about 80 percent. Education is the key factor for women empowerment, prosperity, development and welfare. Discrimination of women from womb to tomb is well known factor. The SHGs are educating its members on the importance of education for rural women in all spheres of life, because of this, the rural women are concentrating on their education and their children's education and ultimately they are getting educational empowerment. The Table-4 presents the changing indicators of SHG women on their educational empowerment before and after joining in SHGs.

It reveals that before joining in SHGs, the awareness on learning, reasoning and questioning is poor among the sample women and shows that a majority of 79.17 percent of sample SHG women have no knowledge on learning, reasoning and questioning. It may also noticed that after joining in SHGs, 55.83 percent of sample women have knowledge and awareness on learning, reasoning and questioning the issues and the remaining 44.17 percent of the sample respondents are not yet concentrating in learning, reasoning and questioning due to their rural and traditional backgrounds.

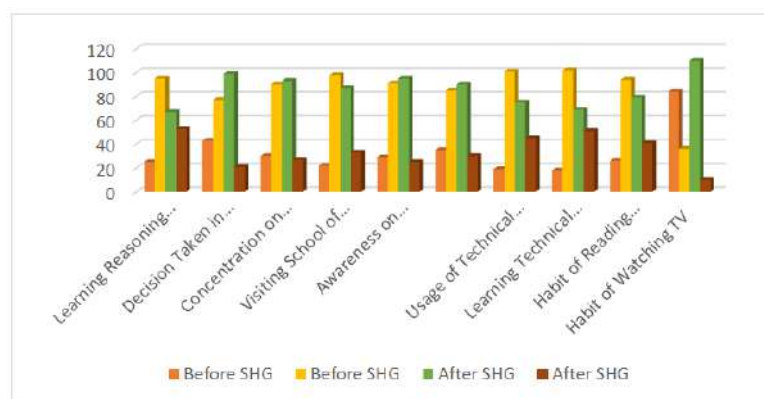
Table-4: Changing Indicators on Educational Empowerment of Rural Women through SHGs

Indicators	Before SHG		After SHG	
	Yes	No	Yes	No
Learning Reasoning and Questioning	25 (20.83)	95 (79.17)	67 (55.83)	53 (44.17)
Decision Taken in Joining Children in the Schools	43 (35.83)	77 (64.17)	99 (82.50)	21 (17.50)
Concentration on Children's Education at Home	30 (25.00)	90 (75.00)	93 (77.50)	27 (22.50)
Visiting Schools of Children	22 (18.33)	98 (81.67)	87 (72.50)	33 (27.50)
Awareness on Sending Children to Higher Studies	29 (24.17)	91 (75.83)	95 (79.17)	25 (20.83)
Communication with others	35 (29.17)	85 (70.83)	90 (75.00)	30 (25.00)
Usage of Technical Appliances	19 (15.83)	101 (84.17)	75 (62.50)	45 (37.50))
Learning Technical Skills	18 (15.00)	102 (85.00)	69 (57.50)	51 (42.50)
Habit of Reading News Papers	26 (21.67)	94 (78.33)	79 (65.83)	41 (34.17)
Habit of Watching TVs	84 (70.00)	36 (30.00)	110(91.67)	10 (8.33)

Source: Field Survey Data, Figures in Parentheses Indicates Percentages to their Total

It may also noticed that before joining in SHGs, only 35.83 percent of sample women are able to take a decision on joining their children in the schools and the remaining 64.17 percent of SHG women are depending on their family members to take a decision to join their children in the schools. After joining in SHGs, 82.50 percent of rural women are able to take a decision to join their children in the schools and a little of 17.50 percent are depending on their family members to take a decision to join the children in the schools. It shows that before joining in SHGs, 75 percent of the sample rural women have no concentration on children's education at home and only 25 percent have

concentrated on their children's education at home. After joining in SHGs, a majority of 77.50 percent of mothers are able to concentrate on children's education at home. It may also observed that before SHGs, only 18.33 percent of rural mothers have been visited the schools, where their children are studying and a majority of 81.67 percent of rural women are unable to visit the schools due to their illiteracy and ignorance. It may also noticed that after joining in SHGs, 72.50 percent of rural women are visiting the schools to observe the performance of their children in the schools.

**Diagram-4: Changing Indicators on Educational Empowerment of Rural Women through SHGs**

It may also observed that before SHGs, there is a poor awareness on sending their children for higher studies. It shows that 75.83 percent of rural women have no awareness on sending their children for higher studies and after the joining in SHGs, they have been improved their awareness on sending their children for higher studies. As shown in Table-4, a majority of 79.17 percent of rural women have an awareness on higher studies and are sending their children for further higher studies. It reveals that before joining in SHGs, only 29.17 percent of rural women have communication with others and a majority of 70.83 percent have no communication with others. After joining in SHGs, a majority of 75 percent of rural women have improved their communication with others in the society through acquiring knowledge and communication skills.

It shows that before joining in SHGs, only 15.83 percent of sample women are able to usage of technical appliances and 84.17 percent are unable to use technical appliances in the house. As against this, after joining in SHGs, 62.50 percent of respondent SHG women have acquired knowledge on the usage of technical appliances and the remaining 37.50 percent have not acquired the knowledge on usage of technical appliances. It may also noticed that before joining in SHGs, only 85 percent of women have not been learned any technical skills. After joining in SHGs, a majority of 57.50 percent of sample women have acquired knowledge on technical skills.

As shown in Table-4, before joining in SHGs, only 21.67 percent have a habit of reading newspapers and 78.33 percent have no habit of reading newspapers. On the other, after joining in SHGs, 65.83 percent of respondent women have improved their interest in reading newspapers. It may also noticed that before joining in SHGs, 70 percent of respondent women have a habit of watching TVs and 30 percent have no habit of watching TVs. After joining in SHGs, 91.67 percent of SHG women have concentrated on watching TVs and only 8.33 percent have not been watching TVs. The changing indicators on educational empowerment of rural women through SHGs is diagrammatically illustrated in diagram 4 under study.

Political Empowerment of Rural Women through SHGs

The political empowerment refers to the process of transferring various elements of power i.e. resources, capabilities and positions to those who do not have it. Political empowerment requires inclusion in democratic decision making process. The political empowerment of women is a social process, crucial to development and progress of the individual as well as the nation. The status of women is measured internationally by the participation of women in politics and their empowerment in politics. In recent years, women participation in politics has been gradually

increasing but not drastically. To secure women's rightful place in society and to enable them to decide their own destiny and for the growth of genuine and sustainable democracy, women's participation in politics is essential. Their participation in public life will solve many problems in the society. The SHGs in the rural areas are encouraging and educating the rural women to participate in public life and are joining in the political activities. The Table-5 illustrates the changing indicators of political empowerment of women before and after joining in SHGs.

It may be noticed that before SHG program, only 11.67 percent of SHG women have awareness on women Rights and Acts and 88.33 percent of rural women have no awareness on women Rights and Acts. After joining in SHGs, 70 percent of respondent SHG women have a knowledge and awareness on women Rights and Acts. It may also observed that before joining in SHGs, only 15.83 percent of the sample respondents opined that they have an awareness on reservation of seats for women in local bodies, but a majority of 84.17 percent of SHG women have no awareness on reservation of seats for women in local bodies. After joining in SHGs, 58.33 percent of SHG women got an awareness on reservation of seats for women in local bodies.

Table-5: Changing Indicators on Political Empowerment of Rural Women through SHGs

Indicators	Before SHG		After SHG	
	Yes	No	Yes	No
Awareness on Women Rights and Acts	14 (11.67)	106 (88.33)	84 (70.00)	36 (30.00)
Awareness on Reservation of Seats for Women in Local Bodies	19 (15.83)	101 (84.17)	70 (58.33)	50 (41.67)
Awareness on Reservation of Gram Panchayats for Women	23 (19.17)	97 (80.83)	87 (72.50)	33 (27.50)
Participation in Gram Sabhas	10 (8.33)	110 (91.67)	103 (85.33)	17 (14.17)
Participation in Political Party Meetings	12 (10.00)	108 (90.00)	94 (78.33)	26 (21.67)
Participation in Other Social Activities	09 (7.50)	111 (92.50)	83 (69.17)	37 (30.83)
Freedom in taking Decision to Vote in favour of any Candidate in Elections	46 (38.33)	74 (61.67)	99 (82.50)	21 (17.50)

Source: Field Survey Data, Figures in Parentheses Indicates Percentages to their Total

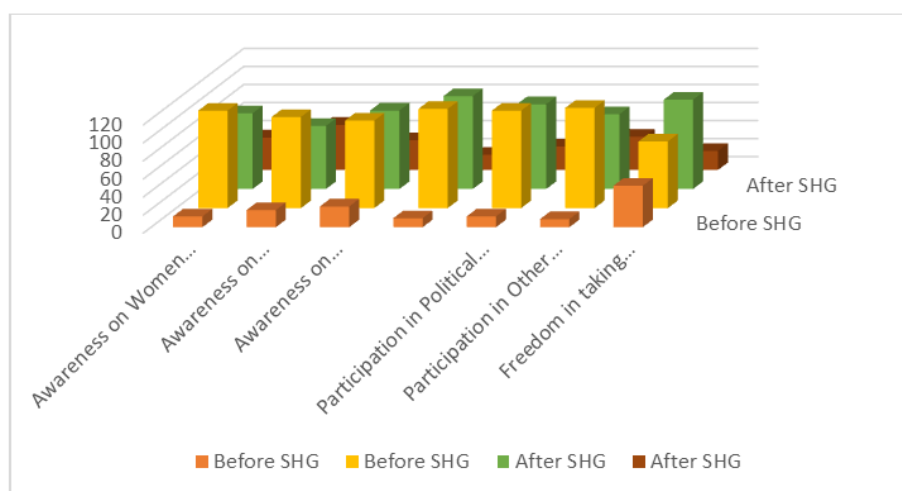


Diagram-5: Changing Indicators on Political Empowerment of Rural Women through SHGs

It may also observed that before joining in SHGs, 19.17 percent of sample SHG women expressed their view that they have an awareness on reservation of gram panchayats for women and 80.83 percent opined that they have no awareness on reservation of gram panchayats for women. On the other side, after joining in SHGs, a majority of 72.50 percent have awareness on reservation of gram panchayats for women. Out of 120 sample SHG women under study, only 8.33 percent of respondent women were participated in Gram Sabha meetings before joining in SHGs and a majority of 91.67 percent were not participated in Gram Sabhas. After joining in SHGs, a majority of 85.33 percent of respondent women were participated in Gram Sabha meetings.

It reveals that before SHGs, only 10 percent of rural women were participated in political party meetings and the remaining 90 percent were not participated in political party meetings. After joining in SHGs, a majority of 78.33 percent were participated in political party meetings. It shows that before SHGs, only 7.50 percent of sample SHG women were participated in other social activities as against 92.50 percent were not attended any social functions/activities. After joining in SHGs, 69.17 percent of respondent SHG women are participating in other social activities.

Before SHG activities, only 38.33 percent of sample women opined that they have freedom in taking decisions to vote in favour of any candidate in the elections as per their wish and a majority of 61.67 percent informed that they have no freedom in taking a decision to vote in favour of any candidate in elections as their wish. It is observed that after joining in SHGs, a majority of 82.50 percent of SHG women opined that they have freedom in taking a decision to vote in favour of any candidate in elections as per their wish. The changing indicators on political empowerment of SHG women before and after joining in SHGs is diagrammatically shown in diagram 5.

CONCLUSIONS

The women empowerment is gaining importance with an added significance in the context of India. The women empowerment has become a subject of growing importance around the world in contemporary times. Women in Indian society have come a long way from the days of being worshipped as goddess. According to Keshab Chandra Mandal, there are five categories of women empowerment such as social, economic, educational, political and psychological. The empowerment by way of involvement in SHGs can bring changes and enhanced the living conditions of rural women. As a group oriented model, SHGs in India is a mechanism for women development to bring individual and collective empowerment.

The empirical data reveals that a majority of rural women involved in SHGs have improved their decision taking power in spending money, taking loans, utilising money for personal needs. The head of the family is giving preference to the SHG women member of their family in taking financial decisions in the family after she joined in SHGs. It may also observed that majority of sample SHG women have gained social empowerment after joining in SHGs. They are sharing their feelings confidently with others, fighting against injustice and inequality, visiting outside the village and market places independently without accompany of their husband or other family members. The domestic violence has also been reduced in their families after joining in SHGs.

It reveals that the SHG women have also gained health empowerment after joining in SHG activities. Now, they are frequently visiting hospitals independently for medical treatment, taking decisions independently on adopting family planning, vaccination and access to health services. The educational empowerment has also improved among SHG women after SHG activities. They are taking decisions in sending their children to the school and visiting the schools to observe the performance of their children. Also taking decisions independently to send their children for higher studies. Reading of newspapers and watching TVs by SHG women have also been changed after joining in SHGs.

The rural women have also gained the political empowerment after joining in SHGs. It is observed that a majority of SHG women have awareness on women Rights and Acts, reservation of seats for women in local bodies, and reservation of gram panchayats for women. Now, they are participating actively in Gram Sabha meetings, political party meetings and other social activities. They are taking independent decisions in casting their vote as they wish.

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Efficient and recyclable visible light-active nickel–phosphorus co-doped TiO₂ nanocatalysts for the abatement of methylene blue dye

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Abstract

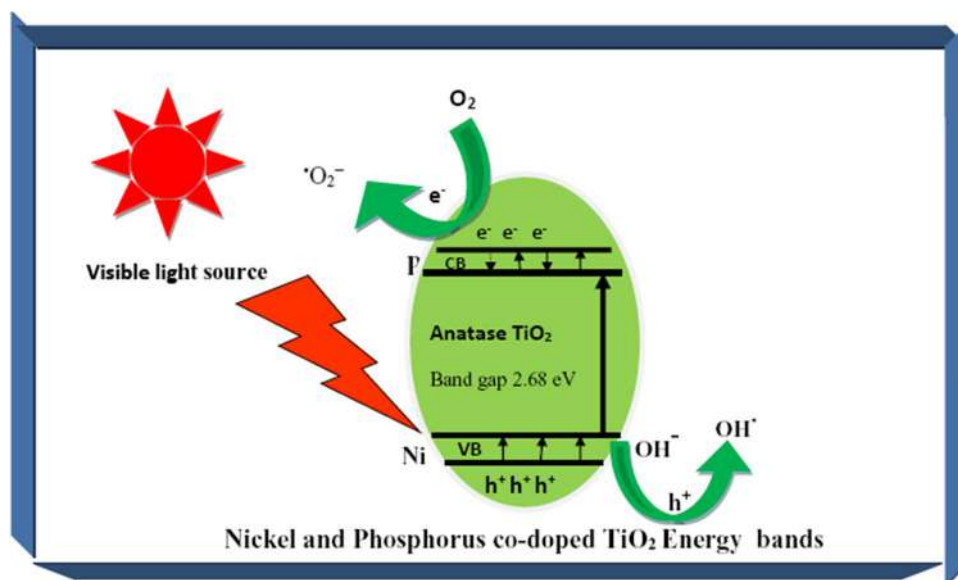
The present investigation aimed to design a best performing improved photocatalytic-active material of extensive implications and suitable to achieve the emerging needs of water pollution abatement. In view of the above, the present research work planned to synthesized nickel and phosphorus double-doped TiO₂ (NPT's) by the sol–gel process, characterized by advanced instrumental techniques and applied for the abatement of methylene blue (MB) under visible light. Characterization results demonstrated that nickel and phosphorus co-doped TiO₂ samples showed anatase phase determined by XRD. Structural aspects such as smooth surface with spherical shape morphology, less band gap, less particle size, and high surface area when compared with bare TiO₂ were determined by SEM, UV–Vis. DRS, TEM and BET, respectively. The elemental composition and oxidation states were identified by XPS analysis. The substitutional doping of Ti⁴⁺ ion by Ni²⁺, P⁵⁺ ion and P³⁻ ion with oxygen in the TiO₂ lattice was evaluated by FT-IR spectroscopy. Based on the characterization results, the catalyst NPT5 was applied for the abatement of MB at various optimum reaction conditions, with pH 10, catalyst weight 0.1 g/l and starting MB concentration 10 mg/l. At these reaction conditions, the degradation was completed within 75 min in the visible light. The photostability of the NPT5 was verified by recycling up to five cycles. Finally, this research work was concluded with a plausible mechanism, using reactive species generated during the degradation process and these species were simultaneously tested using scavenger reagents.

Electronic supplementary material The online version of this article (<https://doi.org/10.1007/s40097-020-00343-z>) contains supplementary material, which is available to authorized users.

Extended author information available on the last page of the article



Graphic abstract



Keywords Nickel phosphorus · Co-doped TiO₂ · Sol–gel method · Methylene blue · Recycling

Introduction

Surface water pollution induced by dye manufacturing units, which discharge the excessive sewage into the environment, has been continuously threatening the ecological balance and human health in modern society. Previous literature reports have revealed that 10–15% of dyes are discharged as effluents at the time of dyeing process from textile, plastics, cosmetics, ink, paper, photographic and paint industries [1–3]. Most of these textile effluents contain azo dyes, which cause unwanted effects on the ecosystem and human health due to their carcinogenicity and mutagenicity [4–7]. We need to remove these dyes from wastewater, which provokes innovative technologies. In the present research scenario among all the oxidation processes, AOP is the suitable method for the generation of highly potential hydroxyl radicals, which are favorable agents [8–10] for the abatement of dye pollutants and finally causes mineralization (CO₂, H₂O and mineral acids) [11].

Among all the semiconductors, TiO₂ shows high photocatalytic activity under UV light sensitivity, and it has increasing attention due to its lower price and being non-poisonous, insoluble, highly photoactive and with comparatively high chemical stability [12]. Nevertheless, its further practical applications were restricted by its large bandgap energy and fast e[−]/h⁺ recombination. Doping is one of the preferred approaches for obtaining the best photocatalytic-active nanomaterials by substituting Ti⁴⁺ ion in the TiO₂ lattice with transition metal ions. This process enable the

attention of the researchers towards the synthesis of transition metal-doped TiO₂, which restrict the high electron–hole recombination. Further, it also causes various exciting effects such as a shift in the surface charge trap population and variation in the reaction dynamics of e[−]/h⁺ transfer [13, 14]. This modification raises the photoquantum efficiency. Another interesting aspect is that non-metal doping into TiO₂ is a critical factor for narrowing the bandgap, making the TiO₂ absorb visible light rather than UV light [15]. This may imply that there is an extra energy band formation above the valence band by overlapping 2p states of non-metal with O 2p states of TiO₂ [16]. The metal and non-metal co-doped TiO₂ lattice shows dual properties, such as narrowing the bandgap without creating intermediate states of TiO₂. Also, it can minimize the e[−]/h⁺ recombination centers, which enhances the photoactive efficiency of the catalyst [17, 18]. In the present investigation, a mesoporous, photocatalytically efficient and stable catalyst is proposed for synthesis by regulating the nickel and phosphorus doping content into the TiO₂ lattice using the sol–gel process. Ni²⁺ has almost similar ionic radii, 0.72 Å, to that of Ti⁴⁺ ion, 0.68 Å, which can facilitate the substitution of the Ti⁴⁺ with Ni²⁺ ion [19]. Also the existence of low valence Ni²⁺ in the TiO₂ lattice significantly suppressed the e[−]/h⁺ recombination and improved the surface photocatalysis of TiO₂ [20].

Phosphorus species doped into TiO₂ lattice has attracted increased interest recently, because of their ability to improve the photocatalytic activity by direct incorporation of phosphorus into the TiO₂ framework by overlapping of P



2p with O 2p orbitals to form an extra energy band, thereby reducing the bandgap of TiO₂, suppressing the grain growth and stabilizing the mesoporous structure of TiO₂ [21, 22]. For the preparation of nanomaterials, the sol–gel method is preferable, as it favors the incorporation of dopant at the molecule level, production of homogeneity, and high purity nano-sized materials [23]. Based on the above advantages, the present investigation proposed to prepare nickel and phosphorus co-doped TiO₂ nanomaterial by employing the sol–gel method and applied for the degradation of methylene blue (MB) dye. The photocatalyst was extracted from solution after photocatalytic degradation. This may be used as a recycled photocatalyst for environmental remediation in future practical applications. MB is a heterocyclic aromatic dye, which is poisonous and highly dangerous, causing mental disorders, hyperhidrosis, vomiting, and breathing hazards [24]. Many scientists have been directing a great deal of attention on thiazine dyes, especially methylene blue, with 37% research articles published on the photocatalytic degradation of MB dye [25].

Experimental section

Materials required

Titanium tetra-*n*-butoxide (99.9%) (E-Merck, Germany), triethyl phosphate (99.9%) (E-Merck, Germany), nickel(II) nitrate 99.9% (Sigma Aldrich, USA) AR-grade chemicals were procured and used as precursors for Ti, P and Ni, respectively, without further purification. Ethanol (99.9%) (Sigma Aldrich, Germany) and nitric acid (E-Merck, India) were utilized as solvents during the sol–gel method. The model pollutant such as methylene blue (82%) was purchased from Merck, India, and used for the determination of the photocatalytic efficiency of the prepared catalyst, Nickel and phosphorus co-doped TiO₂. The required aqueous solutions were prepared from Milli Q water. Chemicals utilized in this work were of analytical grade and moreover utilized without further purification.

Preparation of undoped and nickel–phosphorus co-doped TiO₂

Nickel and phosphorus double-doped and bare TiO₂ nanomaterial were synthesized by the sol–gel process [26, 27]. Solution-1 was prepared by using 40 ml of ethanol, 20 ml of titanium tetra-*n*-butoxide, and 2.5 ml of nitric acid poured into a 250 ml Pyrex glass vessel. Solution-2 contained the required quantities of nickel and phosphorus (given in Table 1), ethanol (40 ml), and Milli Q water (5.6 ml). Both the solutions were stirred separately for half an hour, then solution-2 was mixed with solution-1 dropwise, gradually

Table 1 Prepared catalysts

Catalyst code	Nickel wt%	Phosphorus wt%
Undoped	0	0
NPT1	0.50	0.50
NPT2	0.75	0.25
NPT3	0.25	1.00
NPT4	1.00	0.25
NPT5	0.25	0.75
NPT6	1	1

continuing the stirring until the formation of the sol. The later obtained sol was left in the absence of light for 48 h for the formation of the gel.

The procured gel was dried for 24 h at 80 °C; the dried gel was ground and calcined at 450 °C for 5 h in a muffle furnace. The calcined material was allowed to reach room temperature and again ground in a dark place. The same methodology was also used for the synthesis of undoped TiO₂.

Instrumentation used in the present research work

PAN analytical X'Pert Pro powder XRD instrument was used to find the crystal phase of nickel and phosphorus co-doped and undoped TiO₂ catalysts by using the radiation of CuK α at source $\lambda = 1.541$ Å. Shimadzu 3600 (UV-DRS) UV–Vis NIR Spectrophotometer was utilized for the determination of bandgap and absorption edges of the catalyst were measured with BaSO₄ as a reference standard. PHI quantum ESCA microprobe X-ray photoelectron spectroscopy (XPS) was used for the determination of elemental composition and oxidation states of the elements in the catalyst and spectra recorded at AlK α 250 W, X-ray radiation energy of 1253.6 eV, at current of 16 mA and voltage at 12.5 kV. Micro metrics, Gemini VII 2390 series system Brunauer–Emmett–Teller (BET) instrument was used to measure the catalyst particle's pore volume (VP) and pore size, and the surface area was calculated by N₂ adsorption–desorption isotherm. Thermo Nicolet Nexus 670 spectrophotometer was used for recording the stretching and vibrational frequencies of the NPT's and bare TiO₂ samples, and KBr pellet was used as a reference. ZEISS SIGMA FE-SEM instrument was used for catalyst surface morphology studies at the resolution 1 nm at the rate of 15 kV with HD. TECNAI FE12 Transmitted Electron Microscopy instrument was used to execute the shape and size of the selected catalysts with an operated current of 120 kV. Hitachi F-7000 spectrofluorometry instrument was used to determine the fluorescence intensity of 7-hydroxy coumarin produced at the time of reaction. Shimadzu 3600 UV–Vis Spectrophotometer was used to determine the MB dye absorbance in the



degradation reaction. Elico Digital pH meter, model IIIIE, EI was used to determine the pH throughout the work.

Experimentation for MB dye degradation

The degradation of MB dye determined the photocatalytic ability of the undoped and nickel and phosphorus co-doped TiO₂ nanocatalysts (NPT1, NPT2, NPT3, NPT4, NPT5, NPT6) under visible light illumination at various reaction parameters such as catalyst dosage (0.025–0.125 g/l) and pH (3, 7, 9, 10). The variations in solution pH during the degradation were recognized by dipping a glass electrode of the pH meter and adjusting the required solution by adding 0.1 molar HCl/0.1 molar NaOH. The photocatalytic experimentation was done by taking required quantities of the MB dye in a 150 ml beaker and exposing to 400 W metal halide light (Osram, India), utilized as radiation source with an intensity of 35,000 lm (yield wavelength of the radiation ranging from 436 to 546 nm). 20 cm distance was maintained between radiation source and reaction beaker. UV light filter (No. 51472) was kept in between them to cut off UV radiation. To filter the IR radiation and maintain the room temperature in the reaction, cold water was run around the reaction beaker and the % of the degradation of MB dye was followed [28].

Along with the MB solution, the required amount of the catalyst was taken and mixed in the absence of light for 60 min to obtain equilibrium between the dye and the catalyst surface. At the time of photocatalytic experimentation, 5 ml of solution was collected by using 0.45- μ m Millipore syringe filter, and Shimadzu 3600 UV–visible Spectrophotometer was used to determine the absorbance of MB dye. For a comprehensive comparison, at 664 nm λ max value of MB dye, the equivalent photocatalytic reaction condition was kept for all the co-doped and bare TiO₂ catalysts. The dye solution concentration was estimated during the degradation by utilizing C/C_0 equation, where C is the absorbance of MB dye at time t after degradation, and C_0 is the starting absorbance of the MB dye before degradation.

After arriving at the optimum conditions for the complete abatement of MB from the solution, the same experimental conditions were applied for the recyclability of the selected catalyst. The details are presented in “Nickel and Phosphorus dopant concentration effect”, “Study on concentration variations of Methylene blue dye” and “Recyclability of the catalyst”, respectively.

Catalysts’ bandgap energy calculation

The formula $E_g = 1240/\lambda$ was used to calculate the bandgap energies of all the prepared NPT’s and bare TiO₂ catalysts, where λ is the absorption wavelength and E_g is the bandgap. By applying Kubelka–Munk formalism [29], $F(R) = (1 - R)/2R$ was utilized to calculate the bandgap energies

Table 2 NPT’s and undoped TiO₂ selected characterization results

Catalyst code	D_{XRD} (nm)	S_{BET} (m ² /g)	Pore diameter (nm)	Pore volume (cm ³ /g)	E_g (eV)
Undoped	21	72	10.1	0.21	3.2
NPT1	8.2	131	5.9	0.23	2.8
NPT2	9.3	106	9.6	0.24	2.9
NPT3	7.1	136.1	5.8	0.25	2.7
NPT4	9.5	118.7	6.2	0.22	3.0
NPT5	4.5	168.30	5.5	0.27	2.6
NPT6	10	121.47	7.3	0.24	3.1

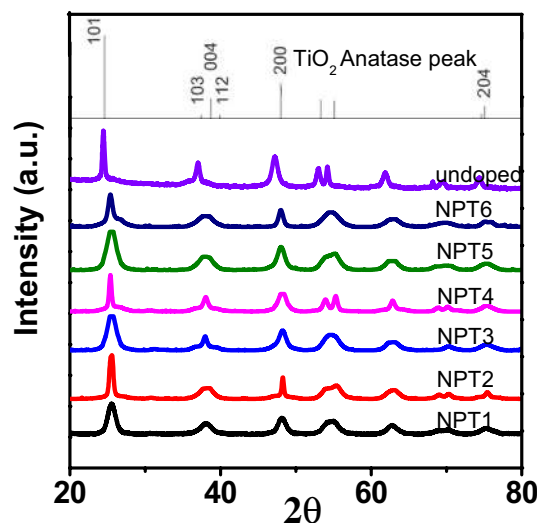


Fig. 1 XRD patterns of NPT’s and undoped TiO₂

of all the prepared catalysts, where R is the reflectance $[F(R)h\nu]/1/2$ versus $h\nu$ formula was adopted for tauc plot calculations, where $h\nu$ is photon energy, and these determined values are displayed in Fig. 2b and Table 2.

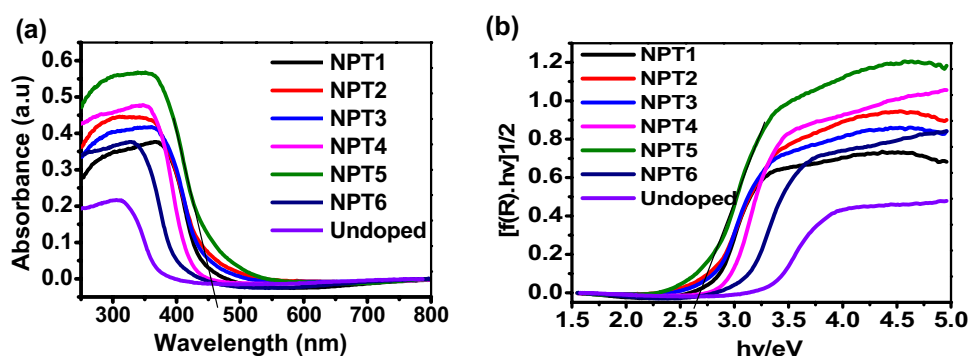
Results and discussion

X-ray diffraction study (XRD)

The XRD technique was utilized to investigate the crystallite size, type of phase and crystalline structure of the synthesized nickel and phosphorus double-doped and bare TiO₂ nanomaterials (NPT1, NPT2, NPT3, NPT4, NPT5, and NPT6) and the resultant spectra are shown in Fig. 1. All the doped and bare TiO₂ catalysts’ XRD patterns were recorded at $2\theta = 20^\circ$ – 80° . All the co-doped catalysts including undoped TiO₂ catalyst measured anatase phase at 2θ value 25.4° and 25.3° respectively with (101) plane and



Fig. 2 NPT's and bare TiO₂ optical properties. **a** UV–Vis absorption spectra. **b** Tauc plot analysis



other peaks shown at 2θ values 38.1° , 48.02° , 53.9° , 55.30° and 62.93° exhibits the planes (004), (200), (105), (211) and (204) respectively, which could be distinguished by JCPDS File No. 21-1272 of anatase TiO₂ [30]. Further, no additional peak was observed relating to 2θ at 27.5° [31], no phase transformation from anatase to rutile phase was observed at 450°C calcination temperature. Further, a little positive shift was seen in Fig. 1 for NPT's and bare TiO₂ samples, at $2\theta = 25.4^\circ$ and $2\theta = 25.3^\circ$, respectively. This might be because the ionic radius of Ni²⁺ (0.72 Å) and P³⁻ (0.21 Å) is a little higher than that of Ti⁴⁺ (0.68 Å) and O²⁻ (0.14 Å). Subsequently, Ni²⁺ and P³⁻ ions can undoubtedly substitute Ti⁴⁺ and O²⁻ particles in the TiO₂ lattice [32]. The peak height of co-doped TiO₂ diminished at $2\theta = 25.4^\circ$ for all co-doped samples. This may be due to an increase in the phosphorus doping into the TiO₂ lattice causing a grain strain, which retards crystalline growth. In other words, when the peak height decreases at $2\theta = 25.4^\circ$, the FWHM value decreases, which leads to a decrease in crystallite size. All the catalysts' crystallite size was determined by Debye Scherrer formula and the results are exhibited in Table 2. NPT's XRD patterns did not show the NiO peak at $2\theta = 37.21^\circ$, which affirmed that there was no formation of NiO [33]. From Table 2, it is comprehended that NPT3 and NPT5 indicated less crystallite size than undoped TiO₂ and other co-doped samples. However, the above two catalysts (NPT3 and NPT5), nickel and phosphorus, displace Ti⁴⁺ ion as Ni²⁺ or P⁵⁺, and some part of phosphorus replaces oxygen as (P³⁻) ion in the TiO₂ lattice. Hence, the NPT3 and NPT5 catalysts grain stain increases; this causes decreases in crystallite size when compared with other catalysts. This was evidenced by the XPS ("Analysis of chemical composition states and electronic states by X-ray photo electron spectroscopy (XPS)") and FT-IR studies ("FT-IR analysis").

UV–visible diffuse reflectance spectroscopy (UV–Vis. DRS) analysis

NPT's and undoped TiO₂ catalysts' bandgap energy was determined by using UV–visible diffused reflectance

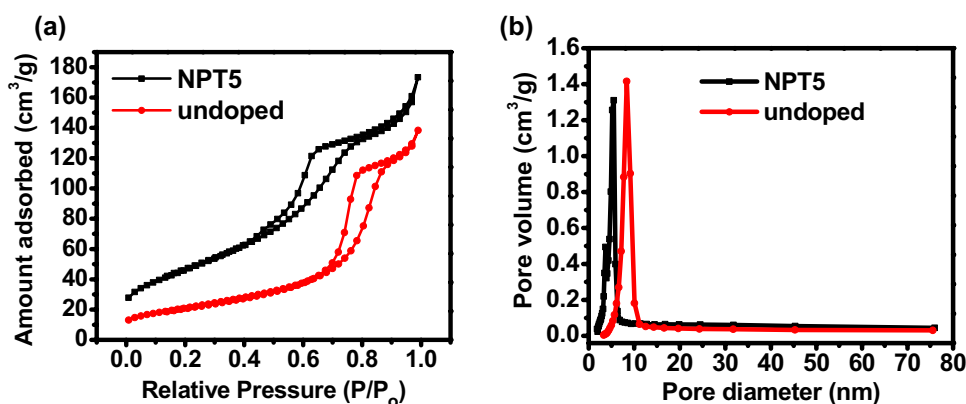
instrument. The prepared NPT's with light yellow color show the optical vibs in the visible light range, which can be confirmed and is shown in Fig. 2a. From all the prepared co-doped and undoped catalysts, NPT5 (0.25% wt% nickel and 0.75 wt% phosphorus), co-doped TiO₂ indicated high tailing absorbance in the visible light range and its bandgap intensity moved to 2.68 eV; other co-doped samples have demonstrated bandgap energies 2.77–3.1 eV and bare sample bandgap 3.2 eV. The adsorption aspect indicates that the prepared NPT's–TiO₂ photocatalyst potentially reacted in the visible light. Phosphorus 2p states and oxygen 2p states associated with each other can form an additional energy level above the valence band of TiO₂, minimizing the NPT's catalyst bandgap. The redshift shows a high number of photogenerated electrons and hole pairs that could be energized by photons with less energy, prompting high photocatalytic effectiveness in the visible light. Hence, NPT's have good potential to harvesting the visible radiation.

Brunauer–Emmett–Teller (BET) method

NPT's co-doped and undoped TiO₂ catalysts' surface area and porous structure were investigated by Brunauer–Emmett–Teller (BET) surface zone analyzer by N₂ adsorption–desorption measurements. According to the IUPAC classifications, undoped and NPT5 (co-doped TiO₂) indicate type-IV isotherms, and H1-type hysteresis loops appeared as shown in Fig. 3a. This might be credited to capillary condensation in mesoporous materials. The corresponding pore size distributions determined by the Barrett–Joyner–Halenda (BJH) method [34] established on the adsorption of isotherms are exhibited in Fig. 3b, which represented that the pore sizes of undoped and NPT5 are at about 10.1 nm and 5.5 nm, respectively. The BET outcomes from Table 2 show that NPT5 has a high explicit surface area (168 m²/g) than that of undoped TiO₂ (72 m²/g). Hence, NPT5 can give increasingly dynamic sites for surface reactions. The vast surface region of the catalysts promotes superior adsorption of dye particles above the catalyst and improves the abatement rate of the reaction [35]. In this manner, NPT5



Fig. 3 **a** N_2 adsorption–desorption isotherm, **b** pore size distribution curves of NPT5 and undoped TiO_2



sample pore size (5.5 nm) demonstrates the mesoporous nature from the classification of pore sizes according to literature: macropores “above 50 nm (0.05 μm)”, mesopores “2–50 nm”, micropores “below 2 nm” [34]. The comprehensive comparison for all the prepared catalysts’ isotherms is given in Fig. S3 in Supplementary data.

TEM analysis study

Undoped and NPT’s catalysts’ TEM images and lattice fringes are shown in Fig. 4a–d. SAED patterns and histograms are presented in Fig. 4e, f, respectively. The bare TiO_2 particle size is large with a spherical shape, but in a co-doped TiO_2 (NPT5) sample particle size is smaller with a roughly spherical shape. The enlargement in the fringe spacing for (101) crystallography plane [35], observed in the above figure, it reveals the Ni^{2+} ion substitution by replacing the Ti^{4+} ion in a TiO_2 lattice that caused the increase the (101) crystallographic plane fringe spacing from ca 3.31 Å to 3.34 Å for undoped to co-doped TiO_2 , respectively. The SAED pattern of NPT5 catalyst exhibited distinct rings; these characteristic features reveal the single crystalline nature of nanoparticle and these results confirm the anatase phase. The particle size of NPT5 sample was calculated using Image J software and the obtained values are shown in the histogram (Fig. 4f), which shows the particle sizes ranging from 1 to 8 nm for NPT5 sample; these values coincide with the crystalline sizes of the NPT5 samples calculated from XRD pattern.

Field emission: scanning electron microscopy

The surface morphology of undoped and NPT’s nanocatalysts is presented in Fig. S1 (a & b). From the images, the undoped TiO_2 catalyst showed spherical and smooth morphology with large particle size, whereas co-doped TiO_2 (NPT5) catalysts exhibited a rough morphology with small particle size. However, there is a small difference in the morphologies between bare TiO_2 and NPT’s samples. It

reveals the substitutional doping of bigger ionic sized Ni^{2+} (0.72 Å) and P^{3-} ions (0.21 Å) in the TiO_2 lattice can replace smaller ionic size Ti^{4+} ion (0.68 Å) and O^{2-} ion (0.14 Å), respectively.

The energy-dispersive X-ray spectroscopy (EDX) analyzer was used to determine the composition of the NPT5 (Ni^{2+} 0.25 wt% and P^{5+} 0.75 wt%) particles. The signals of Ni, Ti, O, and P are entirely present in the co-doped TiO_2 catalyst (NPT5), and the spectra are shown in Fig. S1 (c).

Analysis of chemical composition states and electronic states by X-ray photo electron spectroscopy (XPS)

The XPS technique analyzed the elemental status and oxidation states of the NPT5 sample. The total composition of the catalyst is shown in the survey spectrum in Fig. 5a. The peak positions were calibrated using the C 1 s peak (hydrocarbon contamination) as a reference to 284.8 eV [36]. The XPS peak fitting was analyzed by using Multi-Pack V 6.0a software. It indicates that the catalyst NPT5 sample contains the chemical composition of Ti, O, C, Ni, and P. Element oxidation states and related binding energies of Ti^{4+} , Ni^{2+} , P^{5+} , P^{3-} and O^{2-} are shown in Fig. 5b–e. The binding energies of Ti $2p_{1/2}$ and Ti $2p_{3/2}$ were located at 465.1 and 459.5 eV, respectively [37]. Ti $2p_{1/2}$ and Ti $2p_{3/2}$ splitting binding energy difference at core level in co-doped TiO_2 is about 5.6 eV, which is a higher value than that of Ti^{4+} (5.54 eV) in undoped TiO_2 . This is due to the co-doping of phosphorus and nickel ions doped into TiO_2 lattice by the formation of Ti–P–Ti or Ni–O–Ti and P–O–Ti. Figure 5d XPS results reveal the magnifying spectra of Ni $2p_{1/2}$, and Ni $2p_{3/2}$ shows two characteristic peaks and its binding energies at 868.39 and 853.67 eV, respectively. The spectral binding energies proved that Ni^{2+} is present in the NPT5 catalyst in the divalent state. The binding energy corresponding to Ni $2p_{3/2}$ at 853.67 eV is separate from that of metallic Ni (852.7 eV) and Ni_2O_3 (856.7 eV) [38, 39]. The variation of binding energies of Ni $2p$ and observed shift of Ti $2p$ binding energy

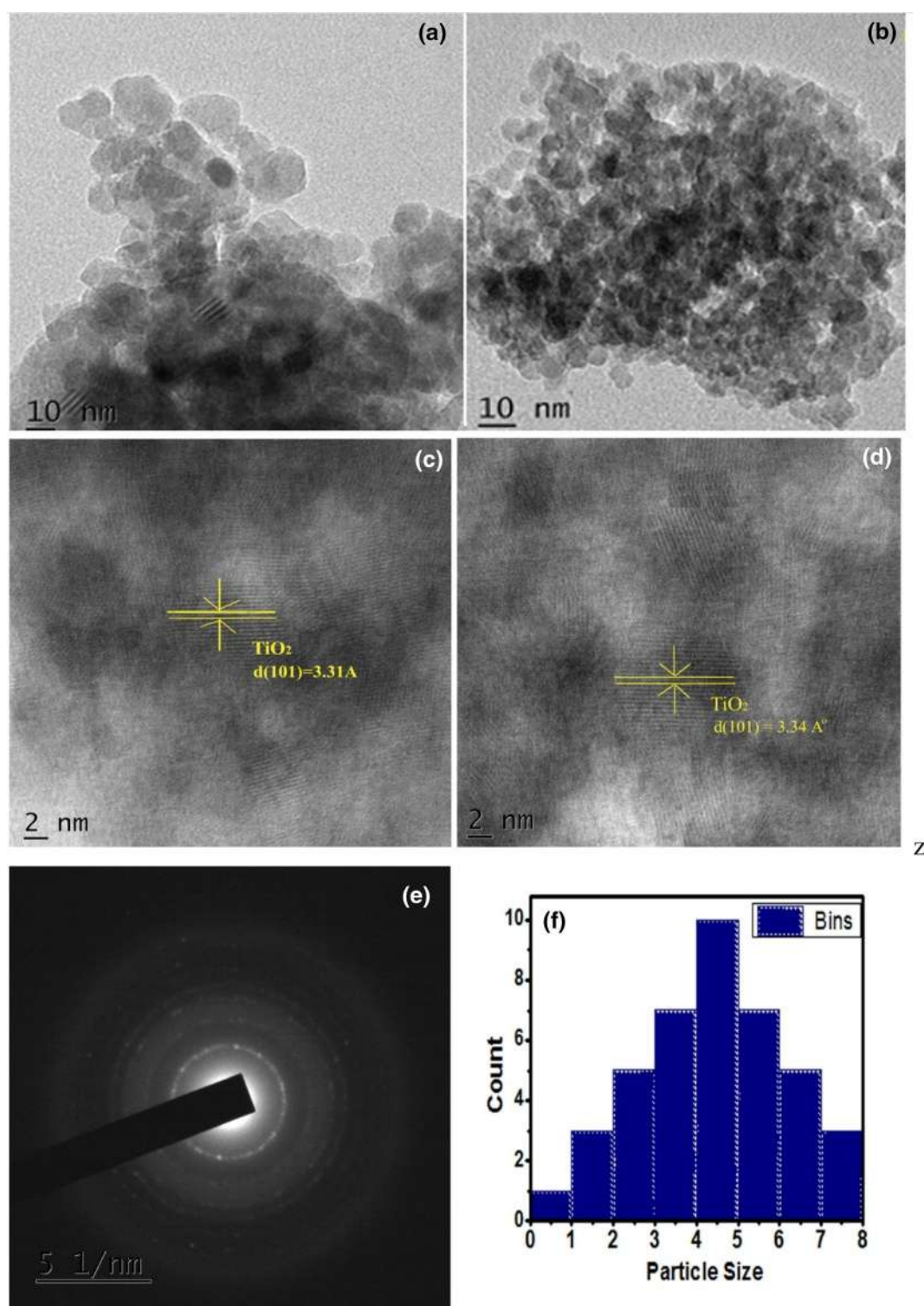


Fig. 4 **a** Undoped, **b** NPT5, **c** undoped TiO₂ lattice fringes, **d** NPT5 lattice fringes, **e** NPT5 SAED pattern, **f** NPT5 histogram

related to the rearrangement of Ti⁴⁺ and Ni²⁺ ions. These results confirm that Ni²⁺ ions favorably substitute a couple of Ti⁴⁺ ions without producing any noticeable impurity phase, like Ni, NiO and Ni₂O₃. Oxygen 1s spectra denote the

two peaks, as shown in Fig. 5c. Oxygen 1s spectra binding energies were 531.3 and 533.4 eV, related to lattice oxygen and adsorbed oxygen, respectively [40]. Figure 5e, P 3p XPS magnifying spectra binding energy values ranged from



-
- Figure 1 displays five XPS spectra of NiO, labeled (a) through (e). Each plot shows Intensity (cps) on the y-axis versus Binding Energy (eV) on the x-axis. The spectra are as follows:
- (a) Survey scan: Shows peaks for Ni 2p (~850 eV), O 1s (~530 eV), Ti 2p (~460 eV), C 1s (~285 eV), and P 2p (~135 eV).
 - (b) Ti 2p: Shows two peaks at 459.591 eV (black) and 465.157 eV (red).
 - (c) O 1s: Shows two peaks at 531.397 eV (black) and 533.433 eV (red).
 - (d) Ni 2p: Shows two peaks at 853.670 eV (black) and 868.396 eV (red).
 - (e) P 2p: Shows two peaks at 133.861 eV (black) and 135.230 eV (red).

The results suggest that in both cases, visible light does not influence the degradation of MB dye.

- In a 150 ml beaker, a fixed quantity of dye and catalyst were added and stirred for 60 min in the absence of light and later the absorbance at the same λ max value was measured. A slight absorbance deviation in the dye solution occurred. Without light, during the stirring process, an absorption–desorption equilibrium occurred between the TiO_2 surface and MB dye solution.
- Finally, In a 150 ml beaker, a fixed quantity of catalyst and dye solution was added and stirred for 60 min under visible radiation and the absorbance was measured. It exhibited a drastic reduction in the absorbance, indicating that light activated the catalyst and generated hydroxyl radicals, which causes the degradation of the dye molecules. It is concluded that light and the catalyst are interdependent.

To attain optimum concentrations for maximum degradation of dyes, the effects of catalysts having different dopant concentrations in TiO_2 at a varied pH, variable catalyst dosages, and different initial dye concentrations were studied. While studying these reaction parameters, one parameter was varied, while other parameters were kept constant in each effect of the reaction.

Nickel and phosphorus dopant concentration effect

Nickel and phosphorus co-doped (NPT1 to NPT6) at various dopant concentrations and bare TiO_2 nanocatalysts' photocatalytic efficiency were studied under visible light irradiation at fixed pH 8, methylene blue dye concentration of 20 mg/l and catalyst weight 0.060 g/l. Among all the co-doped and undoped catalysts, NPT5 exhibits better activity for the abatement of MB dye. The results of the experiment are presented in Fig. 6. NPT5 catalyst has less particle size (4.5 nm) with a high surface area (168.30 m^2/g) and a reduced bandgap (2.6 eV). These values suggested that due to the less size of the particles of the nanocatalyst having

higher surface area facilitated the large number of dye molecules to be adsorbed on the catalyst surface. It favors a better rate of abatement of dye molecules. Increasing the number of TiO_2 particles increases more electron–hole pairs. This may enhance the rate of degradation in visible light. Further, on increasing the concentration of the dopant into the TiO_2 lattice, instead of doping, the dopant deposited on the TiO_2 surface which caused increase in the particle size and decrease in the surface area of catalyst particles. Consequently, the degradation rate diminished.

pH effect

NPT5 catalyst surface adsorption experiments were analyzed in the dark at different pH conditions from 3 to 10 by using MB dye solution and the absorbance values were measured at different time interval reaction time up to 50 min, as shown in Fig. 7. The measurement of organic pollutant adsorbed on the NPT5 surface is a crucial factor that impacts their photocatalytic execution. In this way, at pH-10, the adsorption rate of MB dye was high up to 30 min, and later it was constant. At pH 10, the rate of adsorption was observed to be 32%. From the above outcomes, it is comprehended that the solution pH assumes a critical role in the adsorption of the MB dye particles on the surface of the catalyst, favoring a better rate of abatement of dye molecules due to the generated OH radicals on the TiO_2 catalyst surface [47].

To understand the effect of pH on the photoactivity of NPT5, the pH was varied from 3 to 11 and analyzed using visible radiation experiments at NPT5 weight 0.060 g/l and MB = 20 mg/l. The photocatalytic degradation at each pH effect was calculated by collecting 5 ml aliquot samples from the reaction mixture, and the results are presented as C/C_0 versus time plots as shown in Fig. 7. According to the experimental results, the degradation rate of the dye was high at pH 10, compared to the other pH values. It might be expected that at this pH, the catalyst surface becomes negative, which indicated that the solution pH was higher than the pK_a value of the MB dye ($\text{pK}_a = 3.5$). Hence, this

Fig. 6 **a** NPT5 absorbance decay, **b** NPT's and undoped TiO_2 concentration effect, catalyst weight = 0.060 g/l and MB dye = 20 mg/l

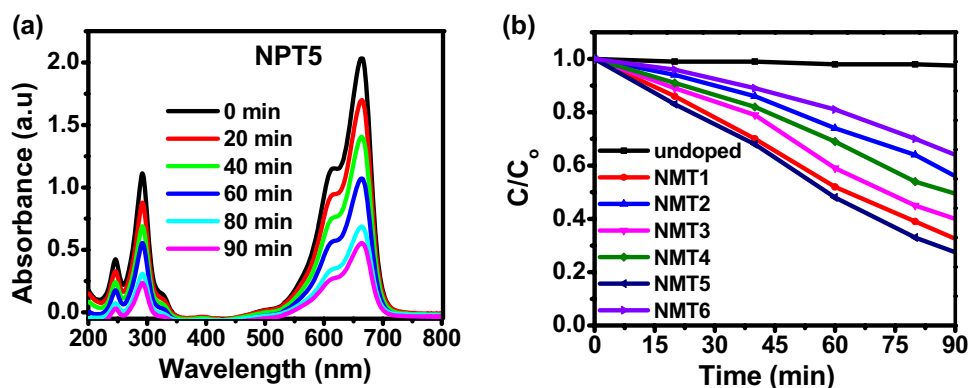
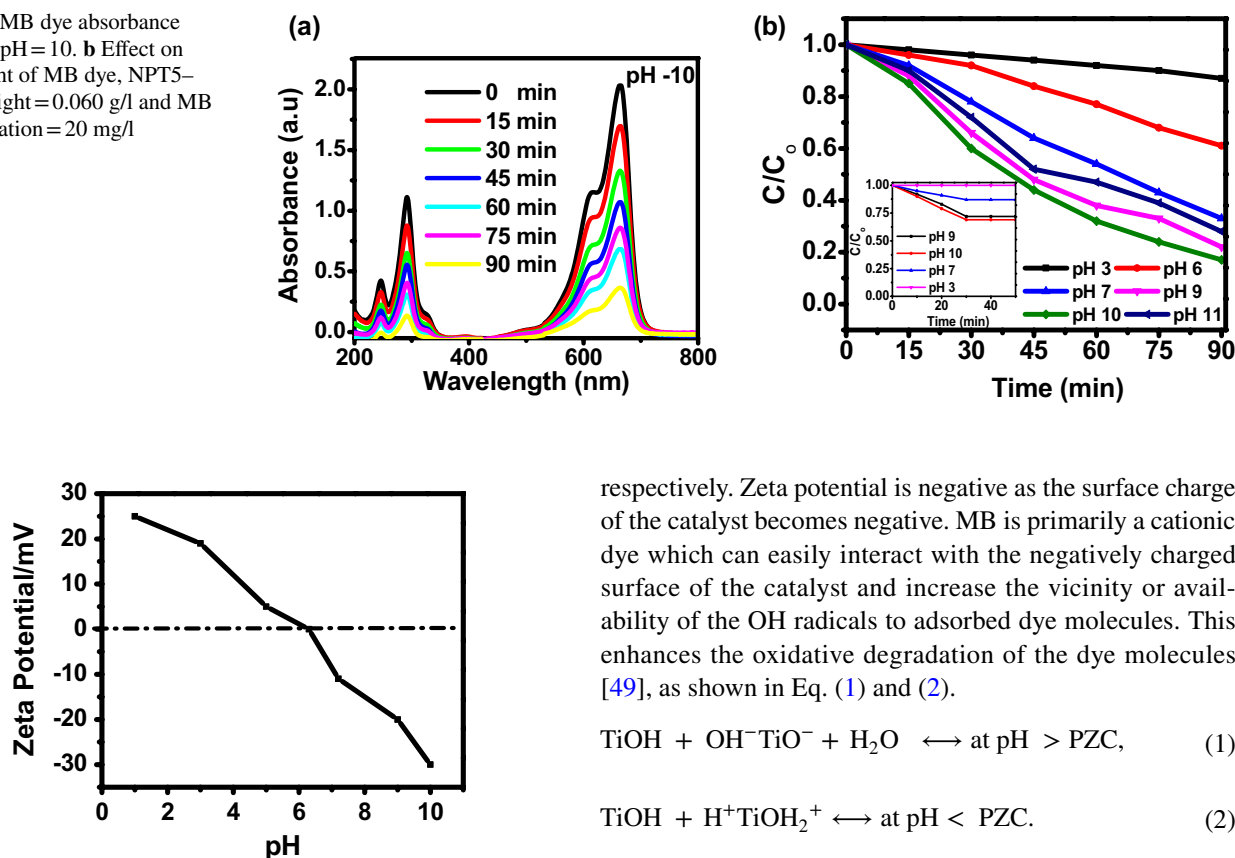


Fig. 7 **a** MB dye absorbance decay at pH=10. **b** Effect on abatement of MB dye, NPT5–TiO₂ weight=0.060 g/l and MB concentration=20 mg/l



respectively. Zeta potential is negative as the surface charge of the catalyst becomes negative. MB is primarily a cationic dye which can easily interact with the negatively charged surface of the catalyst and increase the vicinity or availability of the OH radicals to adsorbed dye molecules. This enhances the oxidative degradation of the dye molecules [49], as shown in Eq. (1) and (2).

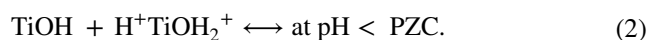
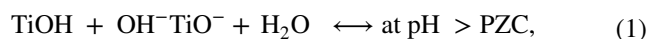


Fig. 8 Determination of zeta potential at different pH values

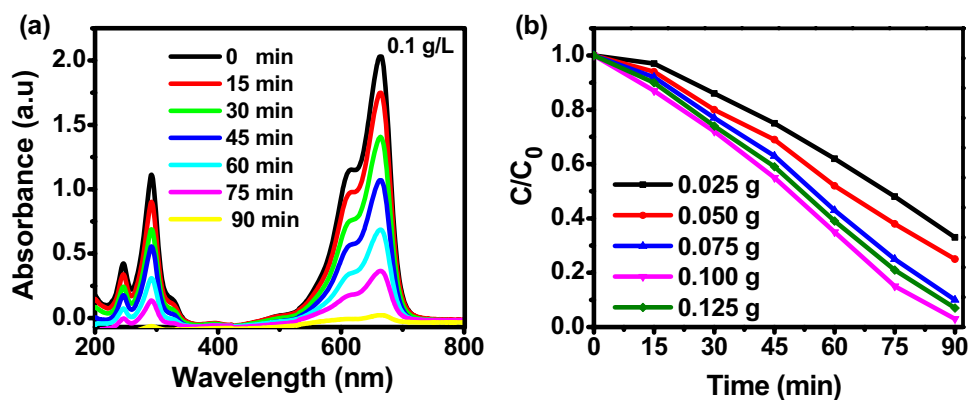
can encourage the electrostatic interaction of the increasing number of positively charged MB particles on the negatively charged surface of the catalyst [48] and prompt the high pace of abatement of the MB dye particles. Further, these results can be elucidated by the determination of PZC experiments. The zeta capability of the NPT5 catalyst has been estimated at various pH values and the results are presented in Fig. 8.

The figure indicated that at lower and higher pH values, the catalyst shows positive and negative zeta potential,

NPT5 catalyst concentration on MB dye

To avoid catalyst wastage during the photocatalytic reaction, the fixation of appropriate catalyst dosage is a more desirable strategic way of harvesting more number of photons. In this context, to optimize the catalyst dosage, an experiment was conducted taking various concentrations ranging from 0.025 to 0.125 g/l maintaining the other reaction conditions constant. Figure 9 shows that 0.1 g/l is the ideal amount for the complete degradation of MB dye, which exhibited a better rate of abatement than other concentrations. At a catalyst dosage lower than 0.1 g/l, limited number of catalyst

Fig. 9 **a** MB dye absorbance decay at NPT5 catalyst concentration 0.1 g/l, **b** degradation of MB by the catalyst NPT5. pH=10 and MB dye=20 mg/l



molecules are available for a high number of dye particles. Hence, it limits the degradation reaction rate. As more than 0.1 g/l of the catalyst dosage the degradation rate decreases even though a greater number of catalyst particles are available, if the catalyst dosage increases the solution turbidity also increases, which prevents penetration the visible radiation and limits the activation of the catalyst particles [47].

Study on concentration variations of methylene blue dye

The photocatalytic abatement rate of MB dye in aqueous media relies upon its underlying dye concentration. Along these lines, the influence of the MB fixation on the photocatalytic activity of the NPT5 catalyst was researched by changing its concentration from 5 mg⁻¹ to 20 mg/L at constant reaction parameter catalyst dosage 0.1 g/l, at pH = 10. The reaction results exhibited in Fig. 10 reveals that the most extreme rate of degradation was completed in 75 min with 10 mg/l introductory dye fixation, at 0.1 g/l NPT5 catalyst. Because of expanding the convergence of the dye, the rate of degradation was diminished, even though the concentration of dye molecules increased. The catalyst concentration was stable for this situation, it is not possible to produce corresponding ratio of reactive species ($\cdot\text{OH}$) to counteract the increased number of dye molecules [50]. These outcomes show that the photocatalytic degradation is all the more encouraging at 10 ppm concentration of the MB dye with NPT5 loading 0.1 g/l at pH = 10. The MB dye was degraded in 75 min.

Overall optimum conditions for complete abatement of MB dye

NPT5 catalyst was selected as the best catalyst at various optimized reaction parameters at catalyst dosage 0.1 g/l, pH = 10, and initial dye concentration 10 mg/l. Other

reaction parameters and other optimum conditions are shown in Fig. S4 and Table S1 in the supplementary data.

Our degradation results were compared with literature results in which they had been degraded with different types of pollutants and various catalysts. The comparison results are presented in Table 3.

From Table 3 it is observed that the results obtained from the photocatalysis process with photoactive semiconductor nanomaterials have shown better degradation at optimum conditions. When compared with the literature reports, our catalyst is more active in visible light.

Control experiments

The impact of the key parameters on the decolourization of methylene blue dye, for example, adsorption (in dark, with catalyst), photolysis (in light without catalyst) and photocatalysis (in light, with catalyst) at different surface morphologies of TiO₂-NPT's were studied. The best MB concentration was fixed at 10 mg/l, the optimum concentration of NPT's-TiO₂ at 0.1 g/l and pH 10 as given in Fig. 11. The experimental results show that among all NPT's and bare TiO₂ catalysts, the highest rate of abatement of methylene blue dye was observed by NPT5 in experiments such as photocatalysis, adsorption and photolysis. From the experimental results, 99.5% of MB dye degradation was attained within 75 min by using the NPT5-TiO₂ catalyst. Concerning the adsorption process, the most extreme MB dye degradation achieved 35.3%. The photolysis process showed that a very low percentage (0.5%) of dye was degraded by visible light only, without utilizing catalysts.

Recyclability of the catalyst

In the recent past, photocatalysis is not highly recognized without recyclability [57, 58]. To understand the stability of the catalyst at the prescribed reaction parameters, recyclability experiments were carried out five times and discussed in "Study on concentration variations of Methylene blue dye".

Fig. 10 **a** Absorbance decay at MB dye at 10 mg/l. **b** Initial concentration variations of methylene blue dye at catalyst NPT5 = 0.1 g solution pH = 10

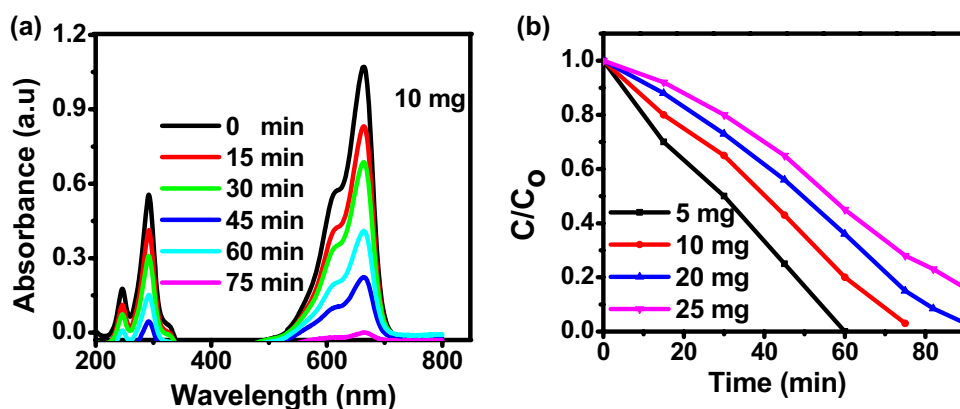
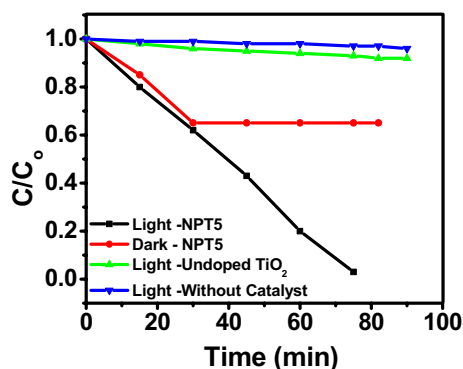


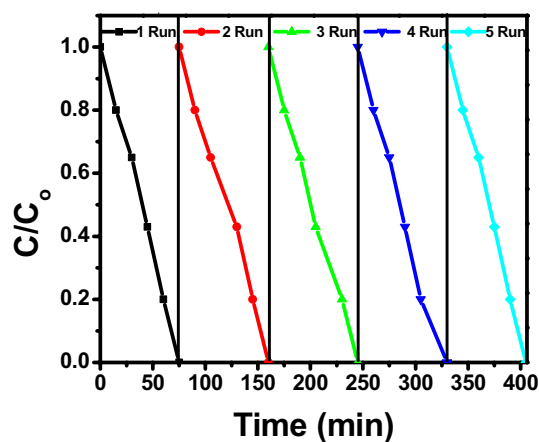
Table 3 Comparison of photocatalytic activity of various nanocatalysts with different organic pollutants

Catalyst used	Organic pollutant	Optimum conditions	Degradation efficiency	References
3% Zn-doped TiO ₂	Malathion	Malathion: 177.59 mg/l, catalyst: 0.99 g/l, pH: 10.99 and reaction time 81.04 min	98%	[51]
2D Ag-TiO ₂ /Al ₂ O ₃ /CS	Nitrate reduction	pH 11 and reaction time 5 min	74%	[52]
N, S doped TiO ₂ /chitosan	Tetracycline	Tetracycline: 10.80 mg/l, catalyst: 0.060 g/l, pH: 8.24 and reaction time 20.73 min	91%	[53]
ZnO	Ibuprofen	pH: 6.7, catalyst: 583 mg/l, IBP: 1.5 mg/l, humic acid: 54 mg/l, and time: 95 min	82.97%	[54]
N, S doped TiO ₂ /MoS ₂	Diclofenac	DCF: 15 ppm, pH: 5.5, catalyst: 0.988 g/l and reaction time of 150 min	97%	[55]
Photolytic activated persulfate	Trichloroethylene	pH 5.5, UV 60 w, PS 61 μmol/l, ultrasound power: 95 w and time 20 min	99.4%	[56]
Ni, P co-doped TiO ₂	Methylene blue	MB: 10 mg/l, catalyst: 0.1 g/l/l, pH: 11, time: 75 min	99.5%	Present work

**Fig. 11** MB dye degradation during the adsorption, direct photolysis and photocatalytic experiments. MB dye fixation 10 mg L⁻¹, NPT5 and undoped TiO₂ loading 0.1 g/l and pH 10

During the photocatalysis, the rate of reaction upon receiving the catalyst must not change drastically. At the time of developing a catalyst, the method was structured so that the catalyst would be effectively recoverable and able to retain the desired properties even after many numbers of cycles.

When performing the recycling of the catalyst, the solid catalyst aspect was regained from the MB dye solution after the first cycle of the catalysis and the recycled catalyst was washed with ultrapure deionized water, after that centrifuged for 10 min at 3500 RPM and finally dried in an oven. After each cycle, a new solution of MB dye and the dried catalyst was used for the photocatalytic degradation. The same process was followed up to five cycles with the same catalyst. Every one of the parameters was controlled as cautiously as feasible for every run (reaction heat condition, fixation proportion of catalyst to MB, the volume of solution utilized, visible radiation flux and distance from light source and pH of the solution). Figure 12 shows the plot of log (C/C_0) versus time with the equivalent NPT5 test for five cycles. It can

**Fig. 12** Five cycles of photocatalytic degradation recyclability test using NPT5 catalyst, MB dye 10 mg/l, solution pH=10, NPT5 loading=0.1 g/l

be clearly seen that there was no much loss in the reaction rate and activity of the catalyst on continued recycling of the same catalyst sample.

Reactive species (h^+ , $O_2^{\cdot-}$ and $\cdot OH$) test

The principal reactive species (h^+ , $O_2^{\cdot-}$ and $\cdot OH$) involved in the photocatalytic abatement process were investigated by utilizing scavenger reagents. Hole (h^+) recognized analysis was studied by adopting 1 mM disodium salt of EDTA. At the point when the scavenger was added to the reaction, clear photocatalytic execution of the MB dye was diminished to 24.34% [59, 60]. This pattern has appeared in Fig. 13a. It can be elucidated that ethylene diamine tetraacetic acid-disodium salt performed as (h^+) scavenger, EDTA reacted with the hole and further decreased the activity of NPT5 and ultimately



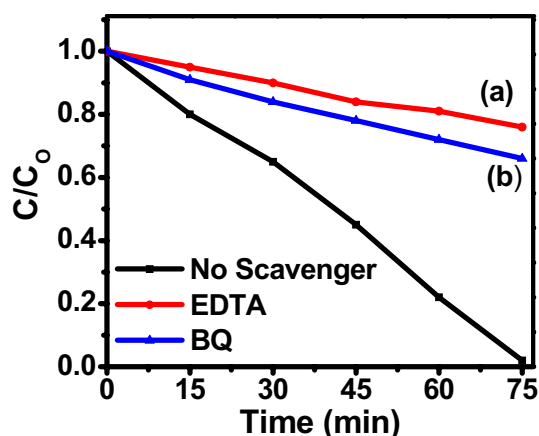


Fig. 13 The methylene blue degradation study by using scavenger reagents, 10 mg/l, catalyst NPT5, pH-10 and NPT5 loading = 0.1 g/l

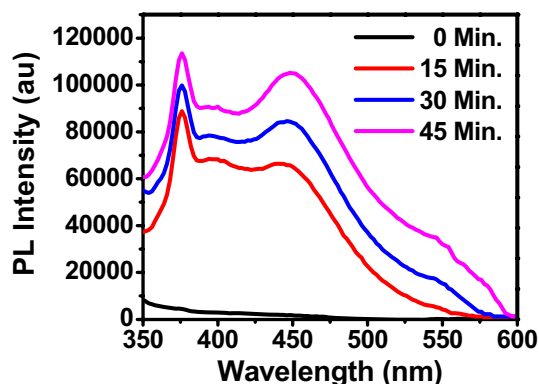


Fig. 14 Photoluminescence spectra of catalyst NPT5, catalyst dosage 0.1 g/l

the MB dye abatement rate was diminished. To identify the superoxide radical ($O_2^{\cdot-}$), 1, 4 benzoquinone (BQ) reagent was utilized and during the photocatalytic abatement reaction, when the BQ reagent was added to the reaction solution, photocatalytic degradation of MB was diminished up to 36.53% [61]. Analysis results are shown in Fig. 13b, suggesting that the $O_2^{\cdot-}$ species has a considerable role in the MB dye photocatalytic abatement process and is a vital source for the generation of H_2O_2 by reacting with $HO_2^{\cdot}$ radicals. Further, H_2O_2 in turn produced OH radicals by decomposition. Photoluminescence (PL) technique was adopted to identify the hydroxyl radicals in the photocatalytic degradation reaction. Coumarin was added to the photocatalytic reaction mixture. Coumarin reacts with photocatalytic reaction-generated OH radicals and is converted to 7-hydroxy coumarin, which is a fluorescent molecule. Its conversion is determined from the fluorescence intensity at 450 nm, as given in Fig. 14. During the photocatalytic reaction, a high number of OH radicals were produced and reacted with coumarin to produce

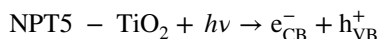
7-hydroxycoumarin, as shown in the figure as an increased fluorescent peak at 450 nm.

At 0 min (Fig. 14), no extreme absorption peak was observed for the sample degradation in the dark. These results suggest that hydroxyl radicals are generated on the NPT5-TiO₂ surface during the illumination time only. PL instrumental analysis data reveal the synthesized NPT5 catalyst producing a high number of OH radicals during the photocatalytic reaction.

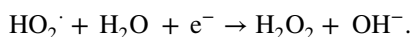
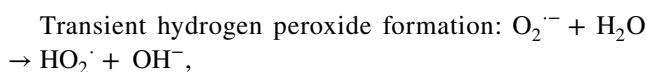
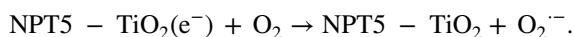
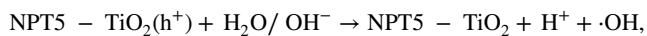
Possible mechanism

In view of the above experimental results, a basic possible mechanism was suggested for the oxidative photocatalytic abatement of methylene blue dye utilizing NPT5-TiO₂ nano-material in visible radiation. The Ni^{2+} ion substitutional doping of Ti^{4+} ion formed a band above the valence band of TiO₂, which captured and returned the electrons originating from the TiO₂ conduction band, and suppressed the electron-hole recombination process. Therefore, a progressive amounts of photogenerated e^-/h^+ were created above the surface of NPT5-TiO₂ catalyst and their segregation capability was enriched.

The absorption of efficient protons of NPT5-TiO₂ from visible light (390–700 nm) is as follows:



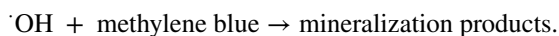
Neutralization of OH^- by photo holes, which produces OH radicals is shown by:



The decomposition of hydrogen peroxide by the reduction of oxygen:



Oxidation of MB via successive attacks of OH radicals:



Conclusions

Nickel and phosphorus co-doped TiO₂ nanoparticles were outstandingly prepared by the sol-gel process without change in the crystalline structure of TiO₂. The synthesized



NPT's nanoparticles presented higher adsorption range and better photocatalytic activity against the abatement of MB than that of undoped catalyst under visible light irradiation because of its lower bandgap, less particle size, high surface area and better adsorption capability. NPT5 shows good photocatalytic activity upon five recycles of MB dye degradation. Based on the identification results of active species, which was produced in the reaction, a plausible mechanism was drawn. The complete abatement of MB dye was executed in 75 min at optimized conditions of NPT5-TiO₂, initial concentration of dye 10 mg/l, pH at 10 and catalyst loading 0.1 g.

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Compliance with ethical standards

Conflict of interest The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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A new species of *Lophopogon* (Poaceae) from Ananthapuramu of Andhra Pradesh, India

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Abstract

A new species of *Lophopogon* (Poaceae), *L. prasannae* is described from dry deciduous forest of Ananthapuramu district, Andhra Pradesh, India. This new species shows morphological similarities with *L. tridentatus* and *L. kingii* but differs in certain characters, which are discussed below. A detailed description, photographs and taxonomic key are provided for easy identification of the species.

Keywords: Andropogoneae, Dry deciduous forest, Grass, Nigidi forest

Introduction

The genus *Lophopogon* Hackel (1887: 26) belongs to the subtribe Germainiinae, tribe Andropogoneae, subfamily Panicoideae in the family Poaceae (Soreng *et al.* 2015) and is endemic to India (Singh *et al.* 2015). The genus is distributed in the tropical dry parts of India and consists of two species, namely, *Lophopogon kingii* Hooker (1896: 149) which is restricted to Bihar and Odisha states and *L. tridentatus* (Roxburgh 1820: 261) Hackel (1887: 26) is widely distributed in Andhra Pradesh, Bihar, Gujarat, Karnataka, Madhya Pradesh, Maharashtra and Tamil Nadu (Hooker 1896, Bor 1960, Singh & Deshpande 1980, Sur 2004, Chandramohan *et al.* 2016, Tiwari *et al.* 2017, Karthigeyan & Murugan 2018). The genus is characterized by having 2 racemes closely appressed to form an ovate head, sterile or male basal spikelets, oblique pedicel tip, lower glume with a transverse row of tufts of hairs across the middle, lodicules absent (Clayton & Renvoize, 1986).

During recent floristic survey of Ananthapuramu district of Andhra Pradesh, the first author collected a *Lophopogon* species from the open dry deciduous forest of Nigidi forest of Eastern Ghats. A critical study of the material, comparison with herbarium specimens (CAL, MH, BSID, BSI, K-images) and perusal of relevant literature (Hooker 1896, Bor 1960, Singh & Deshpande 1980, Sur 2004, Chandramohan *et al.* 2016, Tiwari *et al.* 2017, Karthigeyan & Murugan 2018) revealed that it did not match with the known two species in the genus. Here, we describe it as a new species as *L. prasannae* sp. nov.

Taxonomic Treatment

Lophopogon prasannae K. Prasad, Nagaraju, A. Naray., A.M. Reddy, Sankara Rao & B.R.P. Rao *sp. nov.* (Figs. 1, 2 & 3).

Type:—INDIA. Andhra Pradesh: Ananthapuramu district, Nigidi forest, 458 m, 21 October 2018, K. Prasad 5230 (holo: BSID, iso: CAL, BSID & SKU).

Diagnosis:—The new species is most similar to *Lophopogon tridentatus*, but differs in having leaf sheath woolly at base as well as one margin (vs. margins ciliate), leaf blade with tuberculate hairs at base (vs. glabrous or hairy), lower glume of sessile spikelets with 6 tufts of hairs at middle and faintly forming U-shape between the nerves on dorsal surface and ventral surface glabrous below the middle and villous-hirtellous above the middle (vs. two tufts of hairs at middle and lateral margins and ventral surface sparsely ciliate), lowest spikelet of lower glume with tuft of hairs at basal margins, scabrid with sparsely hairy on dorsal surface and villous-strigose on ventral surface (vs. no tufts of hair on margins, dorsal and ventral surfaces glabrous), upper glume of sessile spikelets 5-nerved, keels having hairs and 2 tufts of hairs at starting point of keels and ventral surface with villous hairs on two lateral nerves towards the tips (vs. 3-nerved, not keeled, margin glabrous, ventral surface hairs on upper lateral sides and base).

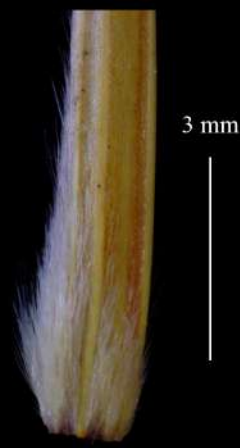
Description:—Caespitose, annuals. Culms 40–45 cm high, erect, slender, base tomentose. Internodes 0.8–14.5 cm long, terete, glabrous; nodes villous. Leaf sheath 1–4.5 cm long, keeled, prominently nerved, woolly at base as well as one margin, mouth bearded; ligule a rim of hairs, 1–3.5 mm long; leaf blade involute, 1–11.5 × 0.15–0.2 cm, linear, apex acuminate, margins scabrid, base with tuberculate hairs, villous on adaxial surface, glabrous on abaxial surface, 6-nerved. Inflorescence 8–15 cm long, spatheolate; spathe 3–6 cm long, flattened, narrowly lanceolate, apex caudate-acuminate; peduncle prominently exerted from spatheole, brown villous at tip. Racemes two, compressed, closely appressed together and appear like one, 1.5–2 cm long, pilose, yellowish-brown. Spikelets obovate, densely imbricate, fragile, yellowish-brown; as triads, two pedicelled and one sessile; pedicels 0.8–1.3 × 0.1–0.3 mm, margins with long brown hairs; base of the joints and callus bearded with 0.8–1.5 mm long brown hairs. Sessile spikelet 5–7.6 × 1–1.5 mm, oblong-ob lanceolate or oblanceolate. Lower glume 4–5 × 1–1.5 mm, oblong, chartaceous, yellowish-brown, apex 3–2-lobed with three teeth, margins with long brown hairs, base curved, 7–9-nerved, nerves rib like when mature; dorsal surface with 6 tufts of hairs at middle and faintly forming U-shape between the nerves, ventral surface glabrous below the middle and villous-hirtellous above the middle (in lower glume of lowest spikelet with tufts of hairs at the basal margins, scabrid with sparsely hairy on dorsal surface, villous-strigose on ventral surface, not closely nerved). Upper glume 5–7.6 × 0.9–1.5 mm, elliptic or oblong-elliptic, coriaceous, yellowish, 5-nerved, lateral two nerves and middle nerve attached together at apex, remaining two lateral nerves never reach the apex; apex cleft, lobes acuminate; awn from sinus, 7–8 mm long, barbellate; margins flapped, hyaline; 2-keeled, keels having 1.5–4 mm long hairs on dorsal surface and 2 tufts of hairs at starting point of keel; ventral surface with brown villous hairs on two lateral nerves towards the tip (in upper glume of lowest spikelet 3–5-nerved, 2-keeled, keels with long brown hairs; apex bifid, lobes acuminate and hairy; arista from sinus, 1–3 mm long, barbellate). Florets 2, lower barren, upper male. Lower lemma 5–5.5 × 1–1.5 mm, linear-lanceolate or oblong-lanceolate, chartaceous, hyaline, apex sub-acute, margins entire, 1-nerved, glabrous. Lower palea 4–5 × 0.6–1 mm, linear-lanceolate, chartaceous, hyaline, apex acute, margins entire, nerveless or obscurely 2-nerved, glabrous. Upper lemma 4.5–6 × 0.8–1.5 mm, oblong-lanceolate or elliptic-lanceolate, chartaceous, hyaline, 1-nerved, 2-keeled near the tip, keels plumose, surface glabrous; apex bifid, lobes acuminate, hairy; awn from sinus, 10–15 mm long, geniculate, barbellate, twisted, dark brownish (in upper lemmas of lowest spikelet apex bifid and lacerate, not keeled, awnless, glabrous). Upper palea 4.5–5.3 × 0.5–1 mm, oblong, chartaceous, hyaline, apex obtuse or lobed, margins entire and infolded, nerveless or obscurely 3-nerved. Anthers 2, 2–2.5 × 0.2–0.5 mm, yellow. Pedicelled spikelets 15–21.5 mm long, lanceolate-elliptic. Lower glumes 4–4.5 × 0.6–1 mm, oblong, coriaceous, apex 3-lobed, margins with long brown hairs, 7–9-nerved, tufts of brown hairs in between nerves below the middle. Upper glumes 6–6.5 × 0.8 mm, elliptic, coriaceous, apex bifid, 5-nerved, tufts of brown hairs above middle on the dorsal side and also margins; awn from sinus, 10–15 mm long, barbellate. Florets 2, lower male or sterile, upper fertile. Lower lemma 3–4 × 0.5 mm, elliptic-oblong, chartaceous, hyaline, apex bifid, margins involute, 2-nerved. Lower palea 3–4.5 × 0.5–0.9 mm, linear-lanceolate, hyaline, apex sub-acute, margins entire, 1-nerved. Upper lemma 5–5.5 × 0.5–1 mm, oblong-ovate, chartaceous, hyaline, apex 2-lobed, margins entire, 3-nerved, 2-keeled, keels scabrid-plumose, puberulous below the middle; awn from sinus, 12–20 mm long, geniculate, barbellate. Upper palea 3–3.5 × 1.5–2 mm, obovate-oblong, chartaceous, hyaline, apex dentate, nerveless. Style short; stigma plumose, c. 4 mm long, purple, exerted from apex of spikelet. Caryopsis 1.5–2 × 0.5–0.8 mm, oblong, narrow and oblique at base, not bulged in middle.



A



B



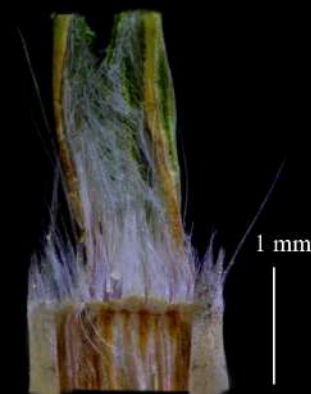
C



D



E



F



G

FIGURE 1. *Lophopogon prasannae* sp. nov. A. Habitat; B & C. Culms tomentose at base; D. Node; E. & F. Ligule; G. Inflorescence.

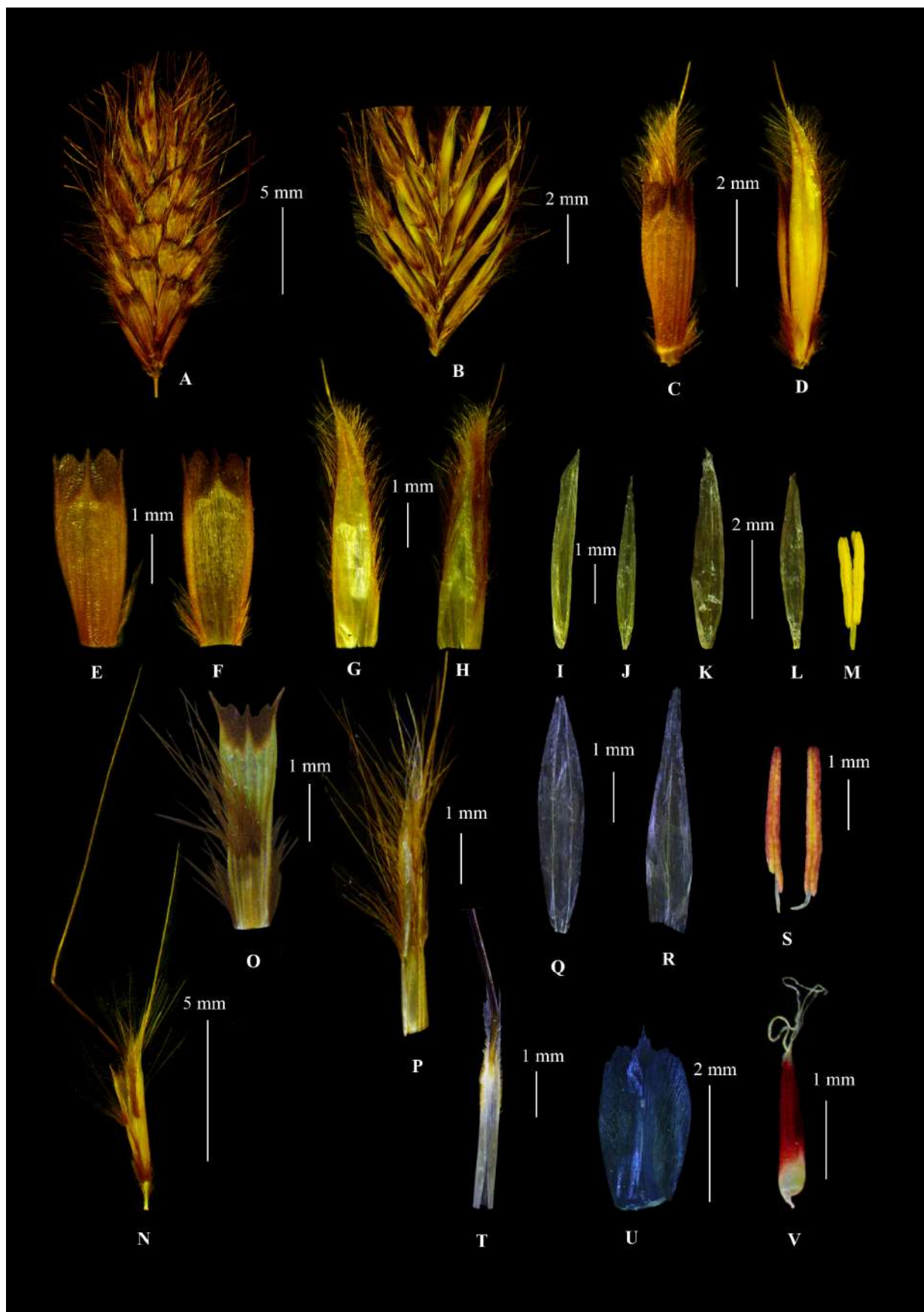


FIGURE 2. *Lophopogon prasannae* sp. nov. A. Racemes; B. Arrangement of spikelets on rachis; C–M. Components of lowest spikelet; C & D. Sessile spikelet-dorsal and ventral views; E & F. Lower glume-dorsal and ventral views; G & H. Upper glume-dorsal and ventral views; I. Lower lemma; J. Lower palea; K. Upper lemma; L. Upper palea; M. Stamens; N–V. Pedicelled spikelet; N. Spikelet; O. Lower glume; P. Upper glume; Q. Lower lemma; R. Lower palea; S. Stamens; T. Upper lemma; U. Upper palea; V. Caryopsis.

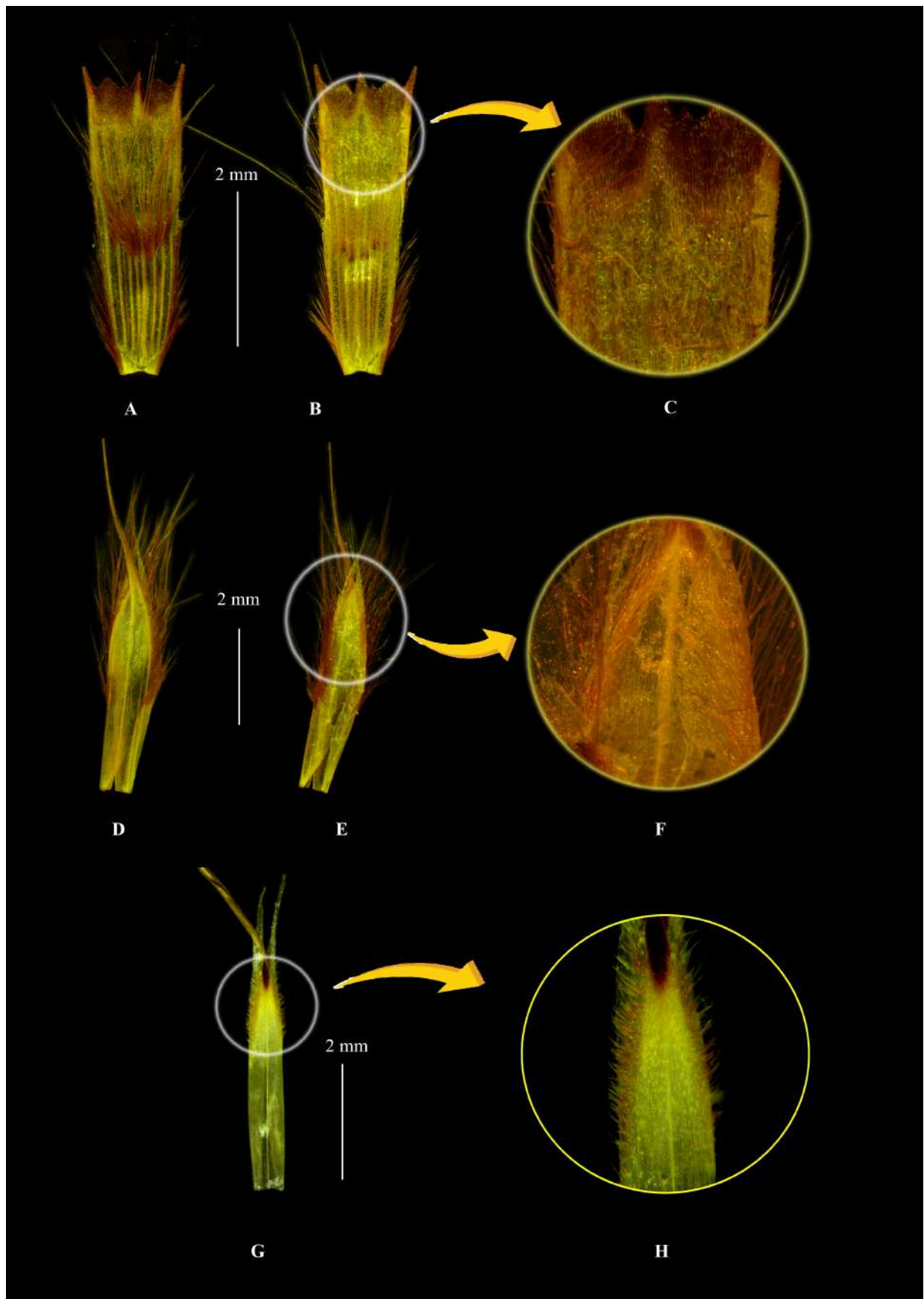


FIGURE 3. *Lophopogon prasannae* sp. nov. Components of sessile spikelet: A & B. Lower glume-dorsal and ventral views; C. Enlarged view of the apical portion of lower glume; D & E. Upper glume-dorsal and ventral views; F. Enlarged view of the apical portion of upper glume; G. Upper lemma; H. Enlarged view of the apical portion of upper lemma.

Flowering & Fruiting:—November–December.

Distribution and habitat:—The new species is currently known only from the Nigidi forest of Ananthapuramu district in Andhra Pradesh. Grows in red soils of dry deciduous open forests dominated by grasses, at an elevation between 400–500 m.

Etymology:—It is named after Dr. P.V. Prasanna, Scientist G, Botanical Survey of India, a noted grass taxonomist from India.

TABLE 1. Morphological comparison between *Lophopogon kingii*, *L. tridentatus* and *L. prasannae* sp. nov.

Characters	<i>L. kingii</i>	<i>L. tridentatus</i>	<i>L. prasannae</i> sp. nov.
Leaf blade	Base more or less villous	Base glabrous or hairy	Base with tuberculate hairs
Leaf sheath	Margins glabrous	Margins ciliate	One margin woolly
Peduncle	Prominently exerted from spatheole	More or less enclosed in spatheole or shortly exerted	Prominently exerted from spatheole
Lower glumes of the lowest spikelets	Closely nerved, tufts of hair on margins, glabrous	Not closely nerved, no hairs on margins, glabrous	Not closely nerved, tufts of hairs only at the basal margins, dorsal surface scabrid with sparsely hairy, ventral surface villous-strigose
Lower glume of sessile spikelet	Tufts of hairs between nerves in the middle forms continuous transverse band, ventral surface glabrous	Two tufts of hairs at middle and lateral margins, ventral surface sparsely ciliate	Six tufts of hairs at middle and faintly forming U-shape between the nerves, ventral surface glabrous below the middle and villous-hirtellous above the middle
Upper glume of sessile spikelet	3-nerved, not keeled, margins with long brown hairs on upper lateral sides, ventral surface glabrous	3-nerved, not keeled, margin glabrous, ventral surface hairs on upper lateral sides and base	5-nerved, keeled; keels hairy and tufts of hairs at starting point of keels; ventral surface with brown villous on two lateral nerves towards the tip
Lower lemma of sessile spikelet	c. 4.1 mm long	3.4–4 mm long	5–5.5 mm
Upper lemma of sessile spikelet	c. 4.4 mm long, surface glabrous below the middle, ciliate or pubescent above the middle, not keeled	c. 4 mm long, surface ciliate to scabrellate, not keeled	4.5–6 mm long, surface glabrous, 2-keeled near the tip, keeled
Lower lemma of sessile spikelet	Tufts of hairs on dorsal surface in the middle; awn c. 10 mm long	Densely hairy on dorsal surface; awn 5–6 mm long	Tufts of hairs on dorsal surface above the middle; awn 10–15 mm long
Palea	c. 1 mm broad, rectangular	0.4–0.5 mm broad, linear-obovate	1.5–2 mm broad, obovate-oblong
Caryopsis	c. 1.8 mm long, bulged above the middle	c. 1.8 mm long, bulged above the middle	1.5–2 mm long, not bulged in middle

Key to the species of *Lophopogon*:—

1. Lower glume of lowest spikelets closely nerved and tufts of hairs on the margins; upper glumes of pedicelled spikelets with tufts of hairs in the middle and forms transverse band..... *L. kingii*
- Lower glume of lowest spikelets not closely nerved and without tufts of hairs on the margins; upper glumes of pedicelled spikelets not forming a transverse band in the middle 2
2. Leaf blade glabrous or hairy at base; peduncle more or less enclosed in spatheole or shortly exerted; upper glume of sessile spikelet 3-nerved, not keeled *L. tridentatus*
- Leaf blade with tuberculate hairs at base; peduncle prominently exerted from spatheole; upper glume of sessile spikelet 5-nerved, keeled..... *L. prasannae* sp. nov.

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Review Article

Health and fitness through cardio training for old adults

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INTRODUCTION

Health and fitness are interrelated if an individual wants to live healthily he needs to have some degree of fitness. This varies on the age and composition of the body. Fitness can be said in two ways as muscular fitness and cardiovascular fitness. This again varies sportsmen and non-sportsman. Here, we are very much concern about the older adults who needs to maintain health-related fitness to carry out their routine activities in day-to-day life.

"Fitness is the ability to carry out one's own routine activity without fatigue".

PHYSIOTHERAPY BASED CARDIO

Physiotherapy base cardio programming combines low-impact aerobic activity and strength training movements in basic patterns of reaching turning, pushing, and pulling. This scientifically-based exercise program was developed by a group of physiotherapists and sports trainers from Switzerland and Germany. Their goal was to introduce a new functional exercise as an alternative to traditional group exercise programs. The combine exercises with functional movements patterns to improve strength, balance, flexibility, mobility, and cardio fitness and they choreographed the program to music. This program is unique as it incorporates elastic resistance bands and tubing, adding resistance to the basic movements. The elastic resistance also allows for resistance progression as strength and endurance improve.

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WATERS NATURAL RESISTANCE (AQUATIC CIRCUIT TRAINING)

Another exercise mode that is appropriate for older adults and other special population is aquatic training. Aquatic circuit training is a combination of water aerobics and muscle strengthening exercises. Water is nature's resistance tool and is about twelve times more resistant than air and has a stabilizing affect that is especially helpful in strengthening the trunk and postural muscles to improve balance and it is minimally weight-bearing. When exercising in water people bear only about thirty percent of their actual weight. In deep water exercise programs, they bear no weight. For these reasons, doctors recommend water exercise for adults whose joints cannot tolerate weight-bearing and exercise programs.

AQUA AEROBICS

The fun and exciting way to fit this exhilarating of exercises combines the format of land aerobic with the no-impact advantage of exercising in the water definitely more pleasant and easier on the body. Loads of fun too- you won't stop smiling.

Benefits Include

- Stress and tension reduction
- Improves cardio-vascular fitness-heart and lungs
- Tones the muscles
- Great for men and women of all ages
- Alleviates arthritis, back and knees problems
- Weight loss- reduces fat
- Helps with pregnancy
- Cross-training, flexibility, increases strength
- Improves motivation and self-esteem
- Work at your own pace and level
- Great for meeting new friends its fun and laughs too.

CLASS SCHEDULE

Day	AM	PM
Monday	9.00–9.45	5.45–6.30
Wednesday	9.00–9.45	5.45–6.30
Friday	9.00–9.45	5.45–6.30

EFFECTS OF AQUA AEROBICS ON CARDIOVASCULAR FITNESS IN RELATION TO DEVELOPMENT OF PHYSICAL FITNESS

- Develops a feeling of pride in yourself
- Improves your posture
- Helps you think clearer and faster
- Corrects your body alignment
- Boosts your morale and confidence
- Makes you stronger more coordinated, flexible, peaceful, and energetic. Trims and shapes your waist, hips, thighs, buttocks calves, ankles, upper arms abdomen
- Enhance your ability and performance in other activities
- Improves the capacity of your heart, lungs, and circulatory system
- Eliminates back and neck pain. Increases your stamina
- Improves Diet and Burns fat and calories. Gives you glowing skin
- Contributes to healthier looks prevents falling hair.

Cardiovascular functions such as the potential it has for preventing circulatory diseases, improving work capacity, and providing greater distance fatigue, this component if properly developed can reach a major contribution to individual's health. According to Robert cardiovascular endurance is the ability to continue or persist the strenuous task involving large muscle groups for a long period of time. By combining strength and aerobic exercises one can help older adults live longer and improved their ability to perform the activities of daily living.

POSITIVE EFFECTS OF EXERCISES

Many studies are documents benefits of resistance exercise for cardiovascular and pulmonary health, it increases blood flow to the heart, lower the number of cardiac event, reduces coronary risk factors, lower resisting heart rate and blood pressure, improves functional capacity among victims of heart disease. Resistance exercises are advisable to older adults who are capable of increasing their strength through exercise just as

ten to thirty percent of gains in strength. Those strength gains result in improved body composition and lipids, lower resting heart rate and blood pressure, and increased endurance, in other words, better cardiovascular health.

POOR NUTRITION AND SEDENTARY LIFE STYLE

Global Impact

- Poor nutrition and lack of physical activities are responsible for an estimated 300,000 to 600,000 preventable deaths each year
- An estimated one-third of all cancers are attributable to poor nutrition, physical inactivity, and being overweight
- Since nutrition and physical activity are associated with many chronic conditions, it is important to note that more than 90 million Americans live with chronic illnesses, which represent 70% of all deaths, 60% of medical care costs, and one-third of the years of potential life lost before age 65 in the US
- Approximately 50% of America's youth aged 12–21 are not regularly, physically active, moreover, physical activity declines dramatically during adolescence
- Those who are physically inactive have between 1.5 and 2.4 times risk for developing coronary heart disease, comparable to that observed for high blood cholesterol, high blood pressure, or cigarette smoking
- A sedentary lifestyle increases the risk of developing diabetes, hypertension, colon cancer, depression and anxiety, obesity, and muscles and bones
- Regular resistance will allow your body to burn more calories while at rest. Regular resistance exercise been proven to prevent and reverse osteoporosis has.

CHOOSING EXERCISE FOR BETTER HEALTH

If a miracle drug could help you lose weight, build muscles, avoid disease, stave off bone loss, and improve your mental health, would you take it. Before you answer, know that you need to take the drug 3–5 times a week, and each dose takes 30–45 min to administer. Furthermore, the drug causes most people to sweat and breathe heavily, but only during its administration.

WEIGHT CONTROL

Obesity is a risk factor for heart disease and a culprit in other diseases as well. Exercise coupled with a healthy diet is the key to effective weight loss.

MENTAL HEALTH

Physical activity can improve self-esteem and impart a general sense of well-being. It can also augment medications to improve depression and anxiety.

REGULAR AEROBIC EXERCISE

Regular aerobic exercise will increase your energy level. An active person has 40% more energy available than a sedentary person. Regular aerobic exercise is effective in helping you to manage your stress. Will make you hardier (stress-resistant) can enhance your mood "Runners high" is a physiological fact. When you exercise, hormones are released that make you feel better.

Regular aerobic exercise will increase your endurance. A fit 50-year-old will have more endurance than an unfit 20-year-old. Regular aerobic exercise when done often and at low to moderate intensity can help to elevate your HDL cholesterol (the good kind). Regular aerobic exercise is the best way to burn body fat. Regular aerobic exercise will help to control your appetite and promote weight loss by moderating your body's insulin production. Regular aerobic exercise can give you a greater of control, a sense of self-mastery.

REGULAR RESISTANCE EXERCISE

- Regular resistance exercise will increase your strength
- Regular resistance exercise will help you to tone and shape your body.

DESIGNING EFFECT EXERCISES

- We must teach exercises that are safe and effective. Designing effective group exercises is a real challenge
- Posture and core conditioning use exercises on the floor, both prone and spine. Never stop talking about neutral posture

- Stay vertical as much as possible. Keep in motion. Move the spine in every direction. Just do not stay in any one position for too long
- Look for simple vertical core exercises. The simplest way to activate the anterior core is to water walk forwards, and/or run forwards
- The simplest way to activate the posterior core is to water walk and/or run backwards. Emphasize back extension, but do not stay there for extended periods of time
- Limit the amount of repeated hip flexion. Stretch the hip flexors and the hamstrings
- Stretch the abductors, adductors, and rotators. Do not use hip flexion for abdominal training
- Heighten awareness by placing hands on hip bones, ribcage, and pelvis. Instead of running in a circle, I use individual challenges like run for 8 counts and then strike a pose
- Strengthen the core buy using blending static, held contractions with moving contractions. Use "bracing" exercise to help strengthen the deep spinal muscles. Maintain strength and mobility in the upper and lower body, because they are connected to the core

When you only have an hour with your class, prioritize the areas that are classic problems-over stretched middle back, tight hip flexors, head too forward, anterior pelvic tilt, tight hamstrings, round shoulders, tight pecks, and breathing. Find more ways to teach posture successfully.

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RESEARCH

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Gemini surfactant assisted synthesis of mesoporous Mn/Mg bimetal doped TiO₂ nanomaterial: characterization and photocatalytic activity studies under visible light irradiation

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Abstract

The present work mainly aimed to synthesize different weight percentages (0.25–1.00 wt%) of Manganese (Mn²⁺) and Magnesium (Mg²⁺) bimetal ions doped TiO₂ nanomaterial assisted with different weight percentages (5–15 wt%) of Gemini surfactant (GS) using sol-gel method. The bimetal doped and undoped TiO₂ photocatalysts were characterized by X-ray Diffraction, Scanning Electron Microscopy, Energy Dispersive X-ray Spectroscopy, Fourier Transform Infrared Spectroscopy (FT-IR), UV-Visible Diffused Reflectance Spectroscopy, Transmission Electron Microscopy, Brunauer-Emmett-Teller surface area analyzer, and Photoluminescence Spectroscopy. Characterization results revealed that mesoporous multi-particle anatase TiO₂ nanoparticles with a narrowed band gap, small particle size, and high surface area were formed due to the combined effect of Mn²⁺/Mg²⁺ bimetal ions doping and effective encapsulation of GS over the initially formed TiO₂ nanoparticles. The surface elemental composition of the 0.25 wt% Mn²⁺ and 1.00 wt% Mg²⁺ bimetal doped TiO₂ in the presence of 10 wt% of GS (after calcination) revealed the presence of both the metal dopants Mn²⁺ and Mg²⁺ along with the Ti and O and their chemical interactions were further confirmed by FT-IR results. The photocatalytic activity of these catalysts was assessed by the degradation of Methyl Red using visible light irradiation. To understand the effect of different reaction parameters on the photocatalytic activity of the nanocatalysts such as the dopant concentration, surfactant concentration, catalyst dosage, solution pH, and initial dye concentration were investigated and optimized to achieve the best performance. The photoluminescence results conclude that OH radicals are the crucial reactive species responsible for oxidative photocatalytic degradation of Methyl Red.

Keywords: Mn²⁺/Mg²⁺ bimetal doped TiO₂, Gemini surfactant, Methyl red, Mesoporous Nanocatalyst, Sol-gel technique, Anatase TiO₂

Introduction

It is worth noting that among the different semiconductors that are being studied from the past few decades for the photocatalytic degradation of various organic pollutants from wastewater, TiO₂ stands as the most preferable

one due to its non-toxicity, non-corrosive, photostability, and low cost. To make it suitable for visible light activity, many attempts are being made to modify the TiO₂ electronic structure to overcome its disadvantages of high bandgap energy and high rate of electron-hole recombination. The recent literature findings revealed that bimetal ions doping into TiO₂ crystal lattice had overcome the above drawbacks and significantly enhanced its visible

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light activity [1–3]. Among the various metal ion dopants studied so far, transition metal ion dopants can greatly reduce the band gap and electron-hole recombination by forming an extra energy level below the conduction band of TiO_2 due to the interaction of their 3d or 4d states with Ti 3d states [4]. Recently, Divya Lakshmi et al. [5] reported that Manganese (Mn^{2+}) is most preferable among the transition metals owing to the presence of t_{2g} orbital of d is very close to the conduction band of TiO_2 by which the absorption can be possibly shifted to the visible part of the spectrum. On the other hand, others [6–8] investigated the effect of Magnesium (Mg^{2+}), an alkaline earth metal, on the crystalline structure and catalytic activity of TiO_2 and found its absorption band was shifted more towards the visible region, which resulted in performing a high photocatalytic activity. Hence, Mn^{2+} and Mg^{2+} ions could be more effective as metal ion dopants to modify the TiO_2 for better photocatalytic performance under visible light irradiation.

As the size, shape, and surface area of the photocatalyst play a major role in the photocatalytic degradation process of organic pollutants from wastewater, surfactants were the best-reported species to control the growth and agglomeration of nanoparticles during the synthesis process. Among those surfactants, more surface-active anionic Gemini surfactant, 1,4-Butane sultone (GS) plays an important role in effective encapsulation of initially formed TiO_2 particles to synthesize the spherical shaped bimetal doped TiO_2 nanoparticles with small grain size and large surface area [9]. Hence, in the present study, we aimed to synthesize the Mn^{2+} and Mg^{2+} bimetal doped TiO_2 nanoparticles in the presence of GS using the sol-gel process through which we can achieve high purity and homogeneous materials at room temperatures under stoichiometry control [10].

Compared to bulk materials, nanomaterials possess unique physical, chemical, and mechanical properties. To understand overall properties, it is important to characterize the structural, optical, and morphological properties of nanomaterials prior to proceed for different applications to obtain better results [11]. Hence, several advanced sophisticated techniques were used in the present study to characterize the crystalline phase, surface morphology, elemental composition, visible light absorption capacity, particle size, and surface area of as-synthesized bimetal doped TiO_2 nanoparticles to understand its suitability for photocatalytic degradation applications.

Due to the widespread industrial activities, various organic dye pollutants are being discharged into water bodies causing severe water pollution. Almost, 15% of the dyes produced worldwide are lost during synthesis and processing with wastewater. Moreover, 50% of all

the dyes used in various industries are carcinogenic azo dyes, which are characterized by one or more azo bonds ($-\text{N}=\text{N}-$) [12] among which, Methyl Red (MR) is a familiar azo dye and is widely used in paper printing, textile dyeing, and leather industries [13]. It causes skin and eye irritation, irritation of the respiratory and digestive tract and is a suspected carcinogen, mutagen, and mitotic poison [14].

Hence, the removal of these pollutants from wastewaters in an eco-friendly way stands as a present major research concern. Therefore, in the present study, we attempted to remove this model azo dye pollutant from the contaminated water using as-synthesized $\text{Mn}^{2+}/\text{Mg}^{2+}$ bimetal doped TiO_2 nanocatalysts, and their photocatalytic efficiency was tested by optimizing the important reaction parameters like dopant concentration, surfactant concentration, solution pH, catalyst dosage and initial dye concentration for the better water pollution abatement.

Experimental

Materials

All the chemicals used in this research were of reagent grade and used without any further purification. Titanium tetrabutoxide ($\text{Ti}(\text{OBu})_4$), Manganese nitrate [$\text{Mn}(\text{NO}_3)_2 \cdot 6\text{H}_2\text{O}$], and Magnesium nitrate [$\text{Mg}(\text{NO}_3)_2 \cdot 6\text{H}_2\text{O}$] purchased from E-Merck Germany were used as precursors of TiO_2 , Mn and Mg respectively, for preparing $\text{Mn}^{2+}/\text{Mg}^{2+}$ bimetal doped TiO_2 samples. For the surfactant-assisted bimetal doped TiO_2 catalysts, GS obtained from Sigma Aldrich (Germany) was used. MR (High media, India.) was used as a model azo dye pollutant for photocatalytic degradation studies. Milli-Q water was used for the preparation of all the solutions.

Synthesis of nanocatalyst

$\text{Mn}^{2+}/\text{Mg}^{2+}$ bimetal ions doped nanotitania and GS assisted $\text{Mn}^{2+}/\text{Mg}^{2+}$ bimetal doped TiO_2 samples were prepared by sol-gel method. In this method, $\text{Ti}(\text{OBu})_4$ (10 mL) was added to ethanol (20 mL) and acidified with 1.4 mL of HNO_3 taken in a pyrex glass vessel (Solution-I) and stirred for 20 min. Desired wt% (0.25–1.0 wt%) of Mn^{2+} and Mg^{2+} dopants proportionate to TiO_2 weight were taken in ethanol (20 mL) in another beaker and added 4.5 mL of Milli-Q water for effective hydrolysis purpose (Solution-II). Then the solution-II was slowly added to solution-I dropwise with continuous stirring. A colloidal solution that formed after complete mixing is further stirred for 90 min and aged for 48 h to obtain the gel. The formed gel was dried (at 70°C), ground, and calcined at 450°C for about 5 h in a furnace. To get homogeneous powder the calcined samples were well ground after cooling.

To optimize the best dopant concentrations, the photocatalytic efficiency of the as-synthesized bimetal

doped TiO_2 samples was tested by degrading MR dye and 0.25 wt% Mn^{2+} and 1.00 wt% Mg^{2+} bimetal doped TiO_2 (MMT5) was found to be the best. For further enhancement in the photocatalytic activity of the MMT5 catalyst, GS assisted MMT5 nanocatalysts were synthesized by following the same procedure but different wt% (5, 10, and 15 wt%) of GS was added after the mixing of solution-I and solution-II. To study and compare the effect of dopants and surfactant on the photocatalytic properties of bimetal doped TiO_2 , an undoped TiO_2 sample was prepared using the same procedure without adding dopants and surfactant precursors. Details and nomenclature of all the synthesized catalysts are presented in Table 1.

Characterization techniques

The crystalline structure of photocatalysts was studied by powder X-ray diffraction (XRD) spectra using PANanalytical diffractometer with $\text{CuK}\alpha$ radiation ($\lambda = 0.15405 \text{ nm}$) operated at 45 kV, 40 mA, and 0.20 min^{-1} scan rate. Based on the Scherrer equation using full width at half maximum (FWHM), the crystallite size of TiO_2 nanocatalysts was determined. The UV-Visible Diffuse reflectance spectra (UV-Vis DRS) of the catalysts were recorded in the range of 200–800 nm with a Shimadzu 3600 UV-Vis DRS Spectrophotometer using BaSO_4 as reference. Scanning electron microscopy (SEM) JSM 6300, Japan equipped with energy dispersive X-Ray (EDX) spectroscopy was used to investigate the surface morphology and elemental analysis, respectively. The microstructure and particle size of the samples were analyzed by high-resolution transmission electron microscopy (HRTEM) JEM-2100 JEOL at an operating voltage of 200 kV. Fourier transform infrared spectra (FT-IR) of the nanocatalysts were recorded on an FT-IR spectrometer (Nicolet Avatar360). Brunauer-Emmett-Teller (BET) surface area, pore size, and pore volume of the nanocatalysts were determined using Quanta Chrome

Nova 2200E system by recording N_2 adsorption-desorption isotherms at 77.3 K. Photoluminescence (PL) analysis was performed by Hitachi F-7000 fluorescence spectrophotometer. The pH of the reaction mixture and the amount of MR degraded during the photocatalytic process were adjusted and monitored using Elico Digital pH meter (Model IIIIE, EI) and UV-vis spectrophotometer (Shimadzu 1601), respectively.

Experimental procedure for the determination of visible light photocatalytic activity of nanocatalyst

The photocatalytic activity of surfactant-assisted $\text{Mn}^{2+}/\text{Mg}^{2+}$ bimetal ions doped TiO_2 nanocatalyst was examined by the degradation of a model azo dye pollutant, MR in a visible light photoreactor as shown in Fig. 1. For visible light illumination, a high-pressure metal halide lamp (400 W, 35,000 lm, and 436–546 nm output) was used and placed 20 cm away from the pyrex glass vessel containing 100 mL of MR dye solution of desired concentration ($1\text{--}10 \text{ mg L}^{-1}$) with sufficient amount of the catalyst. To screen the infrared radiation effect and to keep the constant temperature (25°C) during the degradation experiments, water was passed continuously around the reaction vessel. Prior to visible light irradiation, the pH of the reaction mixture was adjusted to the desired value by the addition of 0.1 N NaOH/0.1 N HCl and the reaction mixture was stirred in dark for 30 min to establish the adsorption-desorption equilibrium between MR dye and surface of the catalyst [15]. After the visible light irradiation, 5 mL aliquots of samples were collected at regular time intervals using a Millipore syringe ($0.45 \mu\text{m}$) and change in the concentration of MR dye during the degradation process was studied with a UV-Vis spectrophotometer (Shimadzu 1601) by measuring its absorbance at 525 nm. The percentage degradation of MR was determined by using the Eq. (1) [16].

Table 1 Name assigned to different TiO_2 nanocatalyst samples

Serial number	Weight percentages of dopants (wt%)	Gemini surfactant wt%	Name given to the sample
1	0.25 Mn 0.75 Mg	–	MMT1
2	0.75 Mn 0.25 Mg	–	MMT2
3	0.50 Mn 0.50 Mg	–	MMT3
4	1.00 Mn 0.25 Mg	–	MMT4
5	0.25 Mn 1.00 Mg	–	MMT5
6	0.25 Mn 1.00 Mg	5	MMT5-GS1
7	0.25 Mn 1.00 Mg	10	MMT5-GS2
8	0.25 Mn 1.00 Mg	15	MMT5-GS3
9	NIL	–	Undoped TiO_2

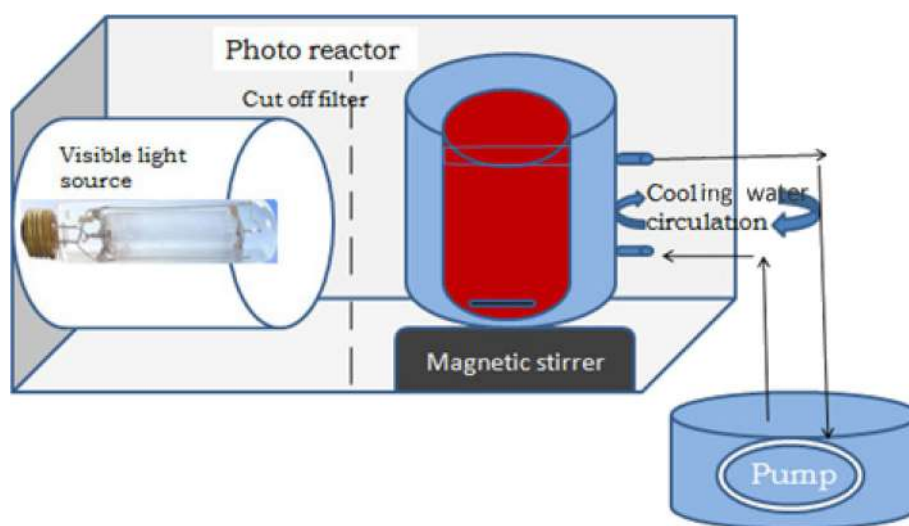


Fig. 1 Schematic representation of photoreactor

$$\% \text{degradation of MR} = \frac{C_0 - C_t}{C_0} \times 100 \quad (1)$$

Where C_0 is the initial concentration of MR dye solution before degradation and C_t is the concentration at time t . For better photocatalytic degradation, the effect of reaction parameters like dopant concentration, surfactant concentration, solution pH, catalyst dosage, and initial dye concentration was studied and optimized by varying the measured parameter while keeping other parameters constant and the results are discussed in section 4.1–4.5. As the photocatalytic degradation of organic pollutants is mainly initiated by highly oxidative hydroxyl radicals ($\bullet\text{OH}$), which can be easily captured by fluorescent probe molecules, the formation of $\bullet\text{OH}$ in the

photocatalysis process was studied by PL technique using coumarin as a probe molecule [16].

Results and discussion

XRD study

From the XRD patterns of all the synthesized catalysts shown in Fig. 2. All samples including undoped TiO_2 calcined at 450°C for 5 h showed the formation of anatase phase having characteristic high-intensity diffraction peak at $2\theta = 25.3^\circ$ along with other corresponding small diffraction peaks at 2θ values 37.9 , 48.1 and 54.1° that can be indexed to planes of (101), (004), (200) and (211) of anatase phase respectively (JCPDS No. 21–1272). No extra peak found at $2\theta = 27.8^\circ$, indicating that there is no formation of the rutile phase. As the ionic radii of Mn^{2+}

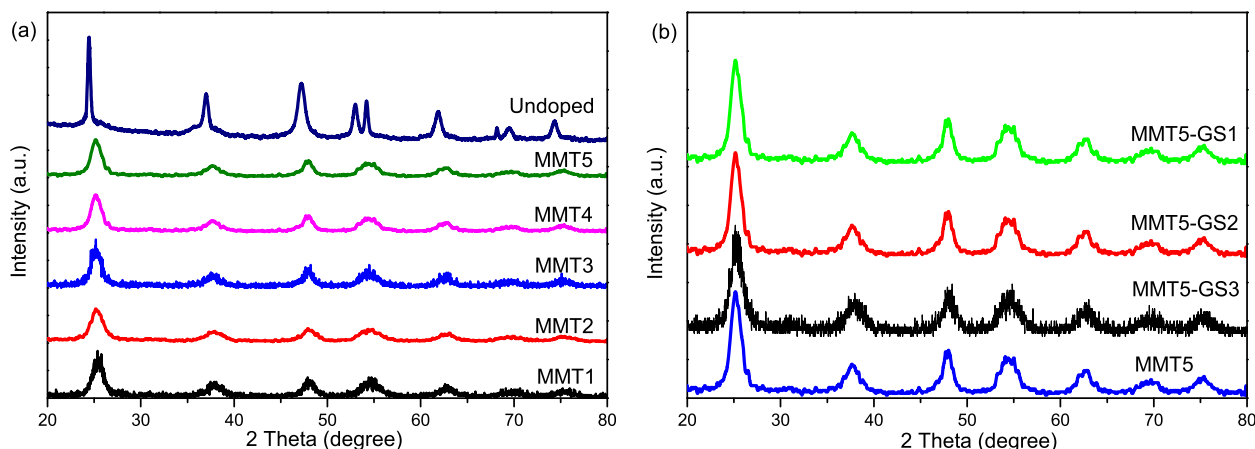


Fig. 2 **a** XRD patterns of undoped TiO_2 and $\text{Mn}^{2+}/\text{Mg}^{2+}$ bimetal doped TiO_2 (MMT1–MMT5) catalysts, **b** MMT5 and surfactant assisted catalysts (MMT5-GS1–MMT5-GS3)

(0.78 Å) and Mg^{2+} (0.72 Å) are closer to the ionic radii of Ti^{4+} (0.68 Å), Mn^{2+} and Mg^{2+} dopant metal ions were expected to substitute Ti^{4+} ions in TiO_2 matrix which is confirmed by the absence of any diffraction peaks related to Mn and Mg oxides or other compounds [17, 18]. And it is also known that as the Mn^{2+} and Mg^{2+} are more electropositive, the electronic cloud in each TiO_2 might be loosely held, favoring the formation of less dense anatase phase [19]. The average crystallite sizes of the undoped, bimetal-doped (MMT) and surfactant-assisted bimetal doped (MMT-GS) catalysts were calculated based on the FWHM of the characteristic high intensified peak using Scherrer eq. [1] ($d = k\lambda/\beta \cos\theta$), where d is the average crystallite size, k is 0.9 (Scherrer constant), λ is 1.5406 (X-ray wavelength), β is the FWHM and θ is the diffraction angle and are tabulated in Table 2. From the table, the average crystallite size of the catalysts was found to be ranging from 7.21–10.22, 10.86–12.87, and 18.30 nm for MMT-GS, MMT, and undoped TiO_2 nanocatalysts, respectively. The substitutional doping of metal ions into the TiO_2 lattice inhibited the grain growth by formation of Ti-O-Mn and Ti-O-Mg due to which the crystallite size was decreased in MMT catalysts. Further decrease in crystallite size was observed for the catalyst prepared in presence of surfactant, MMT-GS, which can be attributed to the effective capping nature of the GS which controls the nucleation and minimizes the agglomeration of TiO_2 nanoparticles during the synthesis process [20].

UV-Vis DRS study

From the UV-Vis DRS of the undoped TiO_2 , MMT, and MMT-GS nanomaterials shown in Fig. 3a, it is observed that absorbance bands are shifted more towards the higher wavelengths, i.e., red-shifted in MMT and MMT-GS catalysts compared to undoped TiO_2 , which is possibly due to the decreased bandgap by co-doping of Mn^{2+} and Mg^{2+} into the TiO_2 matrix. The decrease in

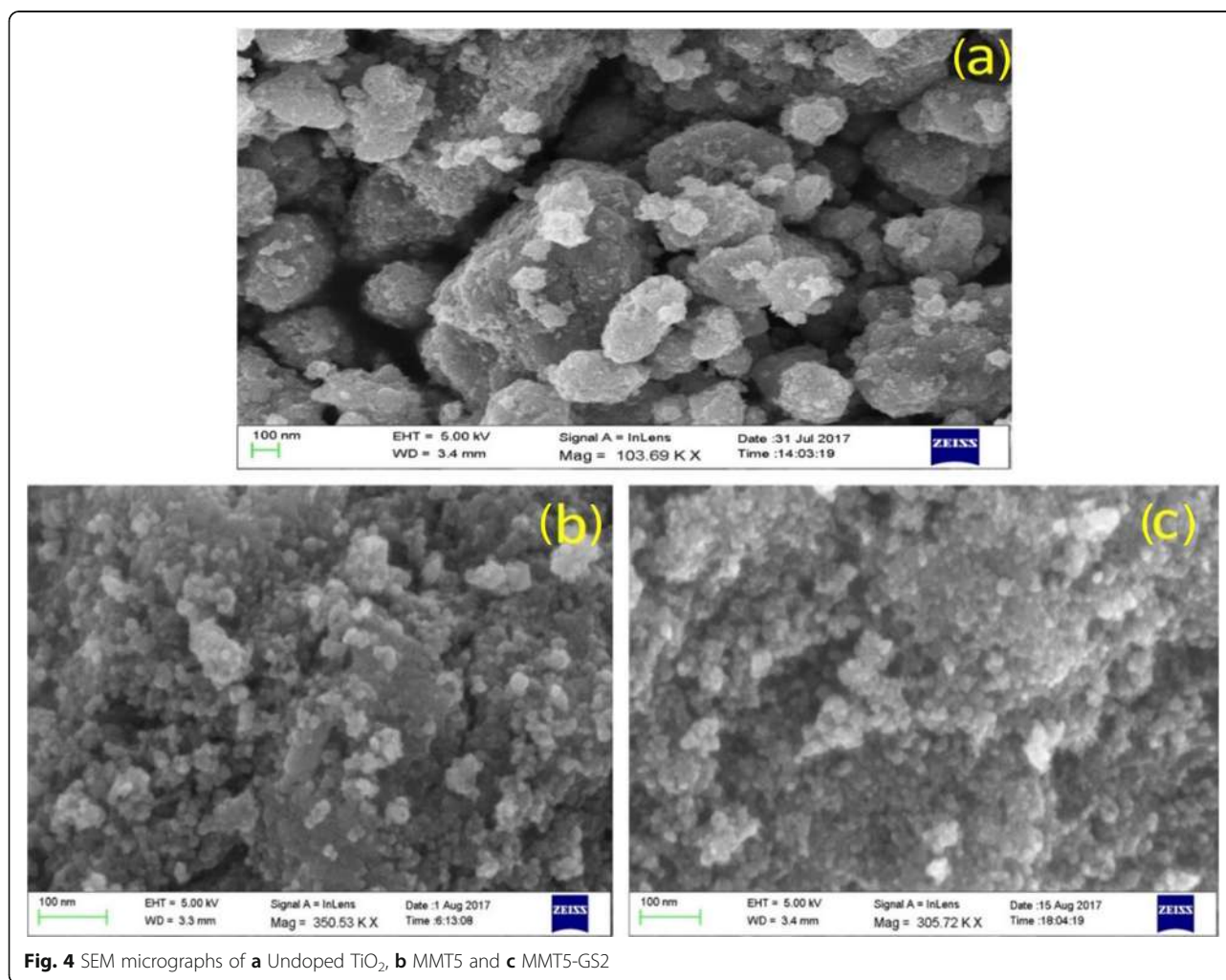
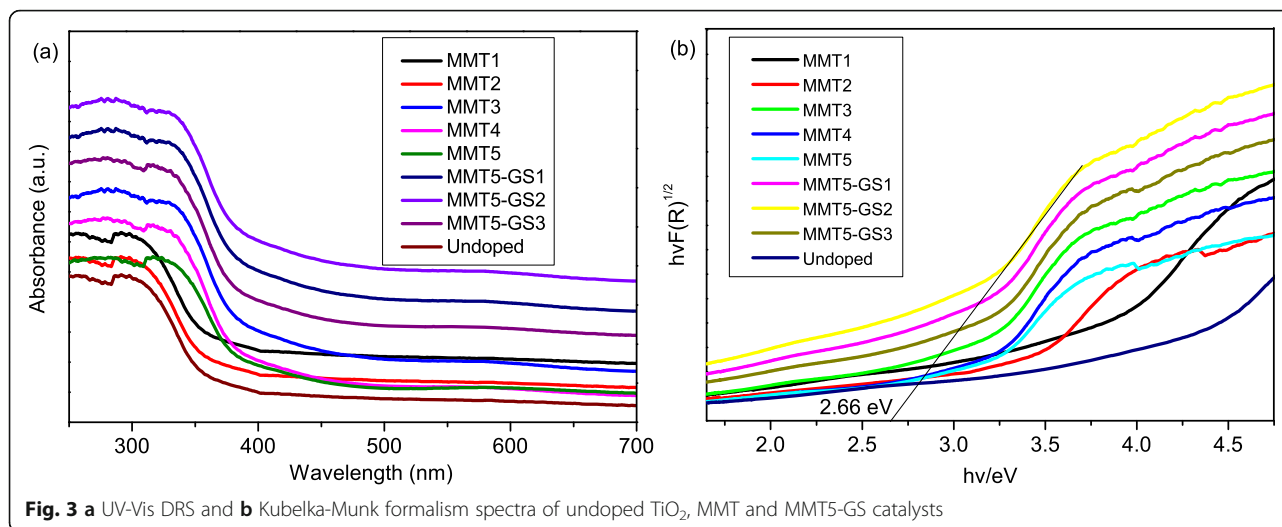
bandgap can be ascribed to the joint effect of these two metal dopant ions (Mn^{2+} and Mg^{2+}) in MMT and MMT-GS system, where these formed the extra energy levels below the conduction band of TiO_2 and thus reduces the electron-hole recombination by trapping electrons and enhances the visible light absorbance. From Fig. 3b it is further confirmed by bandgap energies obtained for all the synthesized catalysts using Kubelka-Monk formalism and Tauc plot method [21]. The corresponding band gap energy values are presented in Table 2. From the table, it is found that the average band gap values of the photocatalysts are in the range of 2.66–2.83, 2.68–2.97, and 3.20 eV for MMT-GS, MMT, and undoped TiO_2 , respectively. These outcomes revealed that all MMT and MMT-GS catalysts are visible light active and can be used as better photocatalysts. The catalysts MMT5, MMT5-GS1, MMT5-GS2, and MMT5-GS3 have the same weight percentage of Mn and Mg; consequently, they have the absorption peaks nearly at the same wavelength. In particular, among all the MMT and MMT-GS catalysts, MMT5-GS2 showed the least bandgap energy, i.e., 2.66 eV.

Before proceeding to further characterization, we have conducted trial photocatalytic degradation experiments for all the synthesized catalysts using MR dye. From the results, it was noticed that among all the MMT catalysts, MMT5 exhibited better photocatalytic activity and moreover, MMT5 assisted with 10 wt% of GS, MMT5-GS2 has shown some more enhanced photocatalytic activity. Hence, we selected these two particular catalysts for further characterization with SEM-EDX, TEM, BET, FT-IR, and PL study.

SEM and EDX studyThe SEM images shown in Fig. 4 illustrate the surface morphology of undoped TiO_2 , MMT5, and MMT5-GS2, respectively. In comparison, it can be clearly seen that the morphology of the TiO_2 has been changed from large aggregates with a scratchy surface in undoped TiO_2 (Fig. 4a) to multiparticle

Table 2 Crystallite size, band gap energy and BET surface area of undoped TiO_2 and all bimetal doped and surfactant-assisted TiO_2 catalysts calcined at 450 °C

Serial number	Nanomaterials	Crystallite size (nm)	Bandgap energy (eV)	BET surface analysis		
				Surface area ($\text{m}^2 \text{g}^{-1}$)	Pore volume ($\text{cm}^3 \text{g}^{-1}$)	Pore size (nm)
1	Undoped TiO_2	18.30	3.20	64.1	0.22	10
2	MMT1	12.87	2.97	84.7	0.23	7.3
3	MMT2	12.05	2.83	83.7	0.22	7.2
4	MMT3	11.37	2.79	94.9	0.23	9.3
5	MMT4	11.74	2.75	91.4	0.24	8.1
6	MMT5	10.86	2.68	112.0	0.24	7.0
7	MMT5-GS1	10.22	2.76	140.6	0.24	7.3
8	MMT5-GS2	7.21	2.66	230.2	0.25	6.4
9	MMT5-GS3	8.33	2.83	160.1	0.22	8.3



agglomerated irregular shaped particles with rough surface in MMT5 (Fig. 4b) and pseudospherical less agglomerated nanoparticles with smooth surface area and small particle size in MMT-GS2 (Fig. 4c). This is clearly indicating that Mn^{2+} and Mg^{2+} bimetal ions doping and capping action with the GS have a significant impact on the morphology of TiO_2 nanoparticles which controls the grain growth and particle nucleation.

Also, the chemical composition of MMT5-GS2 sample was investigated by EDX with the results depicted in Fig. 5. Along with the Ti and O elements of TiO_2 , the dopant elements Mn and Mg are found in the spectra supporting the presence of dopants in the TiO_2 matrix and there are no GS associated peaks are found in the spectra indicating complete elimination of GS after the calcination process. The quantitative analysis results are listed in a table inserted in Fig. 5 describing weight percentage as well as the atomic percentage of the compositional elements of the sample which indicates good compatibility with the dopant concentration used for the synthesis of TiO_2 nanoparticles.

TEM study

The TEM images of MMT5 and MMT5-GS2 photocatalysts are shown in Fig. 6a and b respectively. The TEM image (Fig. 6a) of MMT-5 shows pseudospherical shape with multiparticle agglomeration and an average particle size of 6.6 nm. Whereas in MMT5-GS2 (Fig. 6b), most of the TiO_2 particles are well dispersed with very low agglomeration compare to Fig. 6a and the particle size is in the range of 2.3–5.4 nm, with an average particle size of 3.8 nm. Thus, it clearly indicates that the GS effectively inhibited the particle overgrowth and aggregation and resulted in small particle size with increased surface area, which is well correlated with BET results given in

Table 2. The selected area electron diffraction (SAED) patterns shown in Fig. 6c confirmed the anatase phase with good crystallinity indexed by the concentric rings, which is in good agreement with XRD diffraction patterns. In addition to SAED, from the HRTEM image of MMT5-GS2 (Fig. 6d) the observed lattice fringes with d-spacing of 0.352 nm correspond to (101) plane of anatase and further confirms the single-crystal nature and high crystallinity of anatase TiO_2 [22].

FT-IR study

The incorporation of metal ion dopants, Mn^{2+} and Mg^{2+} into TiO_2 lattice was further confirmed by FT-IR results. The FT-IR spectra of the undoped TiO_2 , MMT5, and MMT5-GS2 (before and after calcination) are shown in Fig. 7. The peaks at 3403.0, 2926.1, 1616.4, 1383.8, 3378.1, 2918.7, 1626.7, and 1372.1 cm^{-1} correspond to stretching vibrations of surface O-H and 3351.8, 2918.7, 1619.4 and 1383.8 cm^{-1} correspond to bending vibrations of adsorbed H_2O molecules [23]. The stretching vibrations of Ti-O and bending vibrations of Ti-O-Ti observed at 575.4 and 1375.8 cm^{-1} in undoped TiO_2 (Fig. 7a) were deformed/shifted to 620.3 and 1300.1 cm^{-1} in MMT5 (Fig. 7b) and 540.0 and 1182.0 cm^{-1} in MMT5-GS2 (Fig. 7c and d), respectively, which can be attributed to the presence of dopants in TiO_2 lattice. Hence, the FT-IR study confirms that Mn^{2+} and Mg^{2+} are substitutionally doped into TiO_2 lattice by replacing Ti^{4+} and formed a new network, i.e., Ti-O-Mn and Ti-O-Mg which are in good agreement with the previous reports [7, 24]. The FT-IR spectra of GS are shown in Fig. S1 as a supplementary file. The bands situated at about 2945.6, 1447.8, 1345.7, 1246.0, 1149.8, 1059.6, and 996.6 cm^{-1} in GS were shifted to

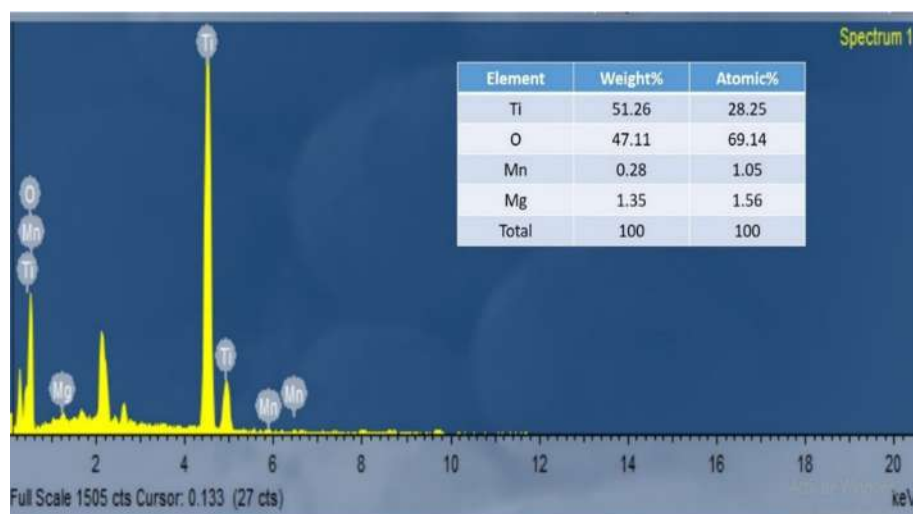


Fig. 5 EDX spectrum of 0.25 wt% Mn^{2+} and 1.00 wt% Mg^{2+} bimetal doped TiO_2 in the presence of 10 wt% of surfactant (MMT5-GS2) after calcination

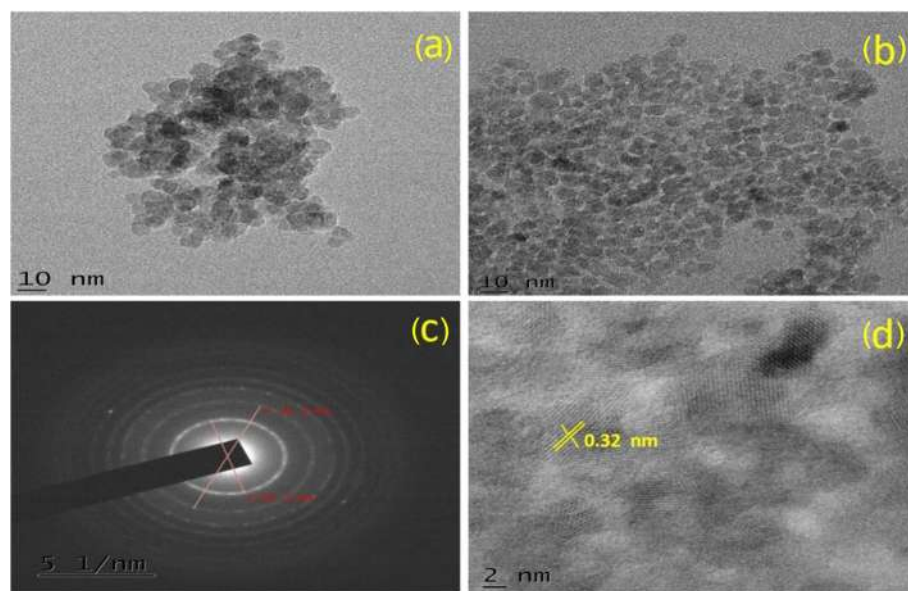


Fig. 6 TEM image of **a** MMT5, **b** MMT5-GS2, **c** Selected area electron diffraction (SEAD) and **d** HRTEM image of MMT5-GS2

2855.8, 1735.0, 1459.9, 1206.7, 1136.5, 1094.1, and 982.9 cm^{-1} in MMT5-GS2 before calcination shown in Fig. 7c which confirms the existence of strong electrostatic interaction between GS and surface of catalyst in MMT5-GS2 before calcination [9].

From Fig. 7d, the absence of these peaks confirms that there is no surfactant remaining in the synthesized catalyst, MMT5-GS2 after calcination. This indicates that due to calcination at 450°C , the surfactant is completely eliminated from nanocatalyst.

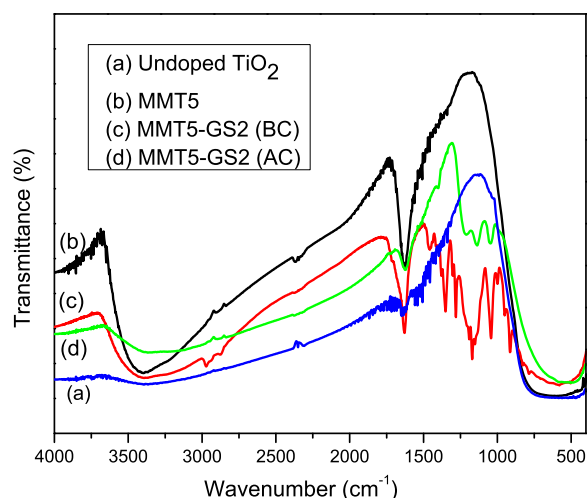


Fig. 7 **a** FT-IR spectra of undoped TiO_2 , **b** MMT5, **c** MMT5-GS2 (before calcination), **d** FT-IR spectra of MMT5-GS2 (after calcination)

BET surface area analysis

To study the effect of bimetal doping and GS on the surface area and porosity nature of the as-synthesized TiO_2 nanoparticles of undoped TiO_2 , MMT5 and MMT5-GS2, N_2 adsorption-desorption isotherms and their corresponding Berret-Johner-Halenda (BJH) pore size distribution plots were recorded and presented in Fig. S2a and S2b. From Fig. S2a, it results in a type -IV isotherm with H_2 hysteresis loop, characteristic of the ordered mesoporous structure of the catalyst [25]. The average surface area, A_{BET} ($\text{m}^2\text{ g}^{-1}$) of all prepared catalysts was determined and tabulated in Table 2.

From Table 2 the MMT5 has shown increased surface area ($112\text{ m}^2\text{ g}^{-1}$) compared to undoped TiO_2 ($64\text{ m}^2\text{ g}^{-1}$) due to crystal growth suppression by dopants. Whereas catalyst prepared in the presence of GS surfactant, MMT5-GS2 showed a higher surface area ($230\text{ m}^2\text{ g}^{-1}$) compared to both MMT5 and undoped TiO_2 . It could be strong evidence for the decreased particle size of the TiO_2 resulting from the effective capping ability of the surfactant, which restricts the particle growth and nucleation during the synthesis process. To better compare the effect of bimetal doping and capping of GS on as-synthesized TiO_2 nanoparticles over single Mn^{2+} and Mg^{2+} doped TiO_2 , comparative results are tabulated by referencing Mn [26] and Mg [27] single doped literature reports in Table 3.

PL spectra

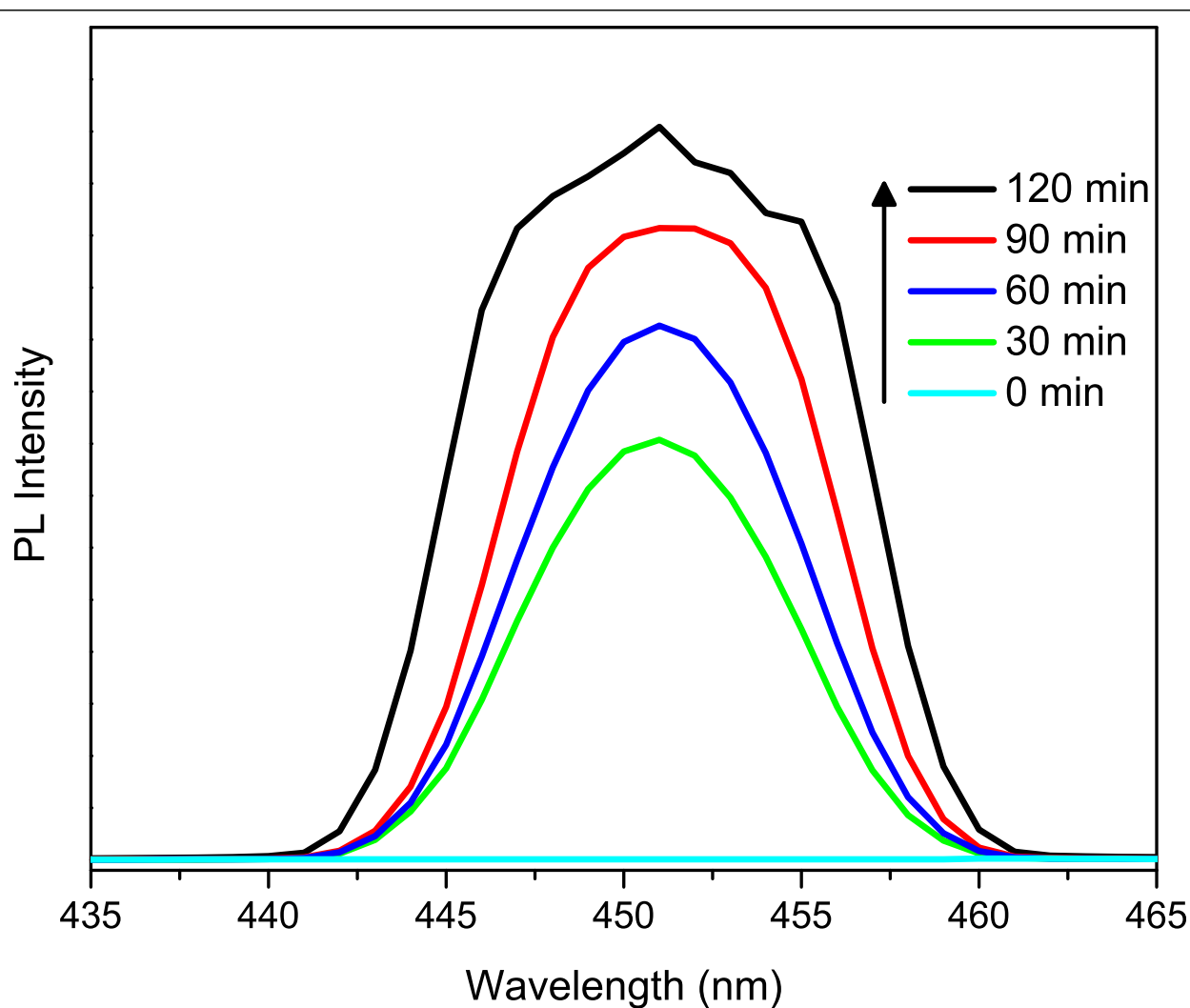
One of the essential reactive species in the process of photocatalysis is $\bullet\text{OH}$ which is responsible for oxidation

Table 3 Comparative study of Mn^{2+} , Mg^{2+} single doped and $\text{Mn}^{2+}/\text{Mg}^{2+}$ bimetal doped TiO_2 nanocatalysts

TiO_2 catalyst	Bandgap energy (eV)	Surface area ($\text{m}^2 \text{g}^{-1}$)	Crystallite size (nm)	References
Mn- TiO_2	2.98	93	21.8	[26]
Mg- TiO_2	2.92	49	20	[27]
Undoped TiO_2	3.2	64	18.3	Present work
MMT5	2.68	112	10.9	Present work
MMT5-GS2	2.66	230	7.2	Present work

reactions. Because of the high reactivity and short life of $\cdot\text{OH}$, it is impossible for direct detection. To inspect the production of $\cdot\text{OH}$ from the catalyst during the photocatalysis reaction, a PL technique has been adopted using coumarin as a fluorescent probe molecule, which on reaction with $\cdot\text{OH}$ yields the 7-hydroxy coumarin [16]. In this technique, 0.1 g of catalyst is dispersed in

100 mL of 10 ppm coumarin solution in acidic conditions and illuminated to visible light irradiation. Small aliquots of reaction solution samples were withdrawn for every 30 min, filtered and PL intensity was measured in the range of 350–600 nm with excitation fixed at a wavelength of 435 nm. It has been observed from Fig. 8 that between 440 and 460 nm there exist PL spectra of the

**Fig. 8** Photoluminescence spectra of MMT5-GS2

generating 7-hydroxy coumarin with maximum emission at 450 nm. A linear increase in PL intensity was observed with increasing irradiation time. However, in the absence of irradiation, no excitation was observed for the sample (0 min in Fig. 8).

From the above results, it could be understood that the number of $\bullet\text{OH}$'s produced on the catalyst surface was directly proportional to the irradiation time. The results further assure that the synthesized nanomaterial shows the enhanced rate of formation of $\bullet\text{OH}$'s under irradiation to visible light. This is due to the fact that the already formed photo holes in the valence band of bimetal doped TiO_2 could directly react with $\text{H}_2\text{O}/\text{OH}^-$ to produce $\bullet\text{OH}$ [28].

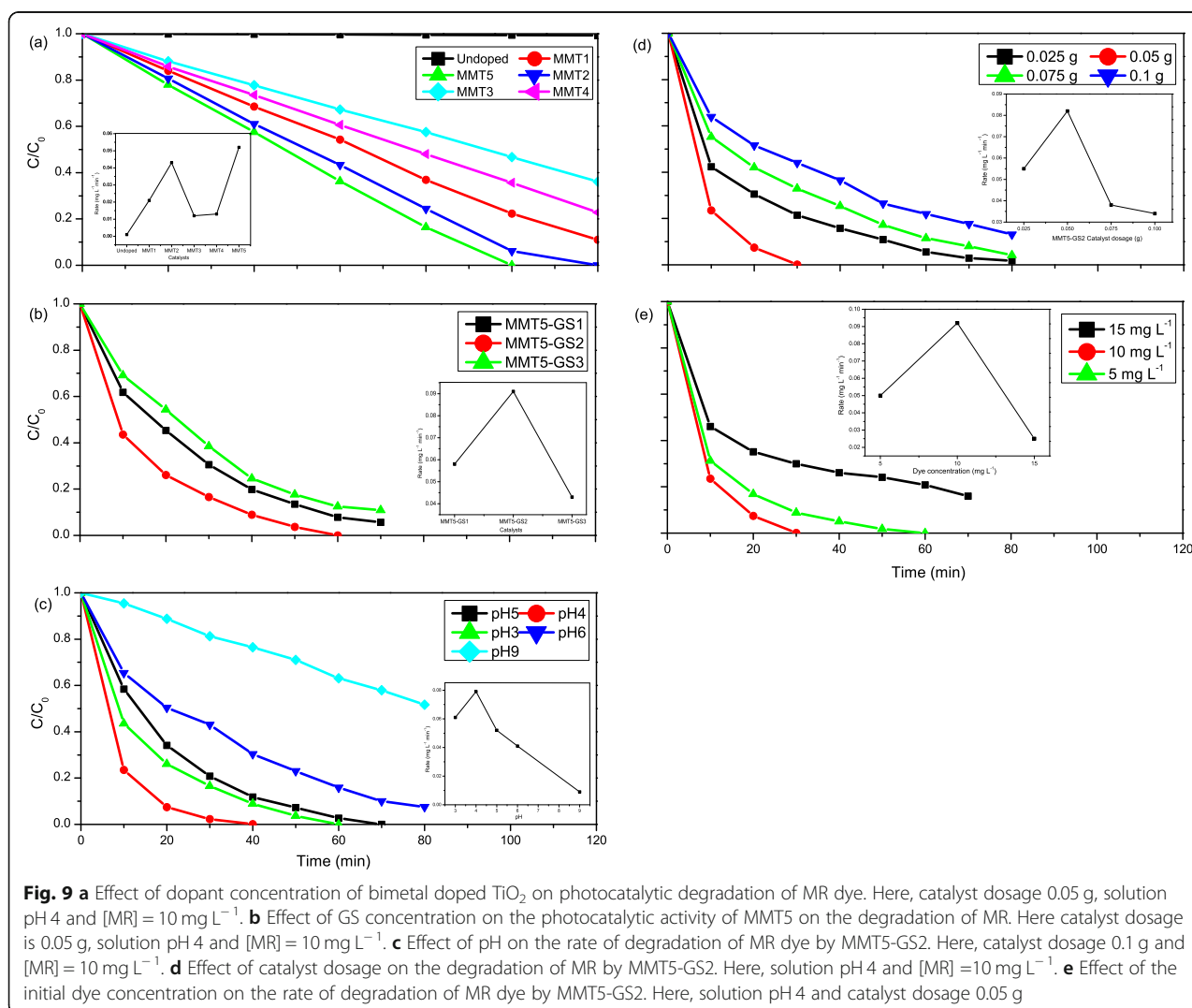
Evaluation of the photocatalytic activity of synthesized MMT-GS nanocatalysts by the degradation of MR

Visible light assisted catalytic activity of the synthesized MMT-GS photocatalysts was evaluated by degradation

of MR. For better photocatalytic degradation, the effect of reaction parameters like concentration of dopants, surfactant concentration, solution pH, catalyst dosage, and initial dye concentration was studied and optimized as follows.

Effect of metal ion dopant (Mn^{2+} and Mg^{2+}) concentration

In order to find out and optimize the best dopant concentration of bimetal doped photocatalyst among all the synthesized MMT photocatalysts, degradation experiments were carried out with each photocatalyst under visible light irradiation by taking catalyst dosage 0.05 g, solution pH 4, and initial MR concentration 10 mg L^{-1} . The rate of degradation of MR has been studied by measuring the MR absorbance, which is inserted in Fig. 9a. It can be seen from the figure that photocatalytic performance was found better for all the bimetal doped TiO_2 photocatalysts than undoped one and among all the synthesized photocatalysts, the best catalytic



performance is shown by MMT5. This can be attributed to its narrowed bandgap resulting from the impurity energy levels between the valence band and conduction band that is created by the presence of both metal dopants which helps in the generation of more electron-hole pairs. Also, its small crystallite size and high surface area facilitate the adsorption of a greater number of dye molecules on its surface for degradation [7]. Therefore, based on the above results MMT5 was selected for optimizing other parameters.

Effect of GS concentration

To find out the optimal concentration of GS in MMT5 photocatalyst for efficient photocatalytic performance, as synthesized MMT5-GS catalysts with various wt% of GS (5, 10, and 15 wt%) along with MMT5 were tested by the degradation of MR under visible light irradiation by maintaining other parameters constant, i.e., catalyst dosage is 0.05 g, solution pH 4 and initial MR concentration 10 mg L^{-1} . It is observed from Fig. 9b that all MMT5 nanocatalysts prepared in the presence of GS degraded the MR in less time compared to MMT5 (Fig. 9a) which clearly indicates the significant role of the capping nature of the GS on the photocatalytic activity of MMT catalysts. From the apparent rate constants obtained by slopes of the individual curves (inset of Fig. 9b), it can be clearly seen that the degradation rate was increased up to 10 wt% GS concentration and then decreased on further loading. It could be due to the fact that increased GS concentration may restrict the effective doping of the metal ions into TiO_2 crystal lattice. Hence, MMT5-GS2 had been taken as a catalyst for further studies.

Effect of solution pH

According to Tang et al. [29], for charged substrates like TiO_2 , there is a significant dependency on the pH value for the effective photocatalytic degradation, because the overall surface charge and adsorptive properties of TiO_2 nanomaterial depend strongly on solution pH. Hence, in this study, the effect of pH on the catalytic performance of the MMT5-GS2 was carried out by ranging the pH from 2 to 8 and keeping other parameters constant, i.e., catalyst dosage 0.1 g and initial MR concentration 10 mg L^{-1} . From Fig. 9c, it is observed that the degradation of MR is high in the acidic medium compared to the basic medium. This may be due to the strong electrostatic interaction between the positively charged surface (H^+ ions) of the catalyst and negatively charged dye molecules. When the pH increased to basic medium the catalyst surface acquires a negative charge and electrostatically repels the like-charged dye molecules. In specific, the degradation of MR is high at solution pH 4, because as the positive charge (H^+ ions) on TiO_2 surface increases, negatively charged MR can easily be adsorbed on the surface of the catalyst.

And a further increase in pH greater than 4 will facilitate the hydrolysis of metal ions on the surface of TiO_2 which seizes its photocatalytic activity.

Effect of catalyst dosage

To avoid the wastage of catalyst and minimize the screening effect, a number of experiments were carried out to get the optimum photocatalyst dosage by varying its amount ranging from 0.025 to 0.1 g using 10 mg L^{-1} of 100 mL of MR solution at solution pH 4. It was observed from Fig. 9d that the degradation of the MR increased linearly with the increase of catalyst loading up to 0.05 g because of the increased total surface area for dye adsorption. But after increasing the photocatalyst beyond 0.05 g, it creates turbidity and agglomeration of the catalyst particles due to excess photocatalyst and reduces the light transmission through the solution which leads to less photocatalytic activity [18]. And also, collisions between active molecules and ground-state molecules of bimetal doped TiO_2 results in the deactivation of the catalyst particles [16].

Effect of initial dye concentration

To study the effect of the initial dye concentration at a fixed weight of catalyst (0.05 g) and solution pH 4, the experiments were carried out with different concentrations of MR dye from 5 to 15 mg L^{-1} with results presented in Fig. 9e. The results demonstrate that the rate of degradation of MR dye increased up to 10 mg L^{-1} . But, a further increase in dye concentration causes the deactivation of the catalyst due to the blanket effect [30]. And because of the fixed catalyst dosage (0.05 g), there is no possibility to produce a sufficient number of $\bullet\text{OH}$ to counteract the increased number of dye molecules. Hence, the rate of degradation decreases.

Conclusions

GS abetted mesoporous $\text{Mn}^{2+}/\text{Mg}^{2+}$ bimetal doped TiO_2 nanocatalysts were successfully synthesized by the sol-gel method without a change in the crystallinity of TiO_2 nanoparticles. The effective charge separation and narrowed band gap created by $\text{Mn}^{2+}/\text{Mg}^{2+}$ bimetal ions doping and reduced particle size and increased surface area resulting from capping of GS had significantly enhanced the photocatalytic performance of MMT5-GS2 nanocatalyst towards the degradation of MR dye under visible light irradiation. The PL results exhibited that $\bullet\text{OH}$ s are the crucial reactive species responsible for oxidative photocatalytic degradation of MR. The highest degradation of MR was achieved in 60 min at optimized reaction conditions of 10 wt% GS on 0.25 wt% $\text{Mn}^{2+}/1.00 \text{ wt% Mg}^{2+}$ bimetal ions doped TiO_2 , solution pH 4, catalyst loading of 0.05 g, and initial MR concentration 10 mg L^{-1} . Based on its effective photocatalytic activity,

MMT5-GS2 nanocatalyst could be used as a promising material for the abatement of water pollution caused by organic dyes.

Supplementary Information

The online version contains supplementary material available at <https://doi.org/10.1186/s42834-021-00078-8>.

Additional file 1: Fig. S1. FT-IR spectra of Gemini surfactant. **Fig. S2** (a) N₂ adsorption-desorption isotherm plot and (b) pore size distribution of undoped TiO₂, MMT5 and MMT5-GS2.

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Not Applicable.

Authors' contributions

SRM planned the concept and carried out the experimental work. TSR supervised the research work and written the original draft. IMR interpreted characterization and experimental results, assisted in original draft writing and review & editing of the manuscript. SAA, GJ, and MLVPC were assisted in experimental work. All authors read and approved the final manuscript.

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Availability of data and materials

All data generated or analyzed during this study are included in this published article [and its supplementary information files].

Competing interests

The authors declare that they have no competing interests.

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Holy basil: A potential herbal source for therapeutic applications

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Abstract

Human dependence on plants, especially for medicinal purpose can be dated back to centuries and this reliance continues till date for various reasons such as minimal cost and easy availability in nature. *Ocimum sanctum*, commonly known as 'Holy basil' is a sacred plant with immense medicinal significance. The present review aims to summarize the holy basil research works and its therapeutic potentials. Juice extracted from the holy basil is used to cure a wide array of ailments such as cold, headache, fevers, eye and mouth disorders and holds anti-stress activity. It controls the blood cholesterol levels, thereby aids in curing cardiac disorders. Also, the plant extracts were proven to possess anti-oxidant, anti-helminthic, anti-inflammatory, anti-diabetic and anti-microbial activities. Specifically, the holy basil extracts possess anti-cancerous properties besides radioprotective properties. In addition, *Ocimum sanctum* products are also helpful to maintain immune levels. Hence, the wide spectrum of medicinal benefits and the consistent increase in demand for plant-based medicines, we have been encouraged to discover further therapeutic values of the sacred holy basil.

Key words: Holy basil, Anti-inflammatory, Anti-cancer, Anti-diabetic, Anti-oxidant, Anti-microbial

Introduction

Since time immemorial plants were given utmost importance in the field of medicine besides serving basic necessities such as food, shelter and clothing (1). The reliance continues till date for several reasons such as minimal cost, easy availability in nature and short life span of synthetic drugs. Scholars of all ages gathered huge knowledge on medicinal plants through trial and error methods which is in practice till date (2, 3). Specifically, they worked on medicinal plants and mentioned their nomenclature, healing properties and provided complex description of the interpretation of medicines. The knowledge of medicinal plants and their therapeutic properties urges the isolation of certain industrial chemicals which are useful to cure various diseases (4). The world health organization (W.H.O) estimates that a large number of people especially in developing countries still rely on traditional plant-derived drugs since they are more economical (5). In contrast, only 1% of phytochemical composition has been investigated amongst a global luxurious gene pool of plant kingdom particularly using leaves, stem, root, flowers and seeds of medicinal plants (2). Several plants are yet to be investigated for their chemical composition and medicinal properties. Generally, medicinal herbs are subjected to

rigorous chemical analysis and the bioactive components found are isolated depending on their composition. Later these compounds are evaluated through pharmacological methods using appropriate procedures, thereby increasing the utility and efficiency of these drugs (6). The pharmacological properties of medicinal plants vary with the composition of metabolites which are unique to individual species. Long back, Wink (7) reported that the feasibility of research extension in medicinal plants is possible through identifying the active principles of secondary metabolites. Parallel to the allopathic drug system, usage of about 2000 or more diversified medicinal plant species in ayurvedic and unani system of medicine has been recorded (8, 9). In addition, the plant medicines need not be sold in the form of powders, instead direct crude extracts of roots, stems and leaves are the best alternatives. Number of indigenous drug industries were established recently which supply either readymade medicines for direct use or partially processed raw material for the preparation of prescriptions (10).

Ocimum sanctum Linn. (syn. *Ocimum tenuiflorum*) commonly known as 'Holy basil' or 'Tulsi' belongs to the family Lamiaceae, which possess a number of therapeutic compounds (4). Holy basil is found in most parts of tropical and semitropical regions in the world. In India, holy basil is grown in all areas due to its countless medicinal benefits as well as its integration into the daily lives of the people, especially its use in religious ceremonies that made it sacred (6). Apart from Indian system, it is a vibrant medicinal plant in other systems of medicine in most of the countries (9, 11). Normally, the solvents used to extract the holy basil are ethanol, methanol, benzene etc. (12). Also, extracts of holy basil (EHB) are used either alone or in combination with other herbal plants to cure various diseases (13). Apart from medicinal purpose, the powdered holy basil is used to make aromatic beverages along with other herbal products in certain countries (14). The genus *Ocimum* has a number of species depending on the region it grows and possess

comparable chemical composition (15, 16). More than 150 *Ocimum* species with numerous cultivars are distributed in different regions and grow up to 6000 feet above sea level (3, 16, 17). Some of the known important species of *Ocimum* includes *O. americanum*, *O. angustifolium*, *O. basilicum*, *O. carnosum*, *O. gratissimum*, *O. minimum*, *O. serratum* etc. Holy basil is used since thousands of years for its healing properties and is often called the queen of herbs as mentioned in *Charaka Samhita* written by a legend in the field of Indian medicine (14). In the present review, several medicinal properties of holy basil are discussed in detail using different case studies.

Bioactive therapeutic components of holy basil:

Holy basil is one of the most reliable resources in the area of medical science since ancient times. Although number of compounds are isolated and characterized, however further investigations are necessary to investigate remaining compounds of holy basil and related *Ocimum* species (11, 12, 17, 18). One of the active constituents of *O. sanctum* is eugenol (2-methoxy-4-(2-propenyl) phenol), an allylbenzene class of volatile compound which is a major part in its essential oil (4). Holy basil is reported to possess ursolic acid (1S, 2R, 4aS, 6aR, 6aS, 6bR, 8aR, 10S, 12aR, 14bS)-10-hydroxy-1,2, 6a, 6b, 9, 9, 12a-heptamethyl-2, 3, 4, 5, 6, 6a, 7, 8, 8a, 10, 11, 12, 13, 14b-tetradecahydro-1H-picene-4a-carboxylic acid) and monoterpenoid phenol namely carvacrol (5-isopropyl 2-methyl phenol), as important medicinal components (Fig. 1). In addition, holy basil possess rosmarinic acid ((2R)-3-(3,4-dihydroxyphenyl)-2-[[[(2E)-3-(3, 4-dihydroxyphenyl) prop-2-enoyl] oxy} propanoic acid), linalool (3,7-dimethylocta-1,6-dien-3-ol), caryophyllene (1R,4E,9S)-4,11,11-trimethyl-8-methylidenebicyclo[7.2.0] undec-4-ene, terpinene-4-ol, (+) α cadinene, 3-careen, eugenol methyl ester and alpha humulene (14).

It also possess important flavonoids such as apigenin (4',5,7-trihydroxyflavone), orientin, vicenin-2, luteolin and other phytoconstituents

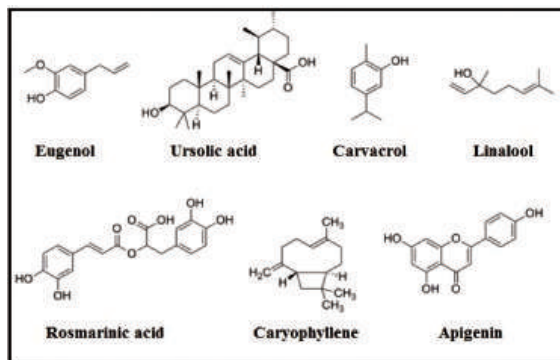


Fig. 1: Some of the therapeutic components of *Ocimum*

including cirsimaritin, α pinene, cervacrol, methylchavicol, isothymusin, isothymon, palmitric acid, vallinin, galic acid, ocimumoside A, ocimumoside B and ocimarin (9, 11, 12, 18). Different chemical compounds mentioned above exhibited mild to severe action against various diseases.

Functions of chemical components and pharmacological uses: In ancient days, without

knowing much phytochemistry, extract of holy basil was used to treat a number of diseases based on the success rate, which was mentioned in ayurveda and naturopathy (4, 6). Initially, holy basil has been used in the treatment of headache (14, 15). Later, by identifying the therapeutic compounds through advanced technology, it was established as a powerful medicinal plant. Extracts of holy basil prepared with various solvents are used to cure several diseases including common colds, cough, headache, mouth and eye disorders, diabetic, heart disorders, cancer, inflammation, other microbial diseases and different fevers as mentioned in Figure 2 (9).

Due to the presence of eugenol and linoleic acid in leaf extracts, holy basil is an excellent remedy for cough, cold and various fevers including malaria and dengue (6, 19). Similarly due to the presence of eugenol, EHB is also used to cure bronchitis. Leaf powder of Tulsi mixed with sandalwood paste is an excellent remedy against heat, headache and allied diseases (4). Holy basil is used to treat regular illnesses, fungal and

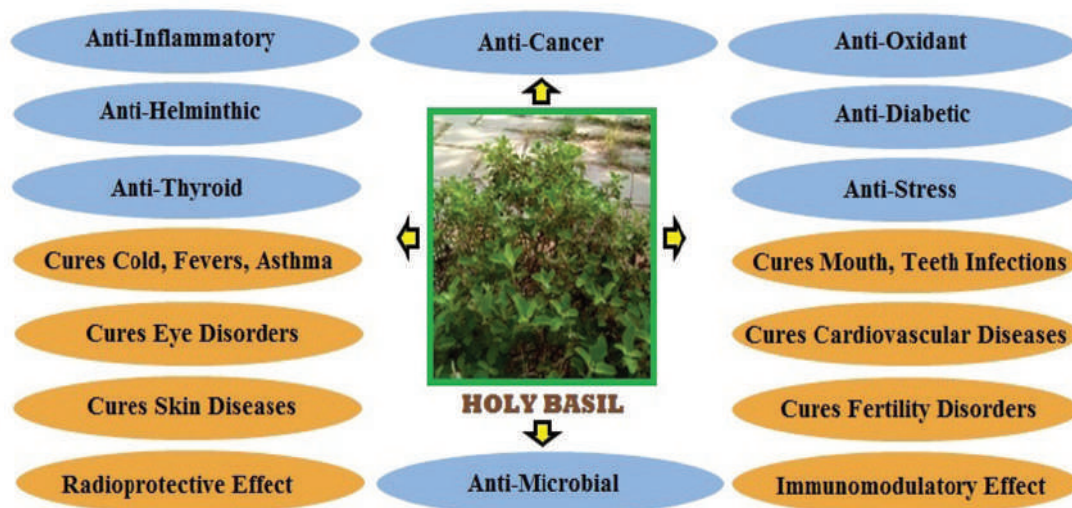


Fig. 2. Medicinal properties of holy basil. Tulsi is majorly used as anti-cancer, anti-inflammatory, anti-oxidant, anthelmintic, anti-diabetic, anti-microbial as well as other medicinal activities.

bacterial infections because of essential oil (20, 21). Also, Tulsi is used to repel insects in stored grains by mixing dried leaves due to the presence of volatile oil (22). In addition, the extract of this plant is used as repellent to control mosquitoes that often act as vectors in spreading different fever causing pathogens (23, 24). Due to the presence of ocimunosides A and B, holy basil is one of the best anti-stress agents (18). Ursolic acid, a pentacyclic triterpene acid is used to stabilize the body from certain pains and is also helpful in recovering from stress (13, 25). According to several studies, chewing holy basil leaves leads to notable changes in salivary pH and enhances the bicarbonate concentration in salivation due to the presence of essential oil, terpenes, terpenoids which includes eugenol, ursolic acid, carvacrol etc. (26). Holy basil's essential oil possess eugenol, caryophyllene and linalool that plays a key role in curing certain diseases including anti-microbial activities (6, 9). Moreover, major components of holy basil are responsible for preventing dental

problems (27, 28, 29). These compounds also improves the metabolic function, levels of immunity, lowers the stress, holds anti-oxidant property by reducing liver lipid synthesis, enhances insulin secretion and reduces inflammation (4, 6, 9, 25, 30). Singh (16) also noticed that the anti-inflammation property of Tulsi due to the presence of chemical compounds such as eugenol, apigenin, rosmarinic acid, cirsimaritin etc. Phytochemicals of holy basil alters the metabolic function, cures obesity related problems and exhibits anti-oxidant property due to the presence of eugenol, isothymusin, isothymonin, rosmarinic acid etc. (31). Mainly the presence of linoleic acid in holy basil is extremely beneficial to treat certain diseases including inflammation and inhibited various cancer cell lines proliferation (16, 32). Ursolic acid down regulates the proliferation and arrested cell cycle at G1 and G0 phases which induces apoptosis in cancer cells and suppresses the activities of nuclear factor (NF)-8B activation (9, 33). Moreover eugenol, ursolic acid, linoleic

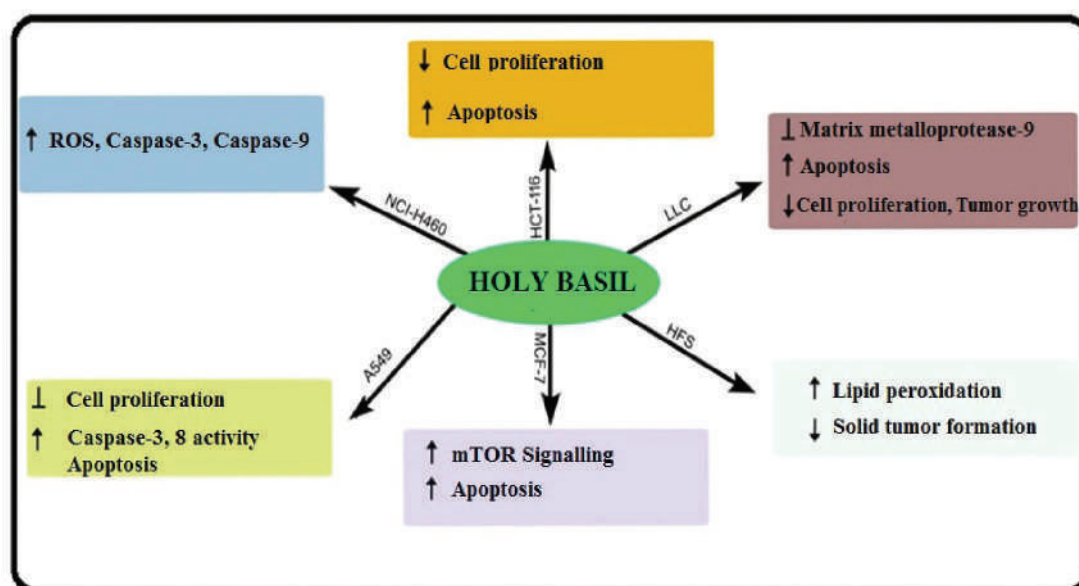


Fig. 3: Holy basil effect on various cancer cells: Holy Basil inhibits proliferation of different cancer cell lines and induces apoptosis by enhancing the ROS and Caspase 3,8 activity and down regulates tumor formation on human fibrocarcinoma and Lewis lung carcinoma models.

acid, betulinic acid, (-)-rabbosin, vicenin-2, orientin etc., were actively involved in anti-cancerous activities (11, 12, 34).

Therapeutic properties of holy basil: The present work offers detailed information on potential therapeutic values of the holy basil. The phytochemical analysis and pharmacological investigations of *O. sanctum* has helped in the treatment of cold, fever and various respiratory ailments such as bronchitis, asthma, influenza and cough (35). Anti-dengue and anti-typhoid activities of Tulsi were recently demonstrated by Tang et al (19) and Mandal et al. (23). Leaf extracts of holy basil elevates the salivary pH and curbs the acidic environment in mouth and stomach thereby, beating ulcers (4, 36). Phytoconstituents of holy basil also prevents dental issues such as caries, plaque, bad breath etc., by mainly targeting *Streptococcus mutans* (*S. mutans*) which are responsible for tooth decay (27, 28, 37). In Ayurvedic medicine, an important poly herbal eye drop extract is prepared with *Ocimum*, *Caesalpinia*, *Jasminum* and *Cynodon* for the treatment of eye disorders and conjunctival congestion in rats as well as other animals. Holy basil is used to prepare eye drops along with Triphala, which is useful to cure cataract, glaucoma, chronic conjunctivitis and other eye-related diseases (11, 35). Further, essential oil obtained from distillation of *O. sanctum* leaves is used extensively in the pharmaceutical industry majorly in skin cream preparation (38). Tabassum and Hamdani (39) prepared a moisturizer to cure acne (skin disease) using ethanolic extract of holy basil (EEOS) as one of the ingredients along with *Andrographis paniculata*, *Glycyrrhiza glabra*, *Azadirachta indica* and green tea extracts. Due to the presence of rich anti-oxidants, ethanolic and aqueous extract of holy basil fastens wound healing in rat skin (40). Gupta et al. (18) isolated ocimunosides A and B from the leaves of holy basil, which are implicated as anti-stress agents. Treatment with Tulsi leaves in albino rats with oxidative stress showed increased superoxide dismutase and reduced glutathione indicating its anti-stressor activity (41).

Myocardial infarction (MI), also known as heart attack is one of the primary reasons for fatality due to the shortage of blood flow to heart and its muscles. Effect of hydroalcoholic extract of holy basil at different doses was investigated against isoproterenol-induced myocardial infarction in rats and found significantly reduced levels of glutathione (GSH), superoxide dismutase (SOD) and lactate dehydrogenase (LDH). The extract also inhibited lipid peroxidation with the maximum cardioprotective effect at 50mg/kg dose (42). Recently, Kavitha et al. (43) proved the relation between inflammation and myocardial infarction using Tulsi extract. Blood clotting within vessels is one of the main diseases, which leads to blood flow issues. Extract of Tulsi exhibits thrombolytic potential along with curcuma, azadirachta and anacardium (44). It was studied that extract of *O. sanctum* leaves exhibited the reversible anti-fertility effect due to the presence of key components such as eugenol (45, 46). Albino rats treated with *holy basil* extract (250 mg/kg body weight) exhibited decreased total sperm count and sperm motility as well as an increase in abnormal sperms. Withdrawal of treatment led to regaining of normal conditions within two weeks (46).

The anthelmintic or anti-parasitic activity of the essential oil of holy basil was evaluated by model *Caenorhabditis elegans* and proved that eugenol is the predominant component in putative anti-helminthic principle (47, 48). Crude aqueous and hydroalcoholic extract of *O. sanctum* showed anthelmintic activity against ovine gastrointestinal nematodes in sheep and no deleterious effect was found indicating that holy basil is safe to use (49). Various extracts of holy basil exhibited anti-inflammatory activity in different animal models (50). Eugenol, cirsilineol, cirsimaritin, apigenin and rosmarinic acid are the main compounds involved in anti-inflammatory activity (9, 35). An ethyl acetate root extract of *O. sanctum* was proved to be the best anti-inflammatory agent in carrageenan-induced paw edema model (51).

Anti-diabetic and anti-hyperlipidemic effects of hydroalcoholic extracts of holy basil have

been evaluated using diabetic rats induced by streptozotocin (STZ) and nicotinamide (52). This experiment predicts the biological activities of holy basil constituents and significantly exhibits the anti-diabetic effect compared to standard drug glibenclamide. In diabetic induced rats, oral administration of extract of Tulsi decreased the blood sugar content. Further, effects of holy basil on aldose reductase activity could help in reducing the complications of diabetes such as cataract, retinopathy etc. (53). Hypoglycemic condition was noticed when normal rats were fed with fructose and later treated with extracts of holy basil for 30 days (54). It was noticed that leaves of Tulsi reduced glucose and cortisol in serum of corticosteroid-induced diabetes mellitus. Gholap and Kar (55) unravel the possible mechanism of glucose-lowering activity of *O. sanctum* in male mice. In another study, Chattopadhyay [56] also observed the reduction of blood sugar levels with oral administration of extract of Tulsi in streptozotocin-induced diabetic rats.

Cancer is one of the most life threatening diseases across the world for several reasons. Statistically, it was estimated that about 1,665,540 new cases of cancer were expected to be diagnosed by the American Cancer Society 2019 (57). Various groups of drugs work in different ways to fight against cancer cells and shrink tumors (58). Apart from synthetic drugs, herbs and sea weeds are also useful for cancer remedy (59). The findings of Kim et al. (60) exhibited that ethanolic extract of *O. sanctum* inactivates matrix metalloprotease-9, stimulated anti-oxidant enzymes, inhibited proliferation of Lewis lung carcinoma (LLC) cells and reduced the volume of tumors in mice. Sridevi et al. (32) also reported that alcoholic root extract of Tulsi inhibited cell proliferation and induced apoptosis through enhancing intracellular reactive oxygen species (ROS) in human non-small cell lung carcinoma cell line (NCI-H460). Recently, Utispan et al. (61) proved the anti-invasive effect of ethanolic leaf extracts of holy basil on head and neck squamous cell carcinoma (HNSCC) cell line by attenuating

matrix metalloproteinase (MMP) activity. *In vitro* anti-cancer activity of holy basil has been demonstrated using human fibrosarcoma (HFS) cells. The ethanolic extract of *O. sanctum* influences lipid peroxidation and decrease the rate of solid tumor formation in tumor-bearing mice (62). Extract of holy basil enhanced anti-tumor activity through down regulating apoptosis regulator BAX and enhancing caspase-3 and cytochrome c which in turn induces apoptosis in forestomach of N-methyl N'-nitro-N-nitrosoguanidine (MNNG)-induced gastric carcinogenesis model (63). *Ocimum sanctum* inhibits proliferation of non-small cell lung carcinoma A549 and induces apoptosis by activating caspase-3 (64). Extract of Tulsi reduces the damage of DNA in normal cells and induces apoptosis in SiHa cancer cells (65). Ehrlich ascites carcinoma (EAC) mice treated with leaf extract of holy basil decreased the haemoglobin content and increased the WBC (white blood cells), which implicit that this sacred plant has high anti-neoplastic activity (66). Ethanol and acetone leaf extracts of *O. sanctum* inhibits the growth of A549 lung cancer cell line but aqueous extract does not show any anti-cancer activity (67). Flegkas et al. (68) isolated rabdosiin (terpenoid) from *O. sanctum* leaves, which induced apoptosis in HCT-116, MCF-7 and SKBR3. It also exhibited reduced cytotoxicity to normal human peripheral blood mononuclear cells. However, orientin from holy basil is non cytotoxic to human cancer cells HepG2 (69). Major cultivars of *O. sanctum* including 'rama' and 'krishna' induced apoptosis in mouth epidermal carcinoma cells (KB) (70). These results indicate that most of the holy basil possess anti-tumor properties. Figure 3 represents the anti-cancerous activity of *O. sanctum* in detail.

Thyroid diseases are generally diagnosed using radioactive iodine therapy that causes structural and functional damage to the salivary glands as a result of lipid peroxidation by reactive oxygen species (71). Aqueous extract of *O. sanctum* and its components such as orientin and vicanin significantly decreased the lipid

peroxidation, leading to membrane protection of salivary glands, thereby reducing the incidence of thyroid cancer (72). Thus, holy basil can be used as potential candidate for radioprotection against iodine induced salivary gland damage (73).

Several laboratory studies proved that *O. sanctum* protects the body against damage caused by toxic chemicals by increasing the level of anti-oxidant enzyme activities (74). These extracts initiate the anti-oxidant enzymes which protect organelles and radical membranes that are caused due to lack of oxygen and other toxic substances (75). The phytochemicals in Tulsi extract are rich in anti-oxidants, which can be used as an effective preservative in the food industry. In cadmium treated albino rats, oral administration of hydroalcoholic extract of *O. sanctum* protect cadmium damage by decreasing lipid peroxidation and by up regulating the superoxide dismutase, catalase and glutathione peroxidase activities (76). In sodium fluoride treated rats, chemical compound such as carvacrol of holy basil protect the liver tissue from fluoride toxicity and also modulates the anti-oxidant enzymes (77). Hydroalcoholic extract of *O. sanctum* down regulates the lipid peroxidation and inhibits DNA damage and reactive oxygen species generated by mitochondrial membrane in SH-SY5Y human neuronal cells (78).

Phytochemicals of holy basil have been evaluated for its radioprotective effects using different models (14, 79). Leaves of *O. sanctum* consist certain compounds such as cirsilineol, isothymusin, apigenin, rosmarinic acid, eugenol etc. were exhibited the diverse pharmacological effects, including radioprotective activity (80). In tumor-bearing animals, holy basil and other plant flavonoids were shown to have a protective effect towards normal tissue during radiation, thereby permitting the application of higher dose of radiation in order to control severe tumors (81, 82).

Ocimum sanctum acts as an important immunomodulator and exhibits great impact on human health (83). The immune system is a complex network of organs, tissues, cell types

and proteins that orchestrate collectively to protect the host from bacterial, fungal, viral and other parasitic infections as well as from tumor growth (84). Immunomodulator (biological and chemical agent) can interfere and alter the functioning pattern of immune response either through immunopotential, immunosuppression or immunological tolerance. Leaf extract of Tulsi increases the production of antibody by stimulating the humoral immune response (85, 86). Vaghasiya et al. (87) compared the alcoholic and aqueous extracts of holy basil in immune modulatory activity. It was reported that the oral administration of aqueous extract of *O. sanctum* in wistar albino rats stimulates the antibody production as compared to untreated samples and also enhanced the production of white blood cells, red blood cells and hemoglobin (88).

Benzene and methanolic extracts of holy basil combined with ampicillin inhibits the *E. coli*, *P. aeruginosa* and *S. aureus* cultures when compared to ampicillin alone (89). Similarly, alcoholic, aqueous and chloroform extracts of *O. sanctum* leaves exhibit adverse effects on *E. coli*, *S. aureus*, *P. aeruginosa* and *S. typhimurium*. Compounds of the holy basil are known to inhibit the growth of both gram-positive and gram-negative bacteria (21). Fixed oil of *O. sanctum* demonstrates anti-bacterial effect towards *B. pumilus*, *S. aureus* and *P. aeruginosa* (90). Also, aqueous extract of holy basil showed a high zone of inhibition towards *E. coli*, *Klebsiella* and *S. aureus* when compared to ethanolic extract (91). Methanolic extract of Tulsi leaves damages the growth of *V. cholerae* cells and show MBC (minimal bactericidal concentration) at 0.5-3.0 mg/ml concentration (92). Apart from above mentioned medicinal properties, ethanolic extract of Tulsi exhibited normal wound healing and dexamethasone-depressed healing properties in albino rats (93). The extract significantly stimulated the wound breaking strength, made wound epithelialize faster as compared to the control. In addition, dried powder or fresh leaf extracts of Tulsi are often consumed in various forms such as herbal

tea, which reduces the formation of stones in the kidney (3).

Need of biotechnological tools to enhance the use of holy basil: Conservation of ancient natural treasure such as holy basil and the capability to utilize it in a sustainable manner are essential for the well being and continued survival of humans (94). There are a number of constraints for systematic collection of elite *Ocimum* and its cultivars, which include variations in edaphic and climatic factors, low percentage of seed set and seasonal dormancy (4, 6). Moreover, future work on Tulsi may require more finesse to exploit additional medicinal benefits (9). The application of biotechnological techniques such as *in vitro* propagation and genetic engineering could prove to be a great benefit for low cost production of these plants with additional secondary metabolites (95). Advantage of these techniques lead to overcome seasonal dormancy. *In vitro* clonal propagation of holy basil enables large scale production of therapeutically high value taxa for commercialization and sustainable utilization in the industrial sector. In addition, it would be more beneficial if tablets could be prepared with powdered holy basil for commercial purpose.

Conclusion

Ocimum sanctum generally known as holy basil holds a set of potential phytochemicals, which possess high therapeutic properties for various diseases including cancer. Extracts of *Ocimum* have certain specificity in the treatment of cold, cough, various kinds of fevers including malaria, dengue and respiratory ailments such as bronchitis, asthma, influenza that spread extensively during particular seasons. Extracts of holy basil also work as an anti-inflammatory, anti-cancer, anti-thyroid, anti-diabetic, anti-oxidant, anti-microbial agent and is also involved in anthelmintic activities. Tulsi juice has the capacity to cure mouth and teeth infections, eye disorders as well as heart and vascular disorders. It also possesses radioprotective property and can balance the immunity levels in the human body.

Hence, studies on this sacred plant can be warranted as extremely beneficial for the human community in the field of medicine. Because of anti-viral property, Tulsi extract may be helpful to cure different viral diseases which need to confirm in near future. Likely, this review reports the therapeutic properties of holy basil in detail.

Conflict of interest

The authors declared that they have no conflict of interest.

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Euphorbia ravii (Euphorbiaceae: subg. *Euphorbia*), a new species from Andhra Pradesh, India

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ABSTRACT: *Euphorbia ravii* is described as a new species from Nigidi hills, Ananthapuramu district of Andhra Pradesh, India. It belongs to the subgenus *Euphorbia* section *Euphorbia*, it is closely allied to *E. caducifolia* but differs in many attributes which are discussed here. An updated key for Indian *E. caducifolia* group is also provided for easy identification.

KEY WORDS: Deccan Plateau, *Euphorbia caducifolia*, Nigidi hills, preliminary conservation status, section *Euphorbia*.

INTRODUCTION

Euphorbia L. is one of the largest genera of flowering plants and the most species-rich in the family Euphorbiaceae with more than 2000 species distributed throughout the world with highest diversity found in arid and semi-arid regions of the tropics and subtropics (Horn *et al.*, 2014; Mabberley, 2017). The genus includes geophytes, herbs, shrubs, trees, and a host of succulent and xerophytic form and is characterized by distinctive morphological synapomorphy, the cyathium inflorescence (Horn *et al.*, 2012). Based on molecular phylogenetic studies (Bruyns *et al.*, 2006; Steinmann and Porter, 2002; Zimmermann *et al.*, 2010; Horn *et al.*, 2012), the genus *Euphorbia* has classified into 4 subgenera namely, *Athymalus* (as *Rhizanthium*) (Peirson *et al.*, 2013), *Chamaesyce* (Yang *et al.*, 2012), *Esula* (Riina *et al.*, 2013) and *Euphorbia* (Dorsey *et al.*, 2013). In India, the genus is represented by 91 species of which 38 are endemic (Binojkumar and Balakrishnan, 2010, 2012; Sarojinidevi, 2017; Sarojinidevi and Raju, 2014; Sarojinidevi and Swamy, 2018; Prasad and Prasanna, 2016; Malpure *et al.*, 2016; Malpure *et al.*, 2021a,b).

In the course of the floristic study of Ananthapuramu district (Andhra Pradesh, part of Decan Plateau), an interesting and chasmophytic species of *Euphorbia* was collected by the senior author from open scrub forest. After critical examination of the collected specimens, and perusal of literature revealed that the collected specimens belong to the subgenus *Euphorbia* and section *Euphorbia* (Dorsey *et al.*, 2013) based on succulent habit and spine-shields characters. The section *Euphorbia* is represented by more than 350 species and mostly distributed in Africa and a few species in South and Southeast Asia and it is limited into the Arabian Peninsula and Pakistan in north and west respectively and has no representatives in other SW Asian countries (Dorsey *et al.*, 2013; Pahlevani *et al.*, 2020). In India, the section *Euphorbia* is represented by

26 taxa of which 15 are endemics. Of the 26 recorded taxa, 4 species *Euphorbia lacei* Craib, *E. lactea* Haw., *E. mauritanica* L. and *E. trigona* Miller are widely cultivated for ornamental purpose. The typical characters of section *Euphorbia* are succulent habit and spine-shield which are usually present in *E. antiquorum* L., *E. caducifolia* Haines, *E. cattimandoo* Elliot ex Wight (endemic), *E. neriifolia* L., *E. nivulia* Buch.-Ham., *E. royleana* Boiss., *E. santapaui* A.N.Henry (endemic), *E. susan-holmesiae* Binojk. & Gopalan, *E. tortilis* Rottler ex Ainslie (Endemic), *E. vajravelui* Binojk. & N.P.Balacr. (endemic), but absent in *E. epiphyllodes* Kurz (endemic) and geophytes (*E. fusiformis* Buch.-Ham. ex D. Don, *E. khandallensis* Blatt. & Hallb. (= *E. panchganiensis* Blatt. & McCann) (endemic), *E. nana* Royle (endemic), *E. meenae* S. Carter (endemic)). During the last decade, 6 new species and one new variety have been published from India in the section *Euphorbia* viz, *E. seshachalamensis* K.Prasad & Prasanna, *E. belagaviensis* Sarojin. & Raja Kullayisw., *E. gokakensis* S.R.Yadav, Malpure & Chandore, *E. venkatarajui* Sarojin., *E. vajravelui* var. *theniensis* B.DeJong & R.W.Stewart, *E. lakshminarasimhanii* Malpure, Chandore, P.S.Raut & B.DeJong and *E. sahyadrica* Sardesai & Malpure.

The new *Euphorbia* species is most similar to *E. caducifolia*, but it significantly differ in certain characters and deserved to be recognized as a distinct species.

TAXONOMIC TREATMENT

Euphorbia ravii A.Naray. & K.Prasad, *sp. nov.*

Figs. 1–3

Type: INDIA, Andhra Pradesh, Ananthapuramu district, Old Pulivendula Ghat road, 530 m, 11th May 2014, A. Narayana Swamy 44906 (holo: SKU, iso: SKU).

Diagnosis: This species is similar to *Euphorbia caducifolia* Haines but differs in its slightly winged and subterete stems (vs. terete stems), conical podaria (vs.



Fig. 1. *Euphorbia ravii* A.Naray. & K.Prasad, sp. nov. **A.** Habit; **B.** Young branches; **C.** Mature branches; **D.** Young spines; **E.** Mature spines; **F.** Leaves with young spines.

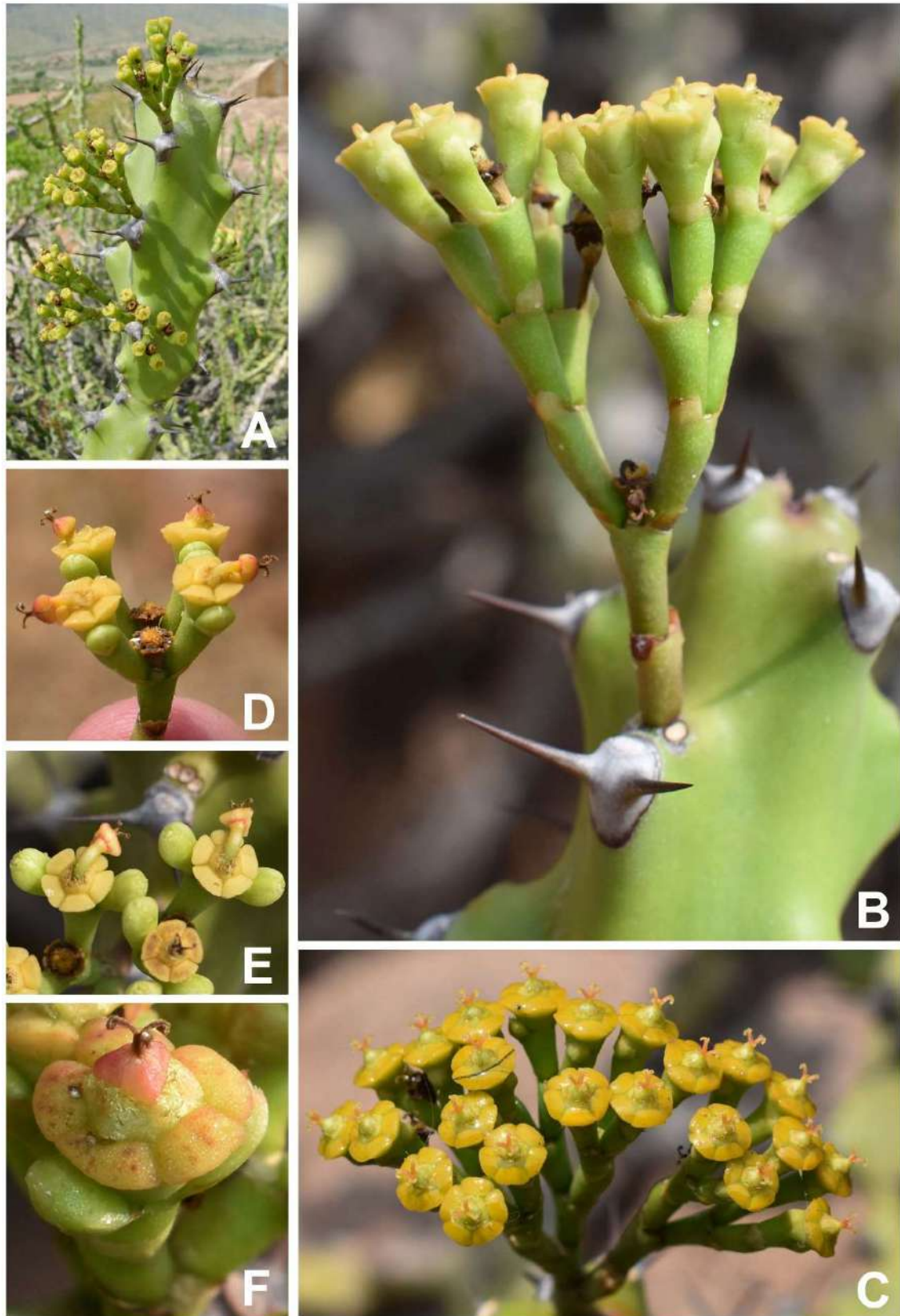


Fig. 2. *Euphorbia ravii* A.Naray. & K.Prasad, sp. nov. **A.** Inflorescence branch; **B & C.** Cyathia; **D.** Dichotomously branched cymes; **E.** Involucres; **F.** Glands surface pitted.

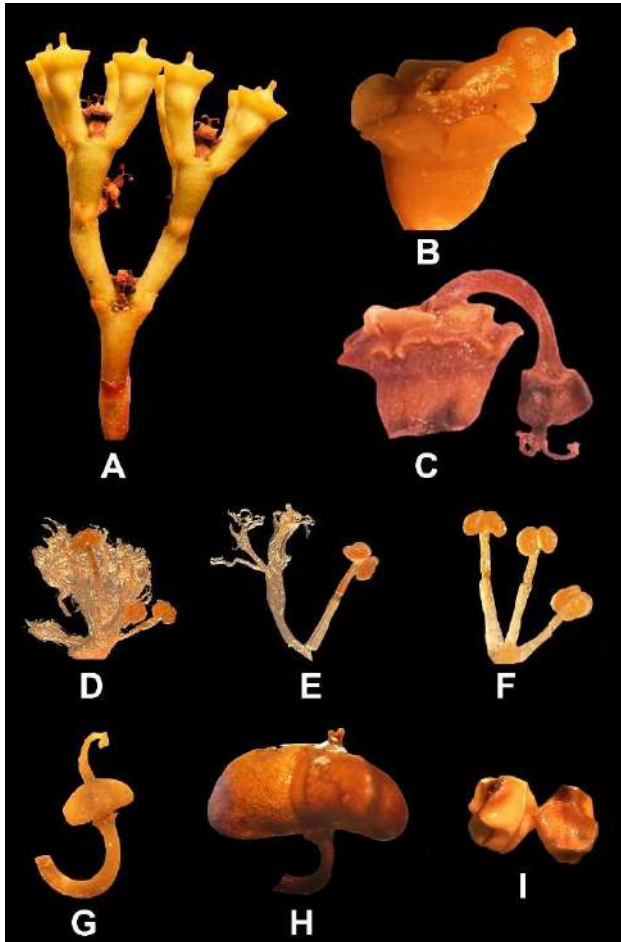


Fig. 3. *Euphorbia ravii* A.Naray. & K.Prasad, sp. nov. **A.** Dichotomously branched cyme; **B & C.** Involucre; **D.** Staminate flowers in fascicle; **E.** Staminate flower with bracteoles; **F.** Staminate flowers; **G.** Pistillate flower; **H.** Capsule; **I.** Seeds.

rounded), broadly ovate leaves with truncate or rounded base (vs. variable, ovate, ovate-elliptic to orbicular, with cuneate base), up to six times dichotomously branching cyathial cymes (vs. triads or fascicles), margins of bracts irregularly serrate (vs. entire), cupular involucre (vs. turbinate), seeds with large rounded to sub-rounded pits (vs. without pits).

Description: Shrubs, about 2.4 m high; stems succulent; branches arising from the base, ascending, much branched, angular or irregularly angular or subcylindrical, spiny, with extended podaria, green or pale green with silvery white coating. Podaria conical, 1–1.2 cm long (base 1 cm wide and narrower upwards), spirally arranged, spiny at the tip; spine shield 6–8 mm in diameter, conical or discoid, distinct, brownish when young becoming ash grey; spines in pairs, divergent, rigid, 0.3–0.6 cm long, reddish when young, later ash grey becoming blackish when mature. Leaves 1.5–4 × 1–2 cm, fleshy, sessile, broadly or narrowly ovate, acute at apex, truncate or rounded at base, entire or serrate along the margins, caducous; prominent mid-nerve and indistinct

lateral nerves. Cyathia in axillary, dichotomously branched cymes, solitary or paired or 3; cymes branching up to 6 times, central one sessile and lateral two pedunculate, greenish-yellow. Primary peduncle short, 4–7 mm long, fleshy, greenish-yellow or reddish-green; bracts 2, opposite, 1.6–2 × 1.7–2 mm, triangular, acute at apex, irregularly serrate along the margins. Involucre 3–4 × 2.5–3 mm, cupular; lobes 5, broadly cuneate, fimbriate at apex; glands 5, 2–2.5 mm long, transversely oblong, upper surface pitted. Staminate flowers: in 5 fascicles, 3 to 9 flowers each; pedicels about 1.5 mm long; anthers ellipsoid to subglobose; bracteoles covering flowers, 1.9–2.1 mm long, lacinate at apex. Pistillate flower: gynophore 5–7 mm long, curved; perianth lobes 3, minute, triangular; ovary trigonous; styles connate to the middle; stigma bi-lobed, papillose. Capsules trilobed, with laterally compressed and obtusely keeled cocci, 6–8 mm in diameter, becoming reddish at maturity; seeds subglobose or ellipsoid, brownish, with large rounded to sub-rounded pits.

Flowering & Fruiting: February–May.

Habitat: It is found growing between granite rocks on small hills in scrub forest, at elevation range of 255–262 m. Its common associates are *Euphorbia antiquorum* L., *E. caducifolia* Haines, *Cymbopogon coloratus* (Hook.f.) Stapf., *Gyrocarpus americanus* Jacq., *Alangium salviifolium* (L.f.) Wangerin and *Wrightia tinctoria* R.Br.

Distribution: *Euphorbia ravii* is known from the type locality in the Ananthapuramu district, Deccan Plateau, Andhra Pradesh, India.

Etymology: The new species named in honour of Dr. B. Ravi Prasad Rao, Professor of Botany at Sri Krishnadevaraya University, Ananthapuramu, India for his contributions to the flora of Andhra Pradesh, Eastern Ghats and Andaman & Nicobar Islands.

Preliminary conservation status: The new species, *Euphorbia ravii* has a restricted distribution with about 20 individuals and spreading about 2 km² in one population. The present habitat is highly threatened due to granite mining (all individuals were observed in this area only) and seasonal/anthropogenic forest fires. Many explorations were made in the adjacent habitat but populations of the species could not be located. Based on 'Extent of Occurrence' (Criterion B1: EOO < 100 km²) and 'Area of Occupancy (Criterion B2: AOO < 10 km²) together with the distributed in single location (subcriterion 'a') and projected decline in area, extent and/or quality of habitat (subcriterion 'b(iii)'), the new species is assessed here as 'Critically Endangered [CR B1 B2 a, b(iii)]' (IUCN 2019). Interestingly, the convention on international trade in endangered species of wild fauna and flora (CITES) regulations protect about 850 succulent species of *Euphorbia* (Carter and Egli, 2003).

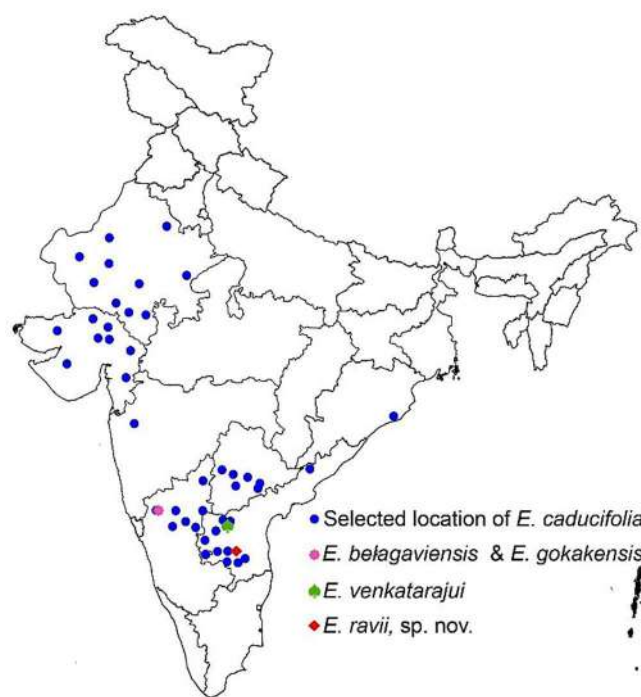
Additional specimens (Paratypes): INDIA. Andhra Pradesh: Ananthapuramu district, Old Pulivendula Ghat, 542 m, 26 April 2015, A. Narayana Swamy & K. Prasad 44958 (SKU); 522 m, 22 May 2016, A. Narayana Swamy & K. Prasad 45002 (SKU); 535 m, 3 June 2017, A. Narayana Swamy & K. Prasad 45072 (SKU).

**Table 1.** Comparative morphology between *Euphorbia ravii*, *E. caducifolia*, *E. belagaviensis*, *E. venkatarajui* and *E. gokakensis*.

Character	<i>E. ravii</i>	<i>E. caducifolia</i>	<i>E. belagaviensis</i>	<i>E. venkatarajui</i>	<i>E. gokakensis</i>
Habit	Not dwarfed, no compact stems	Not dwarfed, no compact stems	Not dwarfed, no compact stems	Dwarf, forming compact cushions	Dwarf, forming compact cushions
Height (m)	Up to 2.4	Up to 2.5	Up to 2.5	Up to 1	Up to 0.5
Stem Branches	Angular or irregularly angular or subcylindrical	Terete throughout	Slightly winged	Terete throughout	Terete, tapering towards apex
Podaria					
Shape	Conical	Rounded	Conical to elongate conical	Conical	Conical
Size (cm long)	1–1.2	0.7	1.2	1–1.2	0.4–0.5
Leaf					
Shape	Broadly or narrowly ovate	Ovate, ovate-elliptic to orbicular	Obovate-spathulate	Obovate	Ovate, obovate or ovate-oblong
Base	truncate or rounded	cuneate	narrowed	rounded	narrowed
Size (cm long)	1.5–4	2–8	0.8–0.9	0.6–0.8	1.2–3
Cyathia nature	Cymes branching up to 6 times in dichotomously	Triads or fascicles	Cymes branching 2 or rarely 3 times in dichotomously	Triads clusters or fascicles	Fascicles
Cyathia colour	Greenish-yellow	Pinkish red or reddish pink	Yellowish to pink	Yellowish to pink	Yellowish
Involucre	Cupular	Turbinate	Cupular	Cupular	Turbinate
Bracts margins and apex	Irregularly serrate, acute	Entire, acuminate	Entire, acuminate	Entire, acuminate	Entire, acuminate
Stigma	Perfectly bi-lobed	Minutely bilobed	Not lobed	Not lobed	Bi-lobed
Seeds	Pitted	Not pitted	Not pitted	Not pitted	Not pitted
Distribution	India (Pulivendula Ghat road, Ananthapuramu district, Andhra Pradesh)	India (Andhra Pradesh, Bihar, Chhattisgarh, Gujarat, Karnataka, Madhya Pradesh, Maharashtra, Odisha, Rajasthan, Telangana) & Pakistan	India (Gokak, Belagavi district, Karnataka)	India (Yaganti, Kurnool district, Andhra Pradesh)	India (Gokak, Belagavi district, Karnataka)

Note: The *Euphorbia caducifolia* group consists of 4 species in India and all with succulent habit and spine-shield. However, all these species were found to have their own diagnostic features and are clearly distinct from present new species, *E. ravii* (Table 1). This new species is easily distinguishable by the up to six times dichotomously branching cyathial cymes and pitted seeds, these characters that are very rare in the genus.

This group is mainly distributed in Indian subcontinent (India & Pakistan) and mostly grows in dry habitats of tropical scrub or open forests and rock outcrops. Only one species *Euphorbia caducifolia*, is commonly widespread in dry habitats of India (Andhra Pradesh, Bihar, Chhattisgarh, Gujarat, Karnataka, Madhya Pradesh, Maharashtra, Odisha, Rajasthan, Telangana) and relatively rare in Pakistan. The remaining 4 species (including present new species) are found to be habitat specific and endemic to their type localities in Deccan plateau of India. Two species, *E. belagaviensis* and *E. gokakensis*, are endemic to scrub forest and open rocky hillocks of Gokak in Karnataka and remaining species, *E. venkatarajui* and *E. ravii* sp. nov. are endemic to dry parts of Kurnool and Ananthapuramu districts of Andhra Pradesh (Fig. 4).

**Fig. 4.** Distribution map of *Euphorbia caducifolia* group in India.

**Key to the *Euphorbia caducifolia* group in India:**

- 1a. Plant compact cushion like, 0.5–1 m high 2
- 1b. Plant not cushion like, about 2.5 m high 3
- 2a. Plant up to 1 m high; leaves less than 1 cm long, rounded or acute at apex; involucre cupular; cocci curved, obtusely keeled *E. venkatarajui*
- 2b. Plant up to 0.5 m high; leaves more than 1 cm long, cuspidate at apex; involucre turbinate; cocci recurved, acutely keeled *E. gokakensis*
- 3a. Stem branches twisted; primary peduncle more than 10 mm long; style free, simple at apex *E. belagaviensis*
- 3b. Stem branches not twisted; primary peduncle less than 8 mm long; style connate at base, bifid at apex 4
- 4a. Podaria rounded; cymes in triads or fascicles; bracts acuminate at apex; seeds not pitted *E. caducifolia*
- 4b. Podaria conical; cymes up to six times dichotomously branched; bracts acute at apex; seeds pitted *E. ravii* sp. nov.

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Toxic effect of deltamethrin on *Ciprinus carpio* with special reference to antioxidants and detoxification enzyme systems

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ABSTRACT

Present study is aimed at to investigate the effect of two different concentrations of (5ppm, 10ppm) deltamethrin in *Ciprinus carpio* different tissues i.e Liver, Heart, Kidney and Brain with reference to antioxidants and detoxification enzyme systems. The fishes were randomly divided into 3 groups having 6 in each group: (1) Control (2) Deltamethrin-experimental toxic group (5ppm) (3) Deltamethrin-experimental toxic group (10 ppm). Deltamethrin- experimental groups decreased the contents of Glutathione content (GSH), Glucose 6-phosphate dehydrogenase (G6PDH) levels, Glutathione S-transferase (GST) levels, Super oxide dismutase (SOD) levels and increased the levels of Catalase (CAT), Cytochrome p450 (CYTP450) levels, Glutathione Peroxidase (GPo) in all the fish organs (Liver, Heart, Kidney and Brain). From the results it is presumed that the enzymes of antioxidant defense system, tends to neutralize the oxidants more particularly hydrogen peroxide generated during different toxic/adverse conditions Deltamethrin

Key words: Deltamethrin, *Ciprinus carpio*, antioxidants and detoxification enzyme.

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INTRODUCTION

Oxidative stress is a mechanism for toxicity of insecticides resulting in cell death includes cellular necrosis and apoptosis and dysfunction in cellular physiology include alterations in metabolic and vital functions of the cells. Hence, fish should be able of managing environmental exposure by detoxifying these xenobiotic. In order to do this task, fish like aerobic animals have evolved complex of detoxification system, composed of two main parts including enzymatic and non-enzymatic components. The roles of enzymatic and non-enzymatic detoxification system of animal's body lessen the potential damages caused by the toxicity of environmental pollutants. Although it is possible that reactive oxygen species (ROS) produced during the insecticides detoxification process in tissues i.e. Liver, Heart, Kidney and Brain may react with vital macromolecules such as lipid, protein, carbohydrate and nucleic acid and result in oxidative damage to aquatic organisms [1]. ROS derived damage to natural and structure cellular components are generally considered a serious mechanism involved in the physiological and pathological disorders [2]. The oxidative stress can be defined as imbalance between antioxidants and pro oxidants and is thought to contribute the development of a wide range of diseases including Alzheimer's disease, Parkinson's disease, rheumatoid arthritis and neurodegenerative diseases [3]. Electron transfer reactions convert the O_2 to H_2O_2 and super oxide radical and hydroxyl radical which are together called as "Reactive oxygen species" (ROS) or oxyradicals. In normal circumstances a balance is maintained between the formation and removal of these free radicals and the cells are protected from any damage due to these ROS. Any alteration in the levels of these substances cause oxidative stress which are characterized by 1) loss of ascorbate, tocopherol and glutathione, 2) Inhibition of protective enzymes such as super oxide dismutase, 3) alteration in the ratio of oxidized and reduced forms of glutathione and 4) conformational changes in the biomolecules such as lipids, protein and DNA. An excessive and /or sustained increase in ROS production has been implicated in the pathogenesis of cancer, diabetes mellitus, ischemia/ reperfusion injury [4]. In order to protect the cellular damage caused due to copious production of free radicals during different degenerative diseases, cells are protected against oxidative stress by an interacting network of antioxidant enzymes [5],[6]. The detoxification pathway is the result of multi-enzyme system with super oxide dismutases, catalases and various peroxidases.

A single exposure of deltamethrin ($0.75\mu\text{g/L}$) for 48h caused induced various antioxidant enzymes and non enzymatic antioxidants in kidney, liver and gill of *Channa Punctatata*. Induction of lipid peroxidation Glutathione levels and ascorbic acid content in all

of these tissues were observed [7]. *Carassius auratus* gibelio exposed to 2µg/L for 1, 2, 3, 7, 14 days exhibited decreased activity of catalases in kidney. Activities of glutathione reductase and glutathione peroxidase were shown to decrease in gill tissue with increase in Glutathione-S- transferase activity [8]. The mRNA levels of IGF-I, IGF-II and GH - I significantly decreased with increasing concentration of deltamethrin (0.25µg/L 1µg/L and 2.5µg/L) in rainbow trout [9]. Amplification of HSP70 mRNA was shown in rainbow trout exposed to two different doses (0.3 and 0.6µg/L) of deltamethrin for 28 days [10].

This study describes some of the important biochemical changes that occur in fish exposed to different concentrations of deltamethrin (5ppm and 10 ppm) insecticide. An initial description is given of the detoxification process, and then the other physiological dysfunction in various biological systems occurring in fish exposed to different insecticides will be discussed.

MATERIALS AND METHODS

Experimental animals

The tests were performed in a concrete holding tanks, glass aquaria, constant supply of water and good lighting system. The indoor tanks were filled with tap water and aerated for 3 days to help reduce the chlorine content. About 300 active test specimens ranging between 5 and 10 cm standard length were transported to the laboratory from a farm. The specimens were acclimatized to laboratory conditions for 7 days in the indoor holding tanks. The pH, dissolved oxygen concentration and temperature of water in the tanks were monitored.

Preliminary tests were conducted to provide guidance on range of concentration of pesticide to use in the bioassay. A stock solution of 25 mg/l was prepared from the original product concentration of 12.5 g/l. From the stock solution, the test solutions were prepared using distilled water. The specimens were not fed a day prior to and during toxicity tests to reduce faecal and excess food contaminating the test solution. The nominal test concentrations were 5ppm&10ppm with six replicates each. The results from the toxicity tests were analyzed, using a World Health Organisation (WHO). The concentrations used were converted by the programme to log dose and the number of dead fishes to mortality Probit values. A plot of these two parameters was made from which the LC₅₀ was estimated. The fishes were maintained according to the ethical guidelines.

Selection of Pesticide

Deltamethrin, a synthetic pyrethroid pesticide, was selected for the present study. It was obtained as commercial grade chemical from Sigma chemicals, USA.

Experimental design

The fishes were divided into 3 groups, each consisted of 6 and used for studying the effects of different concentrations of deltamethrin.

Group 1	-	Control
Group 2	-	5ppm concentration
Group 3	-	10ppm concentration

Isolation of Tissues

The animals were sacrificed. Functionally different organs such as Liver, Heart, Kidney and Brain were separated and frozen in liquid nitrogen (-180°C) and stored at -4°C until further use. At the time of analyses the tissues were thawed and selected parameters were estimated by employing standard methods.

Procurement of Chemicals

All chemicals used in the present study were Analar grade (AR) and obtained from the following scientific companies: Sigma (St. Louis, MO, USA), Fisher (Pittsburg, PA, USA), Merck (Mumbai, India), Ranbaxy (New Delhi, India), Qualigens (Mumbai, India).

Toxicity in aquatic fish for LC_{50}

Fishes were reared and acclimatized to the laboratory conditions in the glass aquaria containing aerated tap water avoiding overcrowding. The water was renewed every day and the fishes were fed with poultry feed on alternate day. During the experimentation fishes were not fed. The physico-chemical characteristics of the test water such as temperature ($22\pm 2^{\circ}\text{C}$), water hardness (420 mg/lit), pH (7 ± 0.2) and Dissolved oxygen (4.27 ml/lit) were analyzed during the experiments according to standard methods suggested by APHA, (1989). The stock solution of pesticide, endosulfan (35%) was prepared by dissolving a known concentration of this pesticide into the distilled water and required concentrations were made from the stock solution. The acute toxicity as widely accepted for the period of 24, 48, 72 and 96 hrs. have been carried out in the present investigation and the observations were made on the percentage mortality of the fish. The LC_{50} values were calculated by using regression equation method of probit analysis [11].

Biochemical analysis

Antioxidants and detoxification enzyme systems

Glutathione (GSH)

Glutathione content was determined according to the method of Theodorus *et al.*, (1981) [12]. The tissue was homogenized in 0.1 M ice cold phosphate buffer (pH 7.0) containing 0.001 M EDTA and protein is precipitated with 1 ml of 5% sulfosalicylic acid (w/v) and the contents were centrifuged at 5000 g for 15 min at 4°C. The resulting supernatant was used as the enzyme source. The reaction mixture in a total volume of 2.5 ml contained 2.0 ml of 0.1 M potassium phosphate buffer, 0.05 ml of NADPH (4mg / ml of 0.5% NaHCO₃), 0.02 ml of DTNB (1.5 mg / ml), 0.02 ml of glutathione reductase (6 units / ml) and required amount of tissue source. The reaction was initiated by adding 0.4 ml of enzyme source and change in absorbance was recorded at 425 nm against the reagent blank. The glutathione content was expressed in nano moles / gm wet weight of the tissue.

Se-Dependant Glutathione Peroxidase (Se-GSH-Px-EC: 1.11.1.9)

Se-Dependant Glutathione Peroxidase (Se-GSH-Px) was determined by a modified version of Flohe and Gunzler, (1984) [13] at 37°C. 5% (w/v) of Brain tissue homogenate was prepared in 50 mM phosphate buffer (pH 7.0) containing 0.1 mM EDTA. The homogenates were centrifuged at 10,000 rpm for min at 4°C in ice cold centrifuge. The resulting supernatant was used as enzyme source. The Reaction mixture consisted of 500 µl of phosphate buffer, 100 µl of 0.01 M GSH (reduced form), 100 µl of 1.5 mM NADPH and 100 µl of GR (0.24 units). 100 µl of tissue extract was added to the reaction mixture and incubated at 37°C for 10 min. Then 50 µl of 12 mM t-butyl hydroperoxide was added to 450 µl of tissue reaction mixture and the colour developed measured at 340 nm for 180 s. The molar extinction coefficient of 6.22 X 10³ M cm⁻¹ was used to determine the activity. One unit of activity is equal to the 1mM of NADPH oxidized / mg protein / min. The enzyme activity was expressed in µm of NADPH oxidized / mg protein / min.

Glutathione Reductase (GR-EC: 1.6.4.2)

Glutathione reductase activity was determined by a slightly modified method of Carlberg and Mannervik, (1985) [14] at 37°C. The Brain tissue was homogenized (5%-w/v) in 50 mM phosphate buffer (pH 7.0) containing 0.1 mM EDTA. The homogenates were centrifuged at 10,000 rpm for min at 4°C in ice cold centrifuge. The separated supernatant part

was used as enzyme source. NADPH (50 μ l, 2mM) in 10mM Tris buffer (pH 7.0) was added to the cuvette containing 50 μ l of GSSG (20mM) in phosphate buffer (0.5 M, pH 7.0 containing 0.1 mM EDTA) and 800 μ l of phosphate buffer. The tissue extract (100 μ l) was added to the NADPH-GSSG buffered solution and measured at 340 nm for 3 min. The molar coefficient of $6.22 \times 10^3 \text{ M cm}^{-1}$ was used to determine GR activity. One unit of activity is equal to the 1mM of NADPH oxidized / mg protein / min. The enzyme activity was expressed in μ moles of NADPH oxidized / mg protein / min.

Glutathione-S-transferase (GST- EC: 2.5.1.18)

Glutathione-S- transferase activity was measured with its conventional substrate, 1-Chloro 2, 4-Dinitro Benzene (CDNB) at 340 nm as per the method of Habig *et al.* (1974) [15]. The Brain tissue was homogenized in 50 mM ice cold Tris-HCL buffer (pH 7.4) containing 0.2 M sucrose and centrifuged at 16,000 g for 45min at 4°C and the resulting supernatant was again centrifuged at 1,05,000 g for 1 hour at 4°C. The pellet was discarded and the supernatant was used as an enzyme source. The reaction mixture in a total volume of 3 ml contain 2.4 ml of 0.3 M potassium phosphate buffer (pH6.9), 0.1 ml of 30 mM CDNB, 0.1 ml of 30 mM GSH and 0.4 ml of enzyme source. The reaction was initiated by the addition of glutathione and the absorbance was read at 340 nm against the reagent blank and the activity was expressed in μ moles of thioether formed / mg protein / min.

Cytochrome P-450 content

The method of Omura & Sato (1964 a&b) [16], [17] was used to measure the change in the microsomal content of cytochrome P-450.

Brain regions were homogenized in 0.25 M ice cold sucrose solution. The 10 % (W/V) homogenate was centrifuged at 16000 x g for 10 minutes to sediment the mitochondria. The pellet was discarded and the supernatant was again centrifuged at 105,000 x g for 1 hour at 4°C to obtain the microsomal fraction. The surface of the pellet was washed with the medium.

Estimation of cytochrome P-450 in microsomes

Microsomes were solubilized prior to the assay and to lower the turbidity. Solubilization can be achieved by adding detergents such as triton x-100 to give a final concentration of 0.5% . To the sample and reference cuvettes containing solubilized microsomes in buffer solution (containing 10mM phosphate buffer pH 7.4 and 0.1 mM EDTA) and solid sodium dithionate was added to reduce the cytochrome P-450. The sample cuvette

was bubbled with carbon monoxide for 1 minute and difference in the spectrum was recorded. The cytochrome P-450 was calculated using extinction coefficient of $91\text{mM}^{-1}\text{ cm}^{-1}$ for the absorbance of 450 nm minus the absorbance at 490 nm. The cytochrome P-450 activity was expressed as nmol of cytochrome P-450.

Glucose-6-Phosphate dehydrogenase (G-6-PDH) (E.C: 1.1.1.49)

Glucose-6-phosphate dehydrogenase activity was assayed by the method of Lohr and Waller (1965) [18], as modified by Mastanaiah *et al.* (1978) [19].

The tissue homogenates 10% (W/V) were prepared in 0.25 M ice cold sucrose solution and centrifuged at 1000 g for 15 min at 4°C. The reaction mixture in a total volume of 2 ml contained 100 μ moles of sodium phosphate buffer (pH 7.4), 20 μ moles of glucose-6-phosphate, 2 μ moles of INT and 0.3 μ moles of NADP. The reaction was initiated by adding 0.5ml containing 50 mg of tissue as an enzyme source. The reaction mixture was incubated at 37°C for 30 min and the reaction was stopped by the addition of 5 ml of glacial acetic acid. The formazan formed was extracted with 5 ml of toluene at 5°C. The optical density of the formazan was read at 495 nm against the toluene blank. The activity was expressed in μ moles of formazan formed/ mg protein / hour.

Superoxide dismutase (SOD – EC: 1.15.1.6)

Superoxide dismutase activity was determined according to the method of Misra and Fridovich (1972) [20] at room temperature. The tissue was homogenized in ice cold 50 mM phosphate buffer (pH 7.0) containing 0.1 mM EDTA to give 5% homogenate (w/v). The homogenates were centrifuged at 10,000 rpm for 10 min at 4°C in cold centrifuge. The supernatant was separated and used for enzyme assay. 100 μ l of tissue extract was added to 880 μ l (0.05 M, pH 10.2, containing 0.1 mM EDTA) carbonate buffer; and 20 μ l of 30 mM epinephrine (in 0.05% acetic acid) was added to the mixture and measured the optical density values at 480 nm for 4 min on a Hitachi U-2000 Spectrophotometer. Activity expressed as the amount of enzyme that inhibits the oxidation of epinephrine by 50% which is equal to 1 unit.

Catalase (CAT-EC 1.11.1.6)

Catalase activity was measured by a slightly modified version of Aebi (1984) [21] at room temperature. The tissue was homogenized in ice cold 50 mM phosphate buffer (pH 7.0) containing 0.1 mM EDTA to give 5% homogenate (w/v). The homogenates were centrifuged at 10,000 rpm for 10 min at 4°C in ice cold centrifuge. The resulting supernatant was used as enzyme source. 10 μ l of 100% ethyl alcohol was added to 100 μ l of tissue extract and then

placed in an ice bath for 30 min. After 30 minutes the tubes were kept at room temperature followed by the addition of 10 μ l of Triton X-100 RS. In a cuvette containing 200 μ l of phosphate buffer, 50 μ l of tissue extract and 250 μ l of 0.066 M H_2O_2 (in phosphate buffer) were added. The decrease in optical density was measured at 240 nm for 60 s in a UV Spectrophotometer. The molar extinction coefficient of 43.6 M cm^{-1} was used to determine CAT activity. One unit activity is equal to the moles of H_2O_2 degraded / mg protein / min.

Statistical treatment of data

All assays were carried out with six separate replicates from each group. The mean, standard error (SE) and Analysis of Variance (ANOVA) were done using SPSS statistical software for different parameters. Difference between control and experimental assays was considered as significant at $p < 0.05$.

Results:

Glutathione (GSH):

Glutathione content were decreased in all the tissues of fish during exposure of different concentrations of deltamethrin. (Detailed results were shown in tables 1.1-1.4 and graphs 1.1 - 1.4).

Liver > Kidney > Brain > Heart

Control > 5ppm > 10ppm

Catalase (CAT):

Catalase levels were increased in all the tissues of fish during exposure of different concentrations of deltamethrin. (Detailed results were shown in tables 1.1-1.4 and graphs 1.1 -1.4). Liver > Kidney > Brain > Heart

Control < 5ppm < 10ppm

Cytochrome p450 (CYTP450):

Cytochrome p450 (CYTP450) levels were increased in all the tissues of fish during exposure of different concentrations of deltamethrin. (Detailed results were shown in tables 1.1-1.4). Liver > Kidney > Brain > Heart

Control < 5ppm < 10ppm

Glucose 6-phosphate dehydrogenase (G6PDH):

Glucose 6-phosphate dehydrogenase (G6PDH) levels were decreased in all the tissues of fish during exposure of different concentrations of deltamethrin. (Detailed results were shown in tables 1.1-1.4). Liver > Kidney > Brain > Heart

Control > 5ppm > 10ppm

Glutathione Peroxidase (GPO): Glutathione Peroxidase (GPO) levels were increased in all the tissues of fish during exposure of different concentrations of deltamethrin. (Detailed results were shown in tables 1.1-1.4). Liver > Kidney > Brain > Heart

Control < 5ppm < 10ppm

Glutathione reductase (GR):

Glutathione reductase (GR) levels were increased in all the tissues of fish during exposure of different concentrations of deltamethrin. (Detailed results were shown in tables 1.1-1.4 1). Liver > Kidney > Brain > Heart

Control < 5ppm < 10ppm

Glutathione S-transferase (GST):

Glutathione S-transferase (GST) levels were decreased in all the tissues of fish during exposure of different concentrations of deltamethrin. (Detailed results were shown in tables 1.1-1.4). Liver > Kidney > Brain > Heart

Control > 5ppm > 10ppm

Super oxide dismutase (SOD):

Super oxide dismutase (SOD) levels were decreased in all the tissues of fish during exposure of different concentrations of deltamethrin. (Detailed results were shown in tables 1.1-1.4). Liver > Kidney > Brain > Heart

Control > 5ppm > 10ppm

DISCUSSION:

Glutathione metabolism

The antioxidant enzymes that provide the first line of cellular defense to ROS include superoxide dismutase (SOD), catalase (CAT), glutathione peroxidase (GPx) and glutathione reductase (GR), glutathione S-transferase (GST) and xanthine oxidase (XOD), etc. However, an imbalance between the activities of cellular antioxidant enzymes and ROS production results in oxidative stress and cellular damage. If the antioxidant system is not able to eliminate or neutralize the excess of ROS, there is an increased risk of oxidative damage [22]. It is well established that waterborne pollutants induces oxidative stress and cellular damage in affected aquatic organisms [23], [24].

Glutathione:

Glutathione is a tripeptide which requires three amino acids viz., cysteine, glutamic acid and glycine for its synthesis. It is an important water soluble antioxidant. GSH directly reacts

with free radicals offering protection to the cells from O_2 , OH and O_2^- species thereby playing a key role in the chemical detoxification. The neuroprotective functions of GSH include detoxification of electrophilic substances via GST conjugation reactions, reduction of peroxides via GSH peroxidase reactions and reduction or conjugation with aminoquinones formed by non-enzymatic oxidation of biogenic amines [25]. In brain GSH may also have important extracellular roles such as regulation of glutamatergic synaptic transmission and prevention of glutamate toxicity [26].

Glutathione peroxidase:

Glutathione peroxidase catalyzes the reduction of hydrogen peroxide, organic hydroperoxide, and lipid peroxides by reduced glutathione and functions in the protection of cells against oxidative damage. Based on selenium (Se) dependency, GPx can be divided into two forms: Se dependent and Se-independent. The enzyme is located in both the cytosol (70%) and mitochondria (30%) of various tissues. As the integrity of the cellular and subcellular membranes depends heavily on glutathione peroxidase, the antioxidative protective system of glutathione peroxidase itself depends heavily on the presence of selenium. GPx is one of the primary antioxidant enzymes, and involves in the direct elimination of active oxygen species. GSH serves as a co-factor for GPx [27].

Since an increase of GPx activity is necessary to eliminate the excess of H_2O_2 and lipid hydroperoxides produced in hepatocytes of fishes exposed to deltamethrin. The increased activity of GPx accelerates the utilization of GSH to GSSG. This increased GSSG, indicative of a more oxidized state, may explain the decreased levels of total antioxidant capacity in tissues of fish after exposure to pesticide. A decrease in GPx activity to basal values is probably related to decreasing cellular GSH levels on the days 14 and 28, although it cannot be discarded a direct effect of diazinon on the biosynthesis of the enzyme. Similar alterations in GPx activity were observed in different tissues of *C. carpio* exposed to diazinon [28]. Decreased GPx activity in gills, muscle, liver and brain of treated fishes with parathion were also reported, by Monterio *et al.* (2006) [29].

Glutathione reductase:

Glutathione reductase is an auxiliary enzyme to limit the amounts of ROS via its reduction of GSSG in the presence of an adequate supply of NADPH thus, the ratio of GSH/GSSG is maintained at a high level so that the cell maintains the capacity to combat

oxidative stress. GR is not directly involved in removing ROS, but it serves an important role in converting GSSG to GSH, thereby maintaining GSH-Px catalytic function and a reduced intracellular redox status [30]. GR, one of the secondary antioxidant enzymes, help in the detoxification of reactive oxygen species [31].

This GSH consumption leads to an increase in GR activity in order to recycle GSH. The increase in GR activity observed after seven days of exposure to sub-lethal concentrations of diazinon was followed by a declining trend, which is clearly manifested after 28 days of diazinon contact [32]. These results agree with a previous study carried out on fishes that had been exposed to environmental pollutants [33].

Glutathione-S-Transferases:

Glutathione-S-Transferases (GSTs) are drug metabolizing and detoxifying enzymes involved in the intracellular transport of metabolism of steroid hormones. GSTs are multifunctional proteins present in many organs and show tissue specific expression. They have the capacity to detoxify electrophilic xenobiotics, including cytotoxic drugs and carcinogens by catalyzing their conjugation with reduced glutathione (GSH). GSTs catalyze the reaction between the SH group of GSH and are potential alkylating agents, neutralizing their electrophilic sites and rendering them more water soluble.

GSTs are known to play a central role in the biotransformation of xenobiotics, including oxidants. The common feature of all GSTs is their ability to increase the nucleophilicity of the sulfhydryl groups of GSH which then participates in various reactions. The well known catalytic functions of GSTs are conjugation, peroxide reduction and isomerization. GSTs play a prominent role in antioxidant defense mechanisms by its former two catalytic functions, conjugation and peroxide reduction [34]. GSTs mediate the first step in the synthesis of mercapturic acid [35]. The purpose of the mercapturic acid formation appears to be inactivation of the potentially toxic electrophilic center of the substrate molecule and at the same time formation of a more hydrophilic conjugate for excretion. Thus GSTs play a key role in preventing the interaction of carcinogens with macromolecules such as nucleic acids and proteins [36].

Oxidants are formed as a normal product of aerobic metabolism and antioxidant defense involves several strategies both enzymatic and non-enzymatic [37]. Chronic oxidative stress has numerous pathological consequences including cancer, arthritis and neurodegenerative

diseases [38]. Glutathione and associated metabolism is a major mechanism for cellular protection against agents which generate oxidative stress. Glutathione participates in detoxification at several different levels and may scavenge free radicals, reduce peroxides or be conjugated with electrophilic compounds. Thus glutathione provides the cell with multiple defenses not only against ROS but also against their toxic products.

Cytochrome P-450:

Cytochrome P-450, a super family of enzymes, are involved in the metabolism of plethora of xenobiotics [39]. Cytochrome P-450 enzymes have attracted a great deal of interest because of their roles in the oxidation of wide variety of hydrocarbons, steroids, vitamins, fatty acids, drugs, pesticides and carcinogens [40] and many of these reactions are important in normal metabolism.

Glucose-6-phosphate dehydrogenase:

Glucose-6-phosphate dehydrogenase (G-6-PDH) is an important enzyme in the HMP shunt pathway which occurs in the cytosol of the cell. This pathway provides a major portion of the cell's NADPH, which functions as a biochemical reductant. The HMP pathway also produces ribose phosphate, required for biosynthesis of nucleotides and provides a mechanism for the metabolic utilization of five carbon sugars [41],[42]. G-6-PDH is inhibited by NADPH and the inhibition is relieved by NADP [43]. Since HMP shunt is an alternate pathway for the supply of energy and reduced coenzymes (NADPH) which function in the detoxification process, an attempt has been made in the present investigation to elucidate the role of G-6-PDH in different tissues of fish during deltamethrin exposed toxicity. It has been reported that the contact with pesticides decreased the synthesis and accelerated the breakdown of GR mediated by a disorder in NADPH synthesis and decreased activity of glucose-6-phosphate dehydrogenase (G6PDH) enzyme[44], [45].

Super oxide dismutase:

SOD is a key antioxidant enzyme inside the cells which catalyzes the dismutation of superoxide into oxygen and hydrogen peroxide. It scavenges intracellular and extracellular superoxide radical and prevents the lipid peroxidation. However, it should be conjugated with catalase or GPx to prevent the action of H₂O₂ which promotes the formation of hydroxyl radicals [46]. SOD is the only enzyme that uses superoxide anions as a substrate and produces

hydrogen peroxide as a metabolite, which is more toxic than the superoxide radical and has to be removed immediately by catalase [47].

This free radical stress gets amplified gradually and is propagated by an autocatalytic cycle of metabolic stress, tissue damage and cell death, leading to further increase in free radical production and depletion of antioxidants [48] including SOD. In response to oxidative stress, antioxidant enzymes are induced to protect cellular and tissue injury [49]. The SOD enzymes are enzymes that catalyse the dismutation of superoxide into hydrogen peroxide and oxygen whereas CAT catalyzes the decomposition of hydrogen peroxide to water and oxygen. The increased SOD and CAT activities in hepatocytes of fishes exposed to diazinon might be biochemical responses to over production of superoxide radicals and H_2O_2 in hepatocytes, respectively [50].

Catalase:

Catalase (CAT) is a tetrameric hemoprotein, whose main function is to detoxify hydrogen peroxide (H_2O_2) into H_2O and O_2 [51]. Catalase, a major antioxidant enzyme, containing iron as the prosthetic group, reduces the toxic hydrogen peroxide into water and protects the cell from possible oxidative damage. Catalase is found mainly in peroxisomes and its activity is known to alter under physiological and pathological conditions. Catalase acts on H_2O_2 , generated via either metabolism of endogenous substances or metabolism of exogenous compounds. Since it removes reactive hydrogen peroxide from the cell, it is important in detoxification mechanisms and has been able to protect cells from toxic injury.

It is also well documented that G6PDH is considered as supporter of the primary antioxidant enzymes and supplies the cell with NADPH required for a variety of reductive reactions and biosynthetic processes. The fall in the G6PDH due to deltamethrin might be implicated to the reduced expression of the enzyme and structural disintegration occurred during the oxidative stress. Further, it can be presumed that the low G6PDH activity decreases the ability to sustain the antioxidant enzymes to neutralize hydrogen peroxide formed during deltamethrin toxicity. The relatively high activity of G6PDH explains the role of it in the production of high concentration of NADPH and sustains the antioxidant enzymes to cope with the hydrogen peroxide production that occurred during deltamethrin toxicity. The enhanced activity of G6PDH not only facilitates the supply of reducing equivalents ($NADPH_2$) for the neutralization of free radicals and also for the conversion of GSSG to GSH by GR as observed in the present investigation.

The decreased SOD activity in different tissues of fish during deltamethrin exposed toxicity suggests failure of dismutation of superoxide anions generated by xanthine oxidase activity. The significant inhibition of SOD activity coupled with increased lipid peroxidation and purine catabolism as observed in the present study suggest the occurrence of oxidative damage. Singh *et al.* (2003)[52] have demonstrated decreased mitochondrial SOD, Catalase and reduced glutathione and increased lipid peroxidation, uric acid and glutathione peroxidase activity in different regions of brain during treatment with monosodium glutamate and hypothesized that oxidative stress produced by glutamate is vulnerable in brain regions may persist for a longer periods and mitochondrial function impairment is an important mechanism of excitatory amino acid mediated neurotoxicity in chronic degeneration. Since glutamate excitotoxicity is the major pathological event associated with the ROS production and inhibition of SOD activity.

Tissues have inherent natural protective defense system against the adverse effects of oxidative damage. Catalase, one of the enzymes of antioxidant defense system, tend to neutralize the oxidants more particularly hydrogen peroxide generated during different pathological conditions. Our results demonstrated a significant decrease in the activity of scavenging enzyme catalase, in different tissues of fish on exposure with deltamethrin suggesting the lesser involvement the antiperoxidant reaction is eliminating hydroxyl radicals and peroxides generated during toxic form of deltamethrin.

From the present findings coupled with the earlier reports, the antioxidant enzymes such as cyt-p 450, G6PDH, GPx, GR, GST, SOD and CAT in order to neutralize the oxidant radicals and lipid peroxides generated during deltamethrin exposure toxicity. [50]Banaee *et al.*, (2012) found that the levels of total antioxidant capacity in hepatocytes of fishes exposed to both concentrations of diazinon were significantly decreased. Similar results were observed in carps exposed to sub-lethal concentrations of cyfluthrin [53]. Therefore, the decline in the hepatic total antioxidant levels make the fish cells more vulnerable to oxidative stress damage.

Table-1.1

Alterations in the antioxidants and detoxification enzymes in **Liver** of fish *Cyprinus carpio* after insecticide deltamethrin exposure.

Values are expressed as nano moles of GSH formed/ gm wet wt. of tissue. CAT: μ moles H_2O_2 hydrolyzed/mg protein/min. CYT450: Nano moles of cytochrome p-450/ gm wet wt. of tissue. G6PDH: μ moles of formazan formed/ mg of protein / hour. Gpo/GR: μ moles of NADPH oxidized/ mg of protein/min. GST: μ moles of thioether formed/ mg of protein/min. SOD: μ moles of epinephrine oxidized/ mg of protein/min.

Liver	Control	5ppm	10ppm
GSH	30.151	24.616*	15.326*
	± 0.208	± 0.050	± 0.675
		(-18.35)	(-37.73)
CAT	15.351	23.536*	29.345*
	± 0.009	± 0.375	± 0.014
		(53.39)	(59.45)
CYT450	6.627	8.834*	13.249*
	± 0.359	± 0.066	± 0.028
		(33.3)	(99.92)
G6PDH	35.825	30.181*	22.247*
	0.006	0.373	0.425
		(-15.75)	(-37.9)
GPO	16.344	25.245*	35.216*
	± 0.125	± 0.270	± 0.719
		(54.46)	(115.46)
GR	18.626	21.63*	32.245*
	± 0.073	± 0.163	± 0.054
		(16.12)	(73.11)
GST	14.426	12.791*	8.14*
	± 0.103	± 0.337	± 0.014
		(-11.33)	(-43.57)
SOD	24.584	14.945*	10.151*
	± 0.018	± 0.012	± 0.088
		(-39.2)	(-58.7)

All the values are mean, $\pm$ SE of six individual observations.

Values in '()' parentheses are % change over control.

*Values are significant at $P < 0.05$ in Scheffe test.

Table-1.2

Alterations in the antioxidants and detoxification enzymes in **Heart** of fish *Cyprinus carpio* after insecticide deltamethrin exposure.

Values are expressed as nano moles of GSH formed/ gm wet wt. of tissue. CAT: μ moles H_2O_2 hydrolyzed/mg protein/min. CYT450: Nano moles of cytochrome p-450/ gm wet wt. of tissue. G6PDH: μ moles of formazan formed/ mg of protein / hour. Gpo/GR: μ moles of NADPH oxidized/ mg of protein/min. GST: μ moles of thioether formed/ mg of protein/min. SOD: μ moles of epinephrine oxidized/ mg of protein/min.

Heart	Control	5ppm	10ppm
GSH	10.647	9.558*	5.45*
	± 1.025	± 0.146	± 0.139
		(-10.22)	(-48.81)
CAT	7.565	9.276*	11.23*
	± 0.069	± 0.049	± 0.012
		(22.61)	(48.44)
CYT450	2.426	2.695*	3.426*
	± 0.749	± 0.069	± 0.806
		(11.08)	(41.22)
G6PDH	16.196	12.025*	7.605*
	± 0.013	± 1.496	± 1.606
		(-25.75)	(-53.04)
GPo	4.365	6.326*	9.356*
	± 0.202	± 0.199	± 0.073
		(44.92)	(114.34)
GR	18.626	21.63*	32.245*
	± 0.073	± 0.263	± 0.543
		(16.12)	(73.11)
GST	0.904	1.261*	1.320*
	± 0.046	± 0.021	± 0.107
		(39.49)	(46.01)
SOD	24.584	14.945	10.151*
	± 0.085	± 0.202	± 0.018
		(-39.2)	(-58.7)

All the values are mean, $\pm$ SE of six individual observations.

Values in '()' parentheses are % change over control.

*Values are significant at $P < 0.05$ in Scheffe test.

Table-1.3

Alterations in the antioxidants and detoxification enzymes in **Kidney** of fish *Cyprinus carpio* after insecticide deltamethrin exposure.

Values are expressed as nano moles of GSH formed/ gm wet wt. of tissue. CAT: μ moles H_2O_2 hydrolyzed/mg protein/min. CYT450: Nano moles of cytochrome p-450/ gm wet wt. of tissue. G6PDH: μ moles of formazan formed/ mg of protein / hour. Gpo/GR: μ moles of NADPH oxidized/ mg of protein/min. GST: μ moles of thioether formed/ mg of protein/min. SOD: μ moles of epinephrine oxidized/ mg of protein/min.

Kidney	Control	5ppm	10ppm
GSH	19.105	12.53*	8.295*
	± 0.069	± 0.339	± 0.336
		(-34.41)	(-56.58)
CAT	11.228	17.257*	22.165*
	± 0.210	± 0.541	± 0.191
		(53.69)	(97.4)
CYT450	5.224	9.865*	13.626*
	± 0.112	± 1.021	± 1.066
		(88.84)	(160.83)
G6PDH	31.941	25.439*	20.426*
	± 0.329	± 0.763	± 0.925
		(-20.35)	(-36.05)
GPo	12.494	22.044*	31.528*
	± 0.085	± 0.102	± 0.065
		(76.43)	(152.34)
GR	15.483	22.845*	35.364*
	± 0.085	± 0.803	± 0.033
		(47.54)	(128.4)
GST	12.251	8.254*	4.255*
	± 0.025	± 0.202	± 0.195
		(-32.62)	(-65.26)
SOD	21.258	12.936*	8.794*
	± 0.069	± 0.339	± 0.336
		(-39.14)	(-58.63)

All the values are mean, $\pm$ SE of six individual observations.

Values in '()' parentheses are % change over control.

*Values are significant at $P < 0.05$ in Scheffe test.

Table-1.4

Alterations in the antioxidants and detoxification enzymes in **Brain** of fish *Cyprinus carpio* after insecticide deltamethrin exposure.

Values are expressed as nano moles of GSH formed/ gm wet wt. of tissue. CAT: μ moles H_2O_2 hydrolyzed/mg protein/min. CYT450: Nano moles of cytochrome p-450/ gm wet wt. of tissue. G6PDH: μ moles of formazan formed/ mg of protein / hour. Gpo/GR: μ moles of NADPH oxidized/ mg of protein/min. GST: μ moles of thioether formed/ mg of protein/min. SOD: μ moles of epinephrine oxidized/ mg of protein/min.

Brain	Control	5ppm	10ppm
GSH	12.447	9.677*	7.35*
	± 0.048	± 0.976	± 0.102
		(-22.25)	(-40.95)
CAT	3.644	3.923	4.446*
	± 0.127	± 0.165	± 0.882
		(7.65)	(22)
CYT450	77.951	67.806*	47.462*
	± 1.421	± 1.297	± 1.042
		(-13.01)	(-39.11)
G6PDH	24.225	16.828*	12.226*
	± 1.046	± 1.127	± 1.315
		(30.53)	(49.53)
GPo	6.242	8.344*	9.383*
	± 0.506	± 0.029	± 0.035
		(33.67)	(50.32)
GR	8.056	12.016*	14.563*
	± 0.075	± 0.256	± 0.898
		(49.15)	(80.77)
GST	6.844	4.635*	2.249*
	± 0.033	± 0.116	± 0.774
		(-32.27)	(-67.13)
SOD	12.864	7.946*	3.326*
	± 0.015	± 0.995	± 0.730
		(-38.23)	(-74.14)

All the values are mean, $\pm$ SE of six individual observations.

Values in '()' parentheses are % change over control.

*Values are significant at $P < 0.05$ in Scheffe test.

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FEMINISM IN GIRISH KARNAD'S PLAYS

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Abstract

Feminism is beneficial to men, women, and their families because it is allowing mothers, daughters, and sisters to have an equal opportunity in life to achieve all they can without any discrimination based on their sex. It is a human right to be equal to others around you and it does not matter if you are male or female. They should both receive the same opportunities and privileges given in life and feminism helps women accomplish this task of equality. Feminism is allowing women to expand their careers and businesses that they never were able to have before. Women now have power in government and they hold high and powerful jobs. They have gained their independence from a male dominated society and are rising to become less dependent on their husbands for financial support. Many women are now even managing their own families, without the help or support of a man. Men are also being helped because their wives are now able to help with financial needs; they are not depended on for the only source of income for their family anymore.

Key Words: Feminism, Play, Society, Patriarchy, family. modern, exploit, relationship

Introduction

Gender issues seem to be suffused in most of the plays of Girish Karnad. In his plays, Karnad very dexterously pictures the condition of a typical Indian female, ruled by the patriarchal order bounded by tradition, but whose spirit remains unbounded. Although the playwright is not an out and out feminist like Henrik Ibsen, the playwright of *The Doll's House*, but the problems of a female in a prejudiced, biased patriarchal society are referred to in most plays by the playwright. The issue of the gender-bias in society and the oppression of women by the patriarchal order happen to form an important part of Karnad's plays. At the same time, Karnad depicts women enthused with feminism, fighting the unjust norms of the patriarchal order. Also more often than not such a direct encounter with patriarchy leads the women to death or disaster. The present paper undertakes to study the treatment of female in two plays of Karnad based on myths, namely *Yayati* (1961) and *Bali: The Sacrifice* (1980; rendered into English in 2004).

Karnad has borrowed the myth of Yayati from the "Adiparva" of the Mahabharata. Yayati re- tells the age-old story of the king who in his longing for eternal youth does not hesitate to usurp the youth and vitality of his son. Karnad takes liberty with the myth and weaves complex dimensions into the plot borrowed from the Mahabharata. To the mythical story of Yayati he adds new characters and alters the story-line so as to deepen its connotative richness which gives it contemporary appeal.

In Karnad's *Yayati*, king Yayati is married to Devyani, an "Aryan" princess and during the course of the play, develops an illicit relationship with Sharmishtha, an "Anarya", and openly expresses his desire to marry her. Puru, here figures as the son of another of the king's spouse, who again like Sharmishtha, comes from the "Anarya" or the "rakshasa" clan. The two novel characters introduced by Karnad in the plot are, Puru's wife Chitrlekha and the maid confidant, Swarnalata. Karnad invests new meaning and significance for contemporary life and reality by exploring the king's motivations. In the Mahabharata, Yayati understands the nature of desire itself and realizes that fulfillment neither diminishes nor eliminates desire. In the drama, Karnad makes Yayati confront the horrifying consequences of not being able to relinquish desire.

Bali: The Sacrifice was first brought out into Kannada in 1980 by the name of Hittina Hunja, but

was not translated in English at that time. The source of the play is an ancient Kannada epic, Yashodhara Charite, which itself draws on several other sources. The play is one that has multiple ideological issues. Though based on an ancient Kannada epic, the story, characters and incidents are often overshadowed by overt ideological concerns as relevant today as they were many centuries ago. The play is a treatise on the viability of violence and non-violence in the present scenario.

The plot of Bali: The Sacrifice comprises of four characters, the Queen, the King, the Queen-Mother and the Mahout. The Queen is a Jain and she marries a Hindu King. Out of love for his spouse, the King converts into Jainism but is unable to come to terms with the new faith. Jainism dictates non-violence and Hinduism believes in the practice of sacrifice or bali, which means violence. The Queen-Mother is a devout Hindu who believes in sacrifices. The King vacillates from one end to the other, from Hinduism to Jainism, from the Queen-Mother to his wife but is unable to come to terms with any faith. In the climactic event of the play, the Queen enchanted by the beautiful voice of a low caste ugly, Mahout, the Elephant-Keeper, mates with him.

Soon after the incident comes to the knowledge of the King and the Queen-Mother, being a Jain, the King cannot indulge into violence by killing the Mahout and avenging the wrong of desecrating the sanctity of marital bond. The question which haunts the King and the Queen-Mother is how to placate the Gods and Goddesses for this act of sin. Finally the Queen-Mother tells the King that to placate for the sin committed, a sacrifice has to be made. The Queen does not want to indulge in this mock sacrifice but is forced to by the King. Since no real blood can be shed, a dough-cock is decided to be sacrificed, which suddenly comes alive. The sacrifice of the dough cock turns into the sacrifice of the Queen herself and she dies. The question posed is whether intended violence is as offensive as real violence—whether the thought of mock- sacrifice is equivalent to actual sacrifice?

In Hittina-Hunja, the Kannada version of Bali, as in the original myth, the Queen did not actually commit adultery but only intended to, while in Karnad's Bali, she actually does commit adultery.

The Oppression of Women

In Yayati, the issue of gender is highlighted especially in the way Yayati treats women in the play. C.N. Ramachandran feels that in Karnad's plays choice and consequences of choice were dissociated and the one who suffered the most due to the choices of others was always a woman. In most plays of Karnad, "the worst sufferers are women . . . who are caught up in a whirlpool of Hindu patriarchy, and are sucked down helplessly." (Ramachandran 28)

Karnad, in order to present the situation of a newly-wed female (had she been in the original mythical story) adds the character of Chitrlekha which throws more light on the gender-bias of society.

The desires of a woman are always curbed in a patriarchal order; here it makes little difference whether she belongs to a high class/ caste or a low class/ caste. Chitrlekha in Yayati is an Aryan princess, the protagonist in Bali: The Sacrifice is a queen and Vishakha in The Fire and the Rain is a Brahmin; all these women belong to a higher social order but suffer at the hands of the unjust patriarchal order. The character of Chitrlekha as has already been said is Karnad's creation. "Through her Karnad explores the futility of being born a princess who finds reality too much to bear and kills herself". (Raju 84)

Chitrlekha suffers first at the hands of her husband, Puru, who does not think of his wife even

once before acceding to the supreme sacrifice of giving up his youth and vitality to serve his father's idiosyncrasies which serves no purpose but to fill up the void in his own life. Chitrlekha finds it hard to live up to the expectations of a royal Aryan woman or to put it in general terms, of an Indian wife who accepts all the decisions of her husband with a smile and never dares to question his authority. When the maid confidant Swarnlata informs Chitrlekha that Puru has accepted his father's curse of old age, the latter has the courage to say—"Do you know I had greatly wronged the Aryan prince. I thought of him as a coward and cursed my fate for being his wife. But I am indeed very lucky Swarna!" (Karnad, Yayati73)

But as soon as Puru confronts her and she sees her husband transformed from a youth full of vigour into a shriveled old man, all her idealism withers away and she cries out in terror and panic—"Don't come near me...go away from here...Don't touch me!"

Yayati comes to picture and consoles Chitrlekha and asks her to behave in a fashion befitting a royal princess. Here the schism between the behaviour expected of a man and a woman in a traditional Indian society surfaces up. While Yayati flouts the rules of morality with ease, develops an illicit relationship with Sharmishtha and even has the cheek to tell his wife in her face that he would marry another woman, the newly married Chitrlekha is expected to exhibit devotion and morality and remain a dutiful wife.

Chitrlekha, unwilling to submit to the patriarchal order and with no hope of emancipation from the mesh, commits suicide. She feels her life is a waste and there is no point in going on with it. Her anguish is expressed in the following speech:

Neither will you return Puru's youth nor will you accept me! . . . Of what use am I to your garland of victories? All of you have achieved your objectives. Who needs me now? You have your youth; Pururaj has his self-sacrifice, but what am I to do?

She expresses the plight of women in Indian society who find themselves completely out of place in a world ruled by men. Finally Chitrlekha commits suicide, rather the society forces her to commit suicide like it had forced Padmini in Hayavadana to perform sati, Nittalai in The Fire and the Rain to be murdered and the Queen in Bali: The Sacrifice to sacrifice herself.

The death of Chitrlekha makes Sharmishtha comment at the exploitative patriarchal set-up, which crushes and oppresses women and offers them not even an infinitesimal hope of emancipation. Sharmishtha accuses Yayati of Chitrlekha's death—"This is the foundation of your future life: One woman [Chitrlekha] has become a ghost; the second [Swarnalata] mad; and the third [Sharmishtha] a fallen woman".

A very significant portion of the play is devoted to the study of the decisions of the patriarchal set-up that expects women to surrender to the will of the male decision makers without protest. This fact is further illustrated through another relationship enunciated in the play: the Swarnalata episode. Swarnalata was jilted by her husband who thought that she had a relationship with a Brahmin boy before their marriage.

Swarnalata tried her best to prove her innocence to her husband but failed. Her husband became miserable and Swarnalata who loved her husband very much, could not bear his condition. She decided to give him peace of mind by lying to her that indeed the Brahmin boy had violated her. This freed her husband of the dilemma and he went away never to return. The narrative reiterates the concept of chastity and virginity which holds a place of prominence in the Indian society. A woman whose virginity has been violated is looked down upon, but the men are never called to question. Sita in The Ramayana too had to take an ordeal to prove her innocence and Rani in

Naga-Mandala was also expected to testify herself at the behest of her indulgent husband in front of the whole village. Swarnalata's narrative once again scrutinizes the patriarchal norms of the society that expects a woman to prove her innocence. She is never taken on her own worth.

S. Subash Chandran asserts that in Bali, the non-violent saviour and the blood-thirsty goddess, representing the Apollonian and the Dionysian order respectively seem to have their earthly emissaries in the form of the Queen-Mother and the Mahout, whose mission is to continue waging war in human heart and mind. The Queen-Mother has an uncanny way of realizing the truth while the divine music of the Mahout can mesmerize its listeners. By mating with the Mahout, the Queen feels herself liberated from the bondage of patriarchy imposed by the Apollonian order. She, by communion with the Mahout, lets the Dionysian principle rule supreme which emancipates her from hackneyed patriarchal traditions.

In Naga-Mandala, the Naga liberates Rani from a world of sterility to that of liveliness and fecundity. The Mahout here emerges as the Queen's saviour. Burdened for fifteen years to bear a child for the royal throne, amidst the mock whispers and the giggling of the palace maids, the ridicule of the Queen-Mother and the desperation of her husband, the Queen has completely forgotten the creative aspect of her sexuality.

The traditional Indian woman is burdened with the idea of bearing a child, more especially a son, for her family. The women in the aforementioned plays of Karnad seem to be aware of their oppression and repression in the patriarchal order but also know that they cannot do much about it. A barren woman in an Indian society is looked down upon. Women themselves have a deep-rooted notion to bear an heir for their family. But here emerges a modern woman, unfettered and free who wishes to make love merely for pleasure and for its own sake.

Conclusion

Whenever they attempt to cross their defined limits, like did Chitrlekha in Yayati and the Queen in Bali, they meet with disaster. It matters little which class they come from, the women of all social strata seem to suffer more or less equally. Chitrlekha and the Queen from superior class/ race, and Swarnalata and Sharmishtha from the lower class/ caste/ race, undergo suffering. Stepping out of marital bonds or claiming their rights, whichever the case, the result is always a disaster—the death of the female initiators.

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ఆధునిక తెలుగు కవిత్వంలో దిగంబర కవిత్వోద్యమం - సామాజిక స్పృహ

- డా॥ కొయ్య శ్రీనివాసులు, తెలుగు విభాగాధిపతి, యస్.టి.యస్.యస్.ప్రభుత్వ డిగ్రీ కళాశాల, కదిరి.

స్వాతంత్ర్యం వచ్చాక తెలుగు సాహిత్యంలో అవతరించిన ఉద్యమం దిగంబర కవిత్వోద్యమం ఈ దిగంబర కవిత్వోద్యమానికి కారకులు ఆరుమంది కవులు, వారు నగ్నముని, నిఖిలేశ్వర్, జ్వాలాముఖి, చెరబండ రాజు, భైరవయ్య, మహాస్వప్న అనే ఆరుమంది దిగంబర కవిత్వోద్యమాన్ని ముందుకు నడిపించారు. దిగంబర కవుల అసలు పేర్లు నగ్నముని - మానేపల్లి హృషికేశవరావు, నిఖిలేశ్వర్ - యాదవ రెడ్డి, చెరబండ రాజు - బద్ధం భాస్కర్ రెడ్డి, జ్వాలాముఖి - వీరవెల్లి రాఘవాచార్యులు, మహాస్వప్న - కమ్మిశెట్టి వెంకటేశ్వరరావు, భైరవయ్య - మన్మోహన్ సహాయ్, దిగంబర కవులు కుల వ్యవస్థకు వ్యతిరేకం కాబట్టి తమ పేర్ల చివరపున్న రావు, రెడ్డి, రాజు, ఆచార్యులు మొ॥ కుల గౌరవ సూచక పేర్లకు బదులు కొత్తపేర్లు ధరించారు. దిక్కులు అంబరంగా కలవారు దిగంబరులు, యోగివేమన వలె భౌతిక దిగంబరత్వం లేదు. వీరిది కేవలం మానసిక దిగంబరత్వం మాత్రమే. ఈ ఆరుగురు దిగంబర కవులుగా ఏర్పడి 1965-1968 సంవత్సరాల మధ్య, మూడు కవితా సంకలనాల్ని వెలువరించి తెలుగు సాహిత్యంలో సంచలనాన్ని సృష్టించారు. వీరు తమ కవితల్ని “దిక్”లుగా ప్రకటించుకున్నారు. వీరు అభ్యుదయ కవితా ధోరణి పై తీవ్రంగా తిరుగుబాటు చేసి, కులాలు, మతాలు, రాజకీయాలు, సిద్ధాంతాలతో తమ దిగంబర కవిత్వానికి సంబంధం లేదని నిర్ణయంగా ప్రకటించుకున్నారు.

దిగంబర కవులు తమ కవిత్వాన్ని గురించి వారే ఈ విధంగా చెప్పుకున్నారు.

- “నేటి చెత్త వ్యవస్థని సమూలంగా తొలగించి,

నిత్యనూతన మహత్తర వ్యవస్థ కోసం తవన పడుతున్న వాళ్ళు” దిగంబర కవులు.

- “మంచికోసం, మనిషిలోని నిప్పులాంటి నిజమైన మనిషి కోసం, కపటం లేని చిరునవ్వు చిందే సమాజం కోసం” ఎలుగెత్తి నిల్చిన వాళ్ళు దిగంబర కవులు.
- “జీవితానికి అర్థం లేదని, నిరర్థక జీవన విధానంతో మనిషి జీవించలేడు. శూన్యంలో ఎక్కడో ఒక మూల లేశమైనా కానీ ఆశాకిరణం దాగివుంది” అన్న అభిప్రాయం గలవారు దిగంబర కవులు.

తెలుగు సాహిత్యంలో దిగంబర కవిత్వోద్యమానికి ఒక ప్రత్యేకత వుంది. ఆరుగురు కవులు కలిసి ఒకటిగా చేరి కవిత్వోద్యమాన్ని లేవదీయటం ఒకటైతే, శాలివాహనాది పూర్వశకాన్ని, ప్రస్తుత క్రీస్తు శకాన్ని కాలదన్ని దిగంబర శకాన్ని చేపట్టారు వీళ్ళు, ప్రభవ, విభవాది సంవత్సరాలకు తిలోదకాలు అర్పించి, నగ్నమాది సంవత్సరాలకు నీరాజనం పలికారు. గ్రీష్మ, వసంతాది ఋతువుల్ని త్రోసిరజని ఆశ, మదిరాది ఋతువులకు ఆహ్వానం పలికారు, ఆది, సోమ వారాలను ప్రక్కన పెట్టి, స్నేహ, విశృంఖలాది వారాలకు జై కొట్టారు. ఈ విధంగా తెలుగు సాహిత్యంలో దిగంబర కవిత్వోద్యమం ఎన్నో ప్రత్యేకతలు చాటుకుంది. ఈ ప్రత్యేకతలను సాహితీ విమర్శకులు అపరిణత, బాల్య చేష్టలుగా కొట్టిపడేశారు.

దిగంబర కవులు మొదటి సంపుటాన్ని 1965వ సం॥ లోనూ, రెండవ సంపుటాన్ని 1966వ సం॥లోనూ, మూడవ సంపుటాన్ని 1968వ సం॥లోనూ ప్రచురించారు. దిగంబర కవులు మూడు సంపుటల్లో కలిసి రాసిన మొత్తం దిక్కులు తొంభై మూడు (93)

	1965 సం॥	1966 సం॥	1968 సం॥		మొత్తం
నగ్నముని	4	7	14	=	25
నిఖిలేశ్వర్	4	9	11	=	24
చెరబండరాజు	4	7	09	=	20
భైరవయ్య	4	4	04	=	12
జ్వాలముఖి	2	2	02	=	06
మహాస్వప్న	3	1	02	=	06
మొత్తం	21	30	42	=	93

దిగంబర కవులు తమ దిక్కుల్లో రాజకీయ, సాంఘికాది రంగాల్ని విమర్శించారు. రాజకీయ నాయకులు, ఛోటామోటా లీడర్లు, ధన పిశాచి బాబాలు, మతోన్మాదులు, ప్రభుత్వతోత్తులుగా మారిన కవులు, కళను వ్యాపారం చేసిన కళాకారులు, సనీ హీరోలు మొ॥ అంశాలను గ్రహించి, వాటిని తమ కవిత్వంలో ప్రతిబింబించారు. అంతేగాకుండా ప్రాచీన భండస్సు పట్ల, ప్రబంధ కవిత్వం పట్ల, అకాడమీల పట్ల, సెక్స్ సాహిత్యం పట్ల, పితృస్వామ్య వ్యవస్థ దుర్మార్గాల పట్ల, స్త్రీ, పురుష సమానత్వం పట్ల, పాలకుల అవినీతి పట్ల, నిరుద్యోగం పట్ల దిగంబర కవులు తమ కవితా సంకలనాల్లో స్పష్టమైన అభిప్రాయాన్ని ప్రకటించారు.

దిగంబర కవులు తమ దిక్కుల్లో నేటి వ్యవస్థకు మూల కారణం ఆర్థిక వ్యవస్థ, ఈ ఆర్థిక వ్యవస్థ దురవస్థకు ప్రధాన కారకులు రాజకీయ నాయకులు అంటుంది.

“జడలు కట్టిన శిరోజాల కొనలు
పట్టుకు వేళ్ళాడుతున్న
పేలు
నాయకులు”

జడలు కొనలు పట్టుకు వేలాడుతున్న ‘పేలు’ కింద పడే దశలో ఉన్నాయని, వేళ్ళాడేవి ఎంతో సేపు స్థిరంగా ఉండలేవని, అలాగే రాజకీయ నాయకులకీ కూడా కాలం సమీపించినదని, రాజకీయ నాయకులను ‘పేల’తో పోల్చారు దిగంబర కవులు.

‘ఇప్పుడు కొత్తరకం కొజ్జాలు దిగారు
లజ్జలేని బొజ్జలున్న కొజ్జాలు దిగారు
యూనిఫారం సరిచేసుకుంటూ
అయిదేళ్ల కొకసారి ప్రేమ వాలకబోస్తూ
బాకాలతో భజంత్రీలతో మందీ మార్పలంతో
వస్తున్నారు’

రాజకీయ నాయకులు వేసే వేషాల్ని, అనుకరించే విధానాన్ని నిశితంగా విమర్శించారు. ఐదేళ్ల కొకసారి వచ్చి, అనురాగం ఒకకబోస్తూ, వంగి వంగి దండాలు పెడుతూ ఓట్టివ్వమని అభ్యర్థిస్తారు. ఇది అచ్చంగా ‘కొజ్జాల మేళం’ లాగా ఉన్నదని దిగంబర కవుల భావన.

‘మజిలి మజిలీకి వేశ్య
కొత్త చీర మార్చుకున్నట్టు
నవుంసకుడు పురీషాన్ని
ప్రతినిమిషం నలిపినట్లు
పార్టీలు మారే పగటి వేషగాళ్లు’

రాజకీయ నాయకులు నాటి నుండి నేటి దాకా తమకు ప్రయోజనం లేదు అనిపిస్తే పార్టీలు మారడం, పాత పార్టీని విమర్శిస్తూ, కొత్త పార్టీని పొగడుతూ ఉండడం దీన్ని దిగంబర కవులు దీన్ని నీచోపమతో సూచించారు. రాజకీయ నాయకులు అధికార దాహంతో తామేం చేస్తున్నామో గమనించటం లేదని అందుకే దిగంబర కవులు వారిని ‘పగటి వేషగాళ్లు’గా అభివర్ణించారు. కుహనా

రాజకీయ నాయకుల పైన తీవ్రమైన పదజాలంతో విరుచుకుపడ్డారు.

దిగంబర కవులు ప్రాచీన కవితా సంప్రదాయాన్ని, భావకవిత్వాన్ని, అభ్యుదయ కవిత్వాన్ని, ప్రముఖ కవుల్ని ఈసడిస్తూ కవిత్వాన్ని రచించారు.

‘నన్నయను నరేంద్రుడి బొందలోనే
నిద్రపోనియ్యి

అంటూ నన్నయ నించి తమ ముందటి తరం కవుల వరకు అందరికీ ‘గుడ్ బై’ చెప్పి తమ ఉద్యమాన్ని ప్రారంభించారు. దిగంబర కవులు భాషాపరంగా కూడా ఎదురుతిరిగారు.

‘అందమైన ఆడదాన్ని వెతికితెచ్చి
ఊపిరాడని గదిలో బంధించి
వొయ్యారపు ఊహలపల్లకిలో ఊరేగించి
పాదలు పట్టుక వ్రేలాడే కవి
కోలు కుంటా వెళ్ళుదు నీ తరతరాల వ్యాధి’ అనీ
‘ఎవరైతే నీవు
స్త్రీవా, భావ కవివా, కొజ్జావా?
.....’

దిగంబర కవులు ప్రాచీన సాహిత్యంతో పాటు, భావ కవితా దృక్పథాన్ని ఈసడించుకొన్నారు.

‘లారీ నిండా పుస్తకాలు రాసి
లారీలా అరచే

కుల, మతతత్వ ‘సామ్రాట్టులు’ అంటూ ప్రముఖ కవుల్ని కూడా దుయ్యబట్టారు.

దిగంబర కవులు తమ దిక్కుల్లో సాంఘిక వ్యవస్థని కూడా గర్హించారు. “ఆడది అంటే రాత్రి తన కింద పడుకొనే డన్ లప్ పిల్లో” అన్న పనికిమాలిన మనస్తత్వాన్ని, ధన వ్యామోహాన్ని, కట్నాలు, వ్యభిచార గృహాలు, సమాజం పట్ల బాధ్యత లేని అపరిణిత వెన్నెముక లేని యువకుల్ని, యాంత్రిక జీవనం గడుపుతున్న ప్రజల్ని, వీళ్లు ఎక్కువగా విమర్శించారు.

‘ఎక్కడ బతుకుతున్నావు నువ్వు
ధనం కుష్టు రసిమీదా హెబిడాల రాచపుళ్ల మీదా
పీనుగు పెంటల అలగా జనం రస్తాల మీదా’

అని

డబ్బున్నవాడు డబ్బు సంపాదనలో పడి ఏం చేస్తున్నాడో తనకే తెలిసి పరిస్థితికి కొంత మంది ధనికులు వచ్చారని వారిని తమ కవితల్లో గర్హించారు.

‘నిన్న రాత్రి ఎన్ని గంటలకు తిరిగి

నీ పెళ్ళాన్ని వాడి మేడ నుండి యింటికి తీసుకొచ్చావు’

డబ్బు సంపాదనలో పడి నీతి, నిజాయితీ, అభిమానం, వ్యక్తిత్వం అన్న పదాల్ని డబ్బు వ్యామోహం వున్న మనుషులు వాటిని మరచి పోయారని ఆవేదన వ్యక్తం చేశారు. అగ్ని సాక్షిగా పెండ్లాడిన భార్యను సైతం పరాయివాడికి తార్చడానికి వెనుదీయని వాళ్ళను నిలదీసి ప్రశ్నించారు దిగంబర కవులు.

నేటి సాంఘిక వ్యవస్థలో రాజకీయ నాయకులే గాకుండా ఛోటా మోటా నాయకులు కూడా అరాచకాలకు కారణమవుతున్నారని వారిని

‘గాది కింద పందికొక్కు
ఊరికంత అదే దిక్కు’

అంటారు దిగంబర కవులు.

దిగంబర కవులు బాబాలు, మతాధిపతులు, జయ్యర్లు వారి మత మౌఢ్యాన్ని ఖండిస్తూ

‘జనాన్ని జాతి నరనరాన్ని, మత మౌఢ్యాన్ని తీర్చి తీర్చి
వయసులో నానా పాయసాలు మరిగి మరిగి
క్రొవ్వెక్కిన పిట్టగూళ్ళ తల బుట్టల బాబాలే
చక్రవర్తుల్లా ఊరేగే జగద్గురు సాములోర్లే
ఈ కుష్టు వ్యవస్థకు మూల విరాట్టులు’

అంటూ ప్రజల్ని చైతన్య పరిచారు.

‘చీము నెత్తురూ వున్న మానవుడు

మానవత్వాన్ని తప్ప మరో మతాన్ని అంగీకరించడు’
అంటూ కూడా తమ దిక్కుల్లో తార్కిక నిర్దేశం చేశారు.

దిగంబర కవులు అంతర్జాతీయ బావంతో విశ్వశాంతిని
కాంక్షించారు.

‘అణ్ణహంకారంతో కావర మెక్కిన
అగ్రరాజ్య శ్వేనాలకు రెక్కలు నరికి
ఈకలు పెరికి చూపాలనుంది’

ప్రపంచమంతా ఒకటే, మానవులందరూ ఒకటే అనే
విశ్వమానవ భావన దిగంబర కవుల్లో కనబడుతుంది.

నగర జీవనంపై దిగంబర కవులు దృష్టి పడింది. నగర
జీవితం యాంత్రికంగా మారిపోయిందని వీరు అవేదన
చెందారు.

‘ఈ దేశంలోని ప్రతి నగరం
నవనవలాడే మహా గాయం
దూరం నుండి అది ఎర్రగులాబి
దగ్గరికి వెడితే రక్తస్రావపు వ్రణం’

నగరంలో ప్రజా జీవనాన్ని వారు పడే బాధల్ని, కష్టాల్ని
దిగంబర కవులు ఏకరువు పెట్టారు.

సమాజంలో నివసిస్తున్న పేదలపై దిగంబర కవులు
సానుభూతిని వ్యక్తం చేశారు. భూస్వాములపై తీవ్రమైన
నిరసనను వ్యక్తం చేశారు.

‘అలగా జనం ఆర్తనాదాలను
కుక్కల మొరుగుడని విర్రవీగే
కామాంధుల కళ్ళు పీకమని’ అంటూ పేదలు
భూస్వాములపై తిరగబడాలని ఉద్ఘోషించారు.

ఈ విధంగా సంఘంలో ఊపిరి పీల్చే ప్రతిమనిషి
ఉనికి కోసం తపనపడి అతడి భావిని చేసి వెక్కి వెక్కి

ఆధార గ్రంథాలు :

1. స్వాతంత్ర్యోత్తర కాలాన తెలుగు కవిత - యన్.భక్తవత్సల రెడ్డి
2. తెలుగు సాహిత్య చరిత్ర - ప్రొఫెసర్ వెలమల సిమ్మన్న
3. అభ్యుదయ కవిత్వానంతర ధోరణులు - ఆచార్య పేర్వారం జగన్నాథం
4. ఆధునిక తెలుగు సామాజిక కవిత్వ ఉద్యమాలు - ఆచార్య కేతవరపు రామకోటి శాస్త్రి
5. ఆధునిక తెలుగు సాహిత్యంలో భిన్న ధోరణులు - ఆచార్య కె.కె.రంగనాథాచార్యులు

★★★

ఏడ్చి ఏడ్చెత్తి ప్రవహించిన కవిత దిగంబర కవిత కనుక
ఈ కవితలో సామాజిక స్పృహ వుంది. ప్రియురాలి పదాల
గునగుసల్ని గాక, సాటి మానవుల కష్టాల్ని చూసి
స్పందించిన వాళ్లు దిగంబర కవులు. సంఘంలోని అత్య
ధిక ప్రజలకు ఏది అవసరమో దాన్ని తమ కవితలో
చొప్పించి ప్రజలలో, పాఠకుల్లో సామాజిక స్పృహ కలి
గించారు.

దిగంబర కవుల ప్రభావం తెలుగు సాహిత్యంపై బాగా
పనిచేసి అభ్యుదయ కవిత్వం తర్వాత తెలుగు
సాహిత్యంలో ఏర్పడిన స్తబ్ధతను ‘దిగంబర కవిత్వం’
తొలగించినదని చెప్పక తప్పదు. అందుకే శ్రీశ్రీ

‘దిగంబర కవులు
ముళ్ళ గులాబి పువ్వులు
ఆగ్రహ భార్గవులు
ప్రభువుల శిరసులపై పరశువులు
పగబట్టిన చక్షుశ్రువులు’

అంటూ ప్రశంసించాడు. దిగంబర కవిత్వంలో
‘అశ్లీలం’ అన్న విమర్శ ఎక్కువగా వినబడుతుంది. కానీ
స్వేచ్ఛగా కవులు, కళాకారులు, రచయితలు తమ
అభిప్రాయాల్ని, అనుభూతుల్ని వ్యక్తీకరించడానికి
అవకాశం కల్పించింది, మార్గ నిర్దేశం చేసింది మాత్రం
దిగంబర కవిత్వోద్యమమే. మూడు సంవత్సరాలు
మాత్రమే నడిచినా ఆ దిగంబర కవిత్వోద్యమ ప్రభావం
విప్లవ, స్త్రీవాద, దళితవాద కవిత్వోద్యమాలకు స్వేచ్ఛగా
భావ ప్రకటన విషయంలో మార్గదర్శకమయింది
అనడంలో ఎటువంటి సందేహం లేదు.

జాతీయోద్యమ తెలుగు కవిత్వంలో పాట, పద్యం

- డా॥ కొయ్య శ్రీనివాసులు, తెలుగు విభాగాధిపతి & లెక్చరర్, యస్.టి.యస్.యస్. ప్రభుత్వ కళాశాల, కదిరి.

తెలుగు వారిలో స్వాతంత్ర్యోద్యమ స్ఫూర్తిని రగిలించ జేయడంలో తెలుగు సాహిత్యం పాత్ర అమోఘమైనది. జాతీయోద్యమ నేపథ్యంలో పలు ప్రక్రియల్లో రచనలు వెలువడ్డాయి. తెలుగు వారికి పద్యం అన్నా, పాట అన్నా పంచప్రాణాలు. అందుకే పద్యప్రక్రియలకు తెలుగువారు వెయ్యేళ్లపాటు నీరాజనాలు పలికినారు. పాటను తెలుగు వారు జానపద పాటల రూపంలో బ్రతికించుకుని, ప్రతి సందర్భంలోనూ పాటరూపంలో కైకట్టి పాడడం ద్వారా పాటకు తెలుగు సంస్కృతిలో ఎంత విశిష్టమైన స్థానం ఉందో మనందరికీ అవగతమే. జాతీయోద్యమంలోనూ, విప్లవ సాహిత్యోద్యమంలోనూ, తెలంగాణా ప్రత్యేక ఆవిర్భావోద్యమంలోనూ తెలుగు పాట తనవంతు పాత్ర పోషించింది. తెలుగు సాహిత్యంలో అత్యంత శక్తివంతమైన, ఆకర్షణీయమైన ప్రక్రియల్లో పద్యం, పాట విశిష్టమైనవి.

రాజమహేంద్రవరంలో 1907లో బిపిన్ చంద్రపాల్ స్వదేశీ ఉద్యమంలో భాగంగా సభ ఏర్పాటుజేశారు. ఆ సభలో బిపిన్చంద్రపాల్ ఆంగ్ల ప్రసంగంతో ప్రభావితమైన ప్రసిద్ధ కవి, రచయిత చిలకమర్తి లక్ష్మీనరసింహం పంతులు చెప్పిన పద్యం ఆనాడు ఎంతో ప్రఖ్యాతి చెందింది.

“భరతఖండంబు చక్కని పాడియావు
హిందువులు లేగదూడలై యేడ్చుచుండ
తెల్లవారను గడుసరి గొల్లవారు

పితుకుచున్నారు మూతులు బిగియగట్టి” - దీన్ని సాహితీ విమర్శకులు తెలుగులో వచ్చిన తొలి జాతీయోద్యమ రచనగా పేర్కొన్నారు. చిలకమర్తి వారు ఎంతో జాతీయ భావ స్ఫూర్తితో రచించిన

“చెరసాలల్ పుడు చంద్రశాలలెయగున్, చెదోయి
గిలించున

తెలుగు సాహిత్యం - జాతీయోద్యమ ప్రభావం, ప్రభుత్వ డిగ్రీ కళాశాల, పాకాల - ప్రత్యేక సంచిక

య్యరదండల్ విరిదండలయ్యెడున్, హేయంబైన
చోడంబలే

పరమాన్నంబగు, మోటు కంబళులు దాల్చన్
పట్టుసెల్లాలగున్

స్థిరుడై యేనరుడాత్మ దేశమును భక్తింగొల్చున
వ్యానికిన్”

ఈ పద్యం ద్వారా తెలుగువారిలో జాతీయోద్యమ చైతన్యం నింపటంతోపాటు, తదనంతర కవులకు పరోక్షంగా మార్గదర్శకులయ్యారు.

రాయప్రోలు సుబ్బారావు రచించిన ‘జన్మభూమి’ గేయం ఎంతో చైతన్యాన్ని, స్ఫూర్తిని రగిలించింది.

“ఏదేశమేగినా ఎందుకాదిదిన

ఏ పీఠమెక్కిన ఎవ్వరెదురైన

పొగడరా నీతల్లి భూమి భారతిని

నిలువరా నీజాతి నిండు గౌరవము” - అని

జాతీయాభిమానం రగిలించే కవిత్వం రచించారు. పూర్వ పుణ్యం వల్ల ఈ స్వర్గఖండంలో జన్మించావని ప్రబోధించారు. రాయప్రోలు వారు తన కవితావర్ణనలో దేశతనం, భాషా నిర్మాణంలో మార్గతత్వం పాటించి రచించిన ఈ గేయం జాతీయోద్యమం కాలంలోనే గాక, ఏ కాలంలోనైనా పాడుకోదగ్గ గొప్పరచన. అందుకే ఇది దేశభక్తి గేయాలలో మణిమకుటాయమానంగా నిలిచిన రచనగా స్థిర కీర్తినందుకొంది.

భారత జాతీయతను ప్రబోధించిన కవుల్లో గురజాడ అప్పారావు ఒకరు. ఆయన రచించిన ‘దేశభక్తి’ గేయంలో జాతీయ అభిమానంతో పాటు విశ్వమానవ ప్రేమను ప్రబోధించి సంకుచిత తత్వానికి కూడా సమాధికట్టాడు.

“దేశమును ప్రేమించుమన్నా

మంచి అన్నది పెంచుమన్నా

వొట్టిమాటలు కట్టిపెట్టోయ్
గట్టిమేల్ తలపెట్టవోయ్” - అని ఉద్బోధించిన ఈ
గేయంలో

“సొంతలాభం కొంతమానుకొని
పొరుగువారికి తోడుపడవోయ్
దేశమంటే మట్టికాదోయ్

దేశమంటే మనుషులోయ్” - అని ఎలుగెత్తి
చాటినాడు గురజాడ దేశభక్తి గేయము కొందరి దృష్టిలో
వాచకపుస్తకములలోని నీతులు వంటిది మాత్రమే. కానీ
శ్రీశ్రీ వంటి మహాకవికి “సమస్త ప్రపంచ మహాజనుల
జాతీయగీతం”గా కనిపించింది, వినిపించింది. దేశభక్తికి,
జాతీయతకు సరియైన అర్థమును మనవతా దృష్టితో
రంగరించి రచించిన “దేశభక్తి” గేయం అంతర్జాతీయ
ప్రసిద్ధికెక్కింది.

ప్రముఖ హేతువాద రచయిత, సంఘ సంస్కర్త,
స్వాతంత్ర్య సమరయోధుడు ‘కవిరాజు’గా కీర్తించబడే
త్రిపురనేని రామస్వామి చౌదరి స్వాతంత్ర్య ఉద్యమ
రోజులలో జాతీయోద్యమానికి స్ఫూర్తినిచ్చే అనేక దేశభక్తి
గీతాలు రచించాడు ఆయన రచించిన గేయాలలో
అత్యంత ప్రసిద్ధమైనది.

“వీరగంధముదెచ్చినారము

వీరుడెవ్వడో తెల్పుడీ

పూసిపోదుము మెడను వైతుము

పూలదండలు భక్తితో” అనే ‘వీరగంధము’ గేయంలో

“నడుము గట్టిన తెలుగు బాలు(డు

పాతీపోవండెన్నడున్” - అని సాగే ఈ గేయం చివరలో

“తెలుగు బాలు(డ యింపునింపుము

తెలుగు బాలు(డ పేరు పెంపుము” అంటూ తెలుగు

జాతి వీరజాతి అని, శత్రువులకు వెన్ను చూపలేదని జాతికీర్తి
వైభవాన్ని ఇనుమడింపజేసిన ఈ గేయంలో తెలుగు
బాలలకు దేశభక్తి ప్రబోధం చేశాడు కవిరాజు.

జాతీయోద్యమ కాలంలో పాట ప్రధాన ప్రచార సాధన
మైంది. ఇది విస్తృత స్థాయిలో ప్రజాదరణ పొందింది.

తెలుగు సాహిత్యం - జాతీయోద్యమ ప్రభావం. ప్రభుత్వ డిగ్రీ కళాశాల, పాకాల - ప్రత్యేక సంచిక

కొంతమంది కవులు గాంధీపై మంగళారతులు రచించారు. వారు పద్యకవ్యాలు వెలువడ్డాయి. సంఘ సంస్కరణ, గాంధేయవాదాల సమ్మేళనంతో వచ్చిన కవ్యాలు గొప్ప గౌరవాన్ని పొందాయి. భరతమాత మాతృ స్వరూపం, గతం, దేశభక్తి, స్వాతంత్ర్యోద్యమంలోని ముఖ్య ఘట్టాలు, జాతీయజెండా, మద్యనిషేధం, హరిజనోద్యమం, సహాయనిరాకరణ, ప్రబోధం, రాట్నం, పరాయి పాలన వ్యతిరేకత, జాతీయ నాయకులు మొదలైనవి జాతీయోద్యమ కవితా వస్తువుగా పద్య కవ్యాలు, గేయాలు, పాటలుగా రూపుదిద్దుకొన్నాయి.

వేదుల సత్యనారాయణ శాస్త్రి, దువ్వూరి రామిరెడ్డి, తుమ్మల సీతారామమూర్తి చౌదరి, విశ్వనాథ సత్యనారాయణ వంటి కవిపుంగవులు దేశభక్తి కవిత్వంతో జాతీయోద్యమ తెలుగు కవిత్వానికి పుష్టి చేకూర్చారు.

“శ్రీ గాంధీనమం మరువాం మరువాం

సిద్ధము జైలుకు వెరువాం వెరువాం

శ్రీ గాంధీనే మేము నమ్మేం నమ్మేం

మరి ఇతరులను మేము నమ్మాం నమ్మాం” -
దామరాజు పుండరీకాక్షుడు

వంటి భజన కీర్తనలు గాంధీపై ఎన్నో వచ్చాయి. “జయ గాంధీ దేవా మంగళం జయ మంగళం” అనే మంగళ హారతులు వెలువడ్డాయి.

“కొల్లాయి గట్టితేనేమి - మా గాంధీ కోమలై పుట్టితేనేమి
వెన్నపూసా మనసు, కన్నతల్లీ ప్రేమ - పండంటి
మోముపై బ్రహ్మతేజస్సు

చకచక నడిస్తేను జగతి కంపించేను - పలుకు
పలికితేను బ్రహ్మ వాక్కేను” - అను బసవరాజు అప్పారావు రాసిన గేయం తెలుగు జాతీయోద్యమ కవిత్వంలో గాంధీజీని తిరుగులేని నాయకుడిగా నిల్పింది.

స్వాతంత్ర్యోద్యమ కవిత్వంలో మహాత్మాగాంధీపై వచ్చినంత కవిత్వం మరి ఏ అంశంపైనా రాలేదు. అది గాంధీ నాయకత్వ ప్రభావం, గాంధీ వ్యక్తిత్వ ఔన్నత్యమే కారణం.

మహాత్ముని ఆస్థానకవిగా పేరొందిన తుమ్మల సీతారామ
మూర్తి చౌదరి గారు

“గాంధీయుగమున పుట్టితి, గాంధీ నడుపు
నుద్యంబుల నలిగితి నోపినంత

గాంధీ నీక్షించితిని గాంధీ కవిత వ్రాయ

గంటి నీ జన్మమునకు నీ పాట చాలు” అంటూ

పొంగిపోయారు. తెనుగు లెంకగా సుప్రసిద్ధుడైన ఆధునిక
పద్యకవుల్లో అగ్రగణ్యుడు తుమ్మల సీతారామమూర్తి
చౌదరి, అభినవ తిక్కనగా బిరుదాంకితుడైన తుమ్మల
వారు తెలుగు జాతీయోద్యమ కవిగా అనేక పద్యకావ్యాలు
రచించారు. ఆయన రచించిన “ఆత్మకథ, మహాత్మకథ,
అమరజ్యోతి, సర్వోదయగానము, గాంధీగానము,
మహాత్మాగాంధీ తారావళి, రాష్ట్రగానం, ఉదయగానం”
ఇవన్నీ అచ్చమైన జాతీయోద్యమ తెలుగు పద్యకావ్యాలే

“ఆంధ్రుడవై జన్మించితి

వాంధ్రుడవై యనుభవింపుమీ యుర్విభవం

బాంధ్రుడవై మరణింపుమి

ఆంధ్రత్వము లేని బ్రతుకు నాసింపకుమీ” - అని

“రాష్ట్రగానం”తో జాతీయతా ప్రబోధాత్మకాలైన కావ్యాలు
రచించి తెలుగు పద్యకవిత్వానికి ఆధునికకాలంలో వ్యాప్తి
కలిగించిన మహాకవులలో తుమ్మల శ్రేష్టుడు.

మంగిపూడి వేంకట శర్మ గాంధీ అనుయాయుగా
అభ్యుదయ జాతీయభావాలతో పద్యాలు రాశారు.
అస్పృశ్యతపై మంగిపూడి రాసిన ‘నిరుద్ధ భారతం’
పద్యకావ్యం మొట్టమొదటిది.

“పరతంత్రత సౌఖ్యహరము

పరతంత్రత ప్రాణమాన భంగకరంబున్

పరతంత్రత బహుహేయము

నరకమువలె భరతమాత! న్యాయసమేతా!” - అంటూ

సంస్కరణాదృక్పథంతో ‘శ్రీగాంధీ నామం మరువాం
మరువాం సిద్ధము జైలుకు వెరువాం వెరువాం’ అనే
పాటను ఆనాటి జనం ఒక మంత్రంలా జపించారు.

తెలుగు సాహిత్యం - జాతీయోద్యమ ప్రభావం, ప్రభుత్వ డిగ్రీ కళాశాల, పాకాల - ప్రత్యేక సంచిక

గరిమెళ్ళ సత్యనారాయణ తెలుగు జాతీయోద్యమ
కవిత్వంలో రచించిన “మాకొద్దీ తెల్లదొరతనం” గేయం
చారిత్రాత్మక పాత్ర పోషించింది. అది సామాన్య ప్రజల
వాణిగా స్వాతంత్ర్య సమర శంఖారావంగా మార్చింది.

పల్లవి : మా కొద్దీ తెల్లదొరతనము దేవ

మా కొద్దీ తెల్లదొరతనము

అను పల్లవి: మా ప్రాణాలపై పాంచి

మానాలు హరియించే ||మాకొద్దీ|| -

జానపద బాణిలో సూటిగా హృదయానికి తాకే రీతిలో
గరిమెళ్ళ గేయాన్ని పాడుతుంటే ప్రజలు ఉద్రౌతలూగే
వారంట!

“నూటనలుబదినాల్గు నోటికి తగిలించి

మాటలాడవద్దంటాడు; మమ్ము

పాటపాడవద్దంటాడు; టోపీ

తీసివీపున బాదుతాడు” అంటూ ఆంగ్లప్రభుత్వ
దమననీతిని నిష్కర్షగా ఎదురించాడు.

తెల్లదొరల 160 ఏళ్ల దౌర్జన్యాన్ని కళ్లకు కడుతూ 160
పాదాలుగా సాగే ఈపాట ప్రపంచ సాహిత్యంలో అతి
పెద్దపాటగా చరిత్రకెక్కింది. గరిమెళ్ళ నిజ జీవితంలో
దుర్భర దారిద్ర్య బాధతో అన్న మాటలు “కొందరు
త్యాగం చేయవలె, కొందరు దారిద్ర్యముతో నశించవలె,
పూర్తిగా నాశనమైన గాని దేశమునకు స్వరాజ్యం రాదు”
అంటూ తన యావజ్జీవితం స్వాతంత్ర్య సమరానికి
ధారపోసి, బ్రిటీషు సామ్రాజ్యవాదులను గడగడలాడించి
అనేక ఏండ్లు జైలు శిక్షలు అనుభవించిన తెలుగు
జాతీయకవి గరిమెళ్ళ.

“మా కొద్దీ తెల్ల దొరతనం” గీతాన్ని గరిమెళ్ళ 1922లో
రచించారు ఈ గీతంలో అర్థంకాని పద ప్రయోగం ఎక్కడా
లేదు. మొత్తం గీతంలోనూ చక్కని భావ అన్వయం
ఉంది. ఈ గీతం బ్రిటీష్ వారి పరిపాలనలోని క్రూరత్వాన్ని,
కొటిల్యాన్ని స్పష్టపరిచింది. ఇది వైయక్తికంగా పాడు
కొనేందుకు, సామూహిక స్థాయిలో ఆలపించేందుకు

కూడా చక్కని సాధనమైంది. ఈ గీతంలో ఎక్కడా అభ్యర్థన, ప్రాధేయపడడం వంటి లక్షణాలు లేవు. ప్రజల్ని చైతన్యవంతుల్ని చేసి జాతీయోద్యమంలో పాల్గొనే విధంగా తీర్చిదిద్దాలనే తపన గరిమెళ్ల గీతంలోని ప్రతి అక్షరం ప్రతిబింబిస్తుంది. కొన్ని వందల పుటల మహాకావ్యానికి దక్కే కీర్తి కన్నా, కొన్ని పంక్తుల్లో ముగిసిన ఈ పాటకు ఎక్కువ ప్రఖ్యాతి లభించింది. ప్రసిద్ధ జాతీయ నాయకులుగా పేరుబడసిన వారు తీసుకురాలేక పోయిన చైతన్యాన్ని గరిమెళ్ల తన పాట ద్వారా తీసుకొచ్చారని సాహితీ విమర్శకుల అభిప్రాయం. శ్రీశ్రీ తన వచన రచనల్లో గరిమెళ్ల గీతానికి మనమైన కితాబునిచ్చారు.

వడ్డాది సీతారామాంజనేయులు, శ్రీ పూడిపెద్ది కాశీవిశ్వనాథ శాస్త్రి కలసి రచించిన “దండాలు దండాలు భరతమాత” గేయం ఎంతో ప్రాచుర్యం పొందింది. ఆ పాట ఆంగ్లేయుల పాలనను విశదపరుస్తుంది.

“దండాలు దండాలు భారతమాత

నీవందుకొని దీవింతు భారతమాత

కుంభినీ వాడు దిగినాక భారతమాత

మాకొంపల్ని కూల్చినాడే భారతమాత” - అంటూ సాగే

ఈ గేయంలో “కుంభినోడ్ని కూలదోసి భారతమాత నీ కొంప నిలబెడతారు భారతమాత” జంటకవులు ఏనాటి కైనా స్వాతంత్ర్యం వస్తుందని ఆశాభావం వ్యక్తం చేశారు. వడ్డాది కవి స్వాతంత్ర్యోద్యమంలో కూడా పాలు పంచు కొన్నారు. భావకవిత్వంలో చిరస్థాయిని అందిన కవిత్వం రచించిన దేవులపల్లి కృష్ణశాస్త్రి రచనల్లో కూడా దేశభక్తి ప్రవహించింది.

“జయ జయ జయ ప్రియభారతి

జనయిత్రీ దివ్యధాత్రి!

జయ జయ జయ శత సహస్ర

నరనారీ హృదయ నేత్రీ!” - అంటూ ఆయన రచించిన గీతం ఎంతో ప్రసిద్ధి చెందింది.

“స్వాతంత్ర్య రథం! స్వాతంత్ర్య రథం

అదిగదిగో అదే అదే అదే

తెలుగు సాహిత్యం - జాతీయోద్యమ ప్రభావం, ప్రభుత్వ డిగ్రీ కళాశాల, పాకాల - ప్రత్యేక సంచిక

స్వాతంత్ర్య రథం! స్వాతంత్ర్య రథం

శీత ధరాధర నేత్రవంతర నర

నారులతో స్వాతంత్ర్య రథం” గేయం కూడా దేవులపల్లి కలం నుండి జాలువారిందే!

ప్రసిద్ధ కవి దువ్వూరి రామిరెడ్డి “మేలుకో భారత కుమారా మేలుకోరా తరుణధీరా” అనే గేయాన్ని రచించారు. స్వాతంత్ర్య సమరయోధుడు దుగ్గిరాల గోపాల క్రిష్ణయ్య గుంటూరు జిల్లా చీరాల - పేరాల సత్యాగ్రహంతో ప్రసిద్ధులు, ఆయన స్వయంగా చక్కని కవి అనాటి జాతీయోద్యమానికి ఉపకరించే గీతరచనలు చేశారు. ఇవి భజనపాటల రూపంలో ఉన్నాయి. “ముప్పుయి కోట్ల ప్రజల రాంభజన, పంజర బంధమైనారు రాంభజన....” అంటూ దుగ్గిరాల వారు జాతీయోద్యమ కవిత్వాన్ని రచించి సమకాలీన ప్రజల చైతన్యానికి ప్రత్యక్షంగా కారకులయ్యారు.

గుర్రంజాషువా గాంధీని భార్యాబిడ్డలున్న ప్రత్యక్ష దైవంగా కీర్తించాడు. కనుపర్తి వరలక్ష్మమ్మ, సుబ్రహ్మణ్య భాగవతులు గాంధీపై దండకాలు రచించారు. దాదాపు ఇరవైమంది దాకా గాంధీ శతకాలు రచించారు. అనాటి నిజాం సంస్థానానికి చెందిన రత్నమ్మ దేశాయ్ అనే కవయిత్రి గాంధీజీపై మంగళహారతి రచించారు. మొత్తం మీద గాంధీ యుగంలోనే ఎక్కువ సంఖ్యలో జాతీయోద్యమ, దేశభక్తి గేయాలు వచ్చాయి. ఈ సాహిత్యానికి ప్రేరకుడు గాంధీ కావడం గమనార్హం.

మంగిపూడి పురుషోత్తమ శర్మ గారు “పాలి పాలి; బలిబలీ” అను పాటలో “మాబేధభావములు మంట కలిపేశాము మమ్ముమన్నింపుమమ్మా! మాతల్లి మమ్మా దరింపవమ్మా” అంటూ స్వరాజ్య దేవతను ప్రార్థించాడు.

మాతృభూమిని దాస్యశృంఖలాల నుండి విముక్తి చేయించాలని ఎందరో తపాతపాలాడారు. దేశం కోసం ఆత్మార్పణ గావించుకున్నారు. తెలుగు కవులు ఆ పవిత్ర యజ్ఞంలో పాలుపంచుకొన్నారు. తమ కలాల్ని తుపాకీలుగా చేసుకొని ప్రబోధ గీతాల్ని తూటాలుగా ఆంగ్లేయు

లపై పైకి వదిలారు. ఎందరో కవులు జాతీయోద్యమ కవితారథ సారధులై ఎన్నో కావ్యాలు, గేయాలు, రచించి ప్రసిద్ధి పొందారు, కొంతమంది కవుల కొన్ని గీతాలు మాత్రమే, వెలుగులోకి వచ్చాయి. ఎందరో కవులు అజ్ఞాతంగా ఉండిపోయారు. మొత్తం మీద జాతీయోద్యమ కవిత్వంలో “నాయకస్మృతి, నాయకస్మృతి, ప్రాచీన వైభవ సంస్మరణం, జాతీయోద్యమం పట్ల ప్రజల్ని, ఆకర్షితుల్ని జేసేలా ప్రచార గీతాలు రాయడం, భరతమాతస్మృతి”, వంటి అంశాల మీద మాత్రమే గాకుండా గ్రంథాలయోద్యమం, అక్షరాస్యత, మద్యపాన నిషేధం, మహిళాభ్యుదయం, హరిజనోద్యమం పట్ల కూడా కవులు పద్యాలు, గేయాలు రచించి ప్రజలలో చైతన్యానికి కారకులయ్యారు.

జాతీయోద్యమ కవిత్వంలో భాగంగా ఎంతోమంది కవులు పద్యకావ్యాలు రచించారు. వారిలో బలిజేపల్లి లక్ష్మీకాంతం రచించిన “స్వరాజ్య రథము, స్వరాజ్య సమన్య” కొండవర్తి వీరభద్రాచార్యులు “భారత దర్పణము” దుగ్గి రామ్మూర్తి “స్వాతంత్ర్య ప్రదర్శనం” భానుమూర్తి “భారతి ప్రదర్శనం” దుర్భాక రాజశేఖర శతావధాని “రాణా ప్రతాప్ సింహ చరిత్ర” గడియారం

వేంకట శేష శాస్త్రి “శివ భారతం” వంటి కావ్యాలు తెలుగు సాహిత్య చరిత్రలో చిరస్థాయిగా నిలుస్తాయి.

ఆంధ్రోద్యమ కవిత్వం కూడా జాతీయోద్యమ కవిత్వంలో భాగమైంది రాయప్రోలు, విశ్వనాథ, తుమ్మల, ఏటుకూరి వెంకట నరసయ్య, పుట్టపర్తి, ఆంధ్రుల గత వైభవాన్ని చాటుతూ ఆంధ్రాభిమానాన్ని ప్రబోధించారు. హంపీ క్షేత్రం, రామచంద్రుని హంపీ యాత్ర, ద్రాక్షరామం, పెనుగొండ లక్ష్మి వంటి పద్య కావ్యాలు పేర్కొనదగినవి.

జాతీయోద్యమ కవిత్వం 1947 ఆగష్టు 15తో ఆగిపోలేదు. అటు తర్వాత కూడా అట్లాగే సాగింది. అయితే అప్పటికీ అటు తర్వాత కాలానికి సంకల్పాల్లో తేడాలున్నాయి. జాతీయోద్యమ కాలంనాటి కవుల లక్ష్యం స్వాతంత్ర్య సముపార్జన ప్రధాన లక్ష్యమైతే, స్వాతంత్ర్య సంతరం నాటి జాతీయోద్యమ కవిత స్వాతంత్ర్య ఫలాలను కాపాడు కొనే ప్రయత్నం, ఆ ఫలాల్ని అందరికీ అందివ్వాలనే తపనను ప్రదర్శించారు. ప్రాచీన తెలుగు కవితా ప్రక్రియలైన పాట, పద్యం జాతీయ కవిత్వోద్యమంలో ప్రజల్ని చైతన్య పరచడానికి కవులకు గొప్ప సాధనాలుగా పనికొచ్చాయని చెప్పవచ్చు.

ఆధార గ్రంథాలు :

1. తెలుగు సాహిత్య చరిత్ర - డా॥ ద్వా.నా.శాస్త్రి
2. తెలుగు సాహిత్య సమీక్ష - ఆచార్య జి.నాగయ్య (రెండవ సంపుటం)
3. జాతీయోద్యమ కవిత్వం - మద్దూరి సుబ్బారావు
4. తెలుగు సాహిత్య చరిత్ర - ప్రొ॥ వెలమల సిమ్మన్న
5. తెలుగు జాతీయోద్యమ దేశభక్తి - డా॥ కొయ్య శ్రీనివాసులు సాహిత్యం - సమకాలీనత (భావవీణ - ఆగష్టు 2020)
6. ఆధునికాంధ్రకవిత్వం - సంప్రదాయాలు, ప్రయోగాలు - ఆచార్య డా॥సి.నారాయణ రెడ్డి





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Foundations of physical education – Biological aspect

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ABSTRACT

Biology is a science which deals with life and life processes, all living beings are naturally active. The major differences between the animate and inanimate things are that the former can generate their own power movement while the latter cannot. Biology tells us that even the plants having the lowest form of life move and grow. Such movements of the body by which development of the total body is precipitated are called developmental activities. Education and learning are aspect of growth. Acquisition of more knowledge and skills points toward better growth of an individual.

Keywords: Biology, Life processes, Living beings etc.

INTRODUCTION

Biology is a science which deals with life and life processes. This includes zoology (the study of animal life), Botany the study of (grass and vegetation-life), microbiology (small life science). Man is a biological entity and the human life has been considered as the most developed form of life. This science has revealed to us an irrefutable fact that man such as other animals has a long and natural evolution. It is long way that man has travelled from the primitive type of existence to the present highly complex life.

The name of Darwin the great naturalist and scientist is very closely associated with the science of biology especially in the interpretation of human evolution. He put forth certain hypotheses which are of utmost importance in understanding evolutionary processes in human life. He says that in the course of evolution man's ancestors lost certain characteristics either fully or in part a keen sense of smell the hairy covering on the body the majority of the dermal muscles the tall prehensile feet pointed ear lobes etc. In discussing the cause that led to the erect mode of locomotion Darwin assumed that a change of feeding was of great importance. This occurred when our

ancestors began to spend more and more time on the ground in search of food.

Biology has revealed to us quite clearly as to what changes took place in human physique in the long span of biological evolution. The changing environment on the earth forced the changes in human body which subsequently brought innumerable changes in his mode of walking, running, climbing, hitting, leaping, bouncing, thinking, and understanding his environment the evolution as not come to an end and it is gradually and imperceptibly going on. Perhaps none can predict what shall be the final outcome of such an unceasing process not only on the surface of the earth but also in human body as well.

ACTIVITY-AS THE BASIS LIFE

All living beings are naturally active. The major differences between the animate and inanimate things are that the former can generate their own power movement while the latter cannot. Biology tells us that even the plants having the lowest form of life move and grow. As and when the power of moving ceases, man ceases to live. Movement is born with living beings and life is characterized by movement. All functions of the organism-unicellular or multi cellular depend on movement. The movement starts in an individual right from the very moment of conception. These are two types of activities

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which form the basis of our life (a) Survival activities and (b) Developmental activities.

SURVIVAL ACTIVITIES

Such movements in the body without which the organism cannot survive are called survival activities. Beating of the heart, respiration, circulation, peristalsis etc. are some of the instances of these activities, heart never stops beating nor do lungs stop dilating and contracting, if they do even for a second, the organism is dead. Ordinarily, these activities are spontaneous, natural, and need no stimulation; these are involuntary and cannot be kept under conscious control. Often these are termed as biological reflexes. If at any stage one or the other of these activities stops, the existence of the organism is put into jeopardy. Ideal state of health cannot be ensured until and unless all these functions of the body are efficiently carried on. For this purpose, one shall have to depend on developmental activity.

DEVELOPMENTAL ACTIVITIES

Such movements of the body by which development of the total body is precipitated, are called developmental activities. These activities as supposed to survival activities are conscious and within voluntary control of the individual and are generally the result of the external stimulation. Due to the survival activity and hidden forces, an organism has to grow but it will not acquire any qualitative change or efficiency without indulging in developmental activities such as running, jumping, climbing, bouncing, and hitting. These activities are the legacy of our primitive life. Not only did they provide ancient human beings with an opportunity to procure food by running after and killing wild animals but also increased the effectiveness of body in combating the forces of nature aiming at this extinction. Muscles gain strength good reaction time etc. only through such activities which are vigorous and enhance the capability of the body to act react and even counter-act.

This has also to be borne in mind that the qualitative change in survival activities is only possible when there is sufficient and vigorous developmental activity especially in the modern age. He shall see later that the vital organs concerned with survival activities cannot be stimulated to bear heavier load unless limbs are desirably exercised.

GROWTH AND DEVELOPMENT- CONSEQUENCES OF PHYSICAL EXERCISE

Growth and development of the human organism are generally used interchangeably without being properly understood.

Ordinarily, the term growth refers to the increase caused by becoming larger and heavier as we generally talk of the enlargement of the muscles elongation of the skeleton and growth of the body in general. Growth denotes increase and enlargement of the limbs and organs. It can be measured quantitatively in points, pounds, and inches. The heart grows and becomes larger and heavier. The body grows in height, weight, and volume.

A person can develop even after his physical growth has topped and maturity attained. He can develop optimally by making fullest use of the capacities; he has biologically inherited. He can acquire many skills and habits. The development of the body from the physical point of view can easily be noticed in the trainees at a physical training institute or at place where exercise is a regular feature of the daily routine. Intellectually, he develops by becoming more broadminded and acquiring vast knowledge by rigorous study. Quantitative and qualitative changes in human organism at various levels of age can easily be visualized by comparing children with adults from the point of view of body structure, mental growth, and skills.

Moreover, it is imperative that the principles of growth and development may be widely known by the physical educator so that he could construct his curriculum accordingly.

PRINCIPLES OF GROWTH AND DEVELOPMENT

- Growth is a creative process in that it increases behavior-variability. As a child grows year by year, marked changes can be seen in his behavior. His natural behavior to instinctive behavior is canalized into variable type of behavior the one he acquires from society.
- Mental growth is dependent on changed structure and experience. A child a small organism is not capable of doing mental acrobatics like an adult who has fully grown and has accumulated rich
- Growth in some direction is inevitable. This denotes that a living organism has to grow come what may. The organism must become bigger though it might not have development due to lack of nutrients and other environmental factors.
- Characteristically, children are ego-centric and mature persons are socio-centric. In childhood, no individual can resist the inner drives but gradually with the growing in years, every one learns to be conscious of society around him and so behaves accordingly.
- Growth is the result of interaction of the organism with his environment. Leaving aside the germ-plasma all other factors which turn a speck into full grown adult come from environment.
- Patterns of behavior tend to follow an orderly sequence of appearance. Each child learns to sit before he can stand

draws a circle before he can draw a square etc. In each case, there is an orderly sequence of behavior which cannot be over-looked.

- Heredity sets limits for development in terms of potential even if environmental factors such as good food, Exercise etc. are sufficiently available; an organism cannot grow beyond the limits, heredity has already set in regard to various species. This also elaborates that a mouse can in no case gain enormity of an elephant. This factor is one of the most important factors in the choice in suitability of activities for individuals and groups.
- The effect of training varies with the stage of maturation, this is more important for a teacher of physical education due to various characteristics physical, mental, and social appearing at various levels of age the effect of an exercise and that of a skill invariably varies on each individual. Certain motor skills can only be learnt and others learnt at a particular period of time. At the same time, there are skills which involve a high degree of complexity and cannot be effectively learnt in the early years if the process is reversed the effect of the skill on the individual would be annoying rather satisfying.
- Growth proceeds most rapidly in the early years. With the advancing of organism in years, the speed of growth goes on slowing down. One of the psychologists tentatively calculated that if the rate of growth that a human embryo

has during the first 6 months continued as it is for 25 years without any impediment in the way the human organism would become as big as the whole solar system. Thus, nature has kept a system of checks and balances.

- Each individual has his own rate of growth. In some child, sex grow faster while others lag behind some mature earlier whereas others are still childish at age of eighteen and even after. That is, each individual is individuality in him and so is his pattern of growth.
- Growth is characterized by fluctuation. Many factors should be held responsible for fluctuation in growth. In general, the early childhood and puberty are the period of faster growth whereas later childhood and adulthood are periods of consolidation. Then, slowly the growth tapers off. Nutrition, happiness, and good environment are conducive to growth. If such factors are constant, there would probably be less fluctuation in growth
- Education and learning are aspect of growth. Acquisition of more knowledge and skills points toward better growth of an individual.

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IMPORTANCE OF LIFE SKILLS IN HIGHER EDUCATION

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ABSTRACT

The paper would discuss the importance of Life skills in Higher Education to empower the youth with abilities to surpass not only employment crisis but also the crisis they go through in their lives. The current higher education system prepares youth for financial stability and standard of living but still facing challenges in preparing them for psycho social stability. Life skills are “the abilities for adaptive and positive behavior that enable individuals to deal effectively with the demands and challenges of everyday life “. It is imperative today seeing the rising number of cases of Depression, drug addiction and suicide that the youth is not fully equipped in dealing with failures and emotional setbacks. The global platforms like WHO and UNICEF have understood the significance of Life Skills in Education and keep discussing around the challenges it faces and suggest measures to overcome it.

Life skills are important for everyone, especially students with different life experiences, financial situation and skill levels. You may not have the basic skills needed for difficult aspects of work or adult life Higher education is clear that the global competitiveness and job creation potential of Indian industries depend on the skills and skilled work force required. Higher education should be accessible and accessible to everyone it should be emphasized that the adaptability of higher education system must be strengthened to continue to provide skills and skilled workers. Improving the skills of those involved in higher education can make a significant contribution to placing higher education at the center of our society. In many ways, scholars have serious doubts about the direction of our society. Life skills help students get to know themselves better, live more consciously achieve personal satisfaction and achieve personal and scientific goals.

Key words: Life skills, Personal skills, Higher Education, skill Development.

Introduction

In the new millennium, education is undergoing a revolutionized change regarding science & technology, globalization, privatization, urbanization, industrialization, etc. Today’s youth are facing many emerging issues such as global warming, famines, poverty, suicide, population explosion as well as social, emotional, physical and psychological issues. Cut-throat competition, unemployment, lack of job security, etc. are some of the major concerns for the educated and as a result, they are caught in the mad race. No one has time for his/her ‘self’, to develop empathy with surrounding and to have harmony in society. Young mind is being considered, as the most productive members of the society, due to their physical and intellectual capability. But in real scenario, most of them are unable to utilize their potential in an appropriate way due to lack of guidance and motivation. Social problems like alcoholism, drug abuse, sexual abuse, smoking, juvenile delinquency, anti-social acts, etc. have an adverse effect on them and others too, to a large extent. This new challenge requires immediate and an effective response from a socially responsible system of education. Education, now a days is hence, very important, but the kind of education, to support and live life better is more important. Thus, the cardinal focus of Education, therefore, needs an extraordinary emphasis on developing such skills in students, as they are the important building blocks for a dynamic citizen, who can cope up with future challenges, and survive. Central Board of Secondary Education (CBSE) India has recognized this fact that it is necessary to develop scholastic as well as co-scholastic areas, and hence, has made life skill education as a compulsory element in its curriculum. It has been felt, that life skills education bridges the gap between basic functioning and capabilities. It strengthens the ability of an individual to meet the needs and demands of the present society. Thus, a relevant life skill education helps in dealing with the above issues in a manner to get desired behavior practical.

Review of Literature

The topic has been a significant area of interest to the researchers, theorists, and practitioners, and there have been numerous researches carried out to emphasize the importance & effectiveness of life skills education in the development of students’ social, emotional and cognitive development &

dealing with their psychosocial problems and issues. According to Albertyn et al. (2004) life skills training enhance critical thinking abilities, which further impacts were living life actively, being responsible in the job and in future planning too. Ramesh and Farshad C. (2004) in his study proved the effectiveness of like skills training in increasing mental and physical health, pro-social behavior and decreasing in behavioral, social problems & self-destructive behaviors. Smith & et al., (2004) noted significant improvement in interpersonal relationship and reduction in aggression and behavioral problems. Tuttle et al., (2006), during their investigation, add the life skills to students' curriculum. The results of this study suggested the extraordinary capability of teens to positive promotion and flexibility. Vranda and Rao (2011) proved that life skills training enhanced their psychosocial Competencies. Puspakumarag (2013) in his study showed that life skills training was effective in preventing a wide range of problems such as substance abuse, teenage pregnancies, violence Bullying & to promote self-confidence and selfesteem among the adolescents. Roodbari, Sahdipoor, and Ghale (2013) in their research showed that life skills training has a positive effect and improves social development, emotional and social adjustment, suggesting an increase in compatibility of children and public health. The present paper focuses on how enhancing social, emotional and thinking skills through life skills education, helps the 21st- century youngsters to achieve their goals strengthens the abilities to meet the needs and demands of the present society and be successful in life

Importance of life skills in Higher education

If we want to live life successfully, then we need to understand the importance of life skills. And it is also very important to implement it in our life. If this happens then our life can move in a simple and right direction. Life skills make us competent to know how to make our life easy and simple, how to create a positive life, how life can be spent in the right way. Therefore, life skills are very important in our life.

It polishes the ability to adapt to all kinds of circumstances and succeed in every aspect of the society. Lack of life skills in the lives of new generations needs to be taken care of as it is important in life. Due to absence of life skills, not only personal lives but professional lives and careers get affected.

By educating life skills, students can develop self confidence in them. It makes them cooperative and communicative. It prepares them to take quick action in any unfavorable circumstances.

Types of life skills

There are two types of life skills which need to be taught to students. The first one is General Life Skills and the other is High Level skills. And under these skills comes a variety of skills which are the following.

General skills

- ❖ Confidence skills.
- ❖ Decision-making skills.
- ❖ Stress alleviation skills.
- ❖ Adjustment skills in adversity.
- ❖ Self-awareness skills.
- ❖ Skill of negative tendency towards wrongdoing.
- ❖ Positive behavior.
- ❖ Critical Thinking.
- ❖ Society's skills towards each other.
- ❖ High level skills
- ❖ **The following skills are covered under high level skills.**
- ❖ Excellent warmth and high mental level.
- ❖ Way of thinking.
- ❖ Mental and physical relaxation.
- ❖ Goal Setting and Problem Solving.
- ❖ Communication.
- ❖ Social support.
- ❖ Standard of living with health.

Aims of Development of Life Skills

Following are the objectives of development of life skills.

- ❖ The purpose of social development.
- ❖ Development of experimental knowledge.
- ❖ The purpose of the development of adjustment power.
- ❖ Objective of development of life values.
- ❖ Objective of mental development.
- ❖ Of all-round development

Essential Life Skills Everyone Should Learn

Developing life skill is important and every life skill has its importance to apply in life. Following are life skills:

1. **Self-Awareness Skills:** By developing the Self-awareness skill, one can be aware of his/her doings. They will be aware of their own performance and their behaviours which will make them competent to handle any situation. A person will get to know his feelings for things or towards other people. It also helps them to make sound decisions.
2. **Empathy and Sympathy Skills:** With Empathy, a person will be able to understand other people's perceptions, their feelings, and circumstances any person is in. It simply put them in someone's place to understand their actual emotions. It helps them to react accordingly. With sympathy, a person will be able show appreciation and compassion towards other people and their emotional reaction.
3. **Problem-Solving Skills:** The life skill of problem-solving makes an individual to trace a problem, suggesting options to solutions, evaluate the solutions to pick the best solution, and then apply the solution to the problem within the time limit. It is one of the most important life skills to practice in life on an everyday basis.
4. **Decision-Making Skills:** Every now and then, an individual has to face times when they have to make a decision which can affect their life. With decision-making skills, a person develops a skill to make the right and appropriate decision and pass it on. Decision making enables them to take decisions in any hard and fast situation.
5. **Thinking Skills:** Developing thinking skill is very important as it is the mental activity by which an individual can process information, use experiences, make relationships, finalize solutions to problems, pass on decisions, ask questions, and suggest new ideas.

Thinking skills are of four types:

- a. **Analytical Thinking Skills:** It is a visual thinking skill which makes an individual competent to break complex problems into manageable components to solve it effectively.
- b. **Divergent Thinking Skills:** With Divergent thinking skill, one can generate creative ideas after working on or exploring many possible solutions. It is a spontaneous and free flow thinking.
- c. **Creative Thinking Skills:** Creative thinking skill helps a person to create something new. It also allows their brain to explore things and look at things in creative ways to suggest creative solutions. Creative thinking is infused with imagination and it does not involve logical reasoning.
- d. **Critical Thinking Skills:** Critical thinking skill is opposite to creative thinking skill. It is the ability to make a difference between fake truth and real truth, judgement and opinion. It prepares a person to think rationally and prepare to build trust on right and to avoid wrong.
6. **Communication skills:** Without proper communication, you cannot express and make people understand your thinking and it can be made possible by developing communication skills. It helps them to convey people in a very convincing and clear way. It develops confidence in people as well and good communication skills helps them in the professional environment too.
7. **Interpersonal Skills:** Interpersonal skills are basically the interaction skills and social skills. This skill prepares an individual to communicate socially in person or in group. These skills have traits such as self-confidence, critical thinking, communication skills, active listening, leadership etc. To develop interpersonal skills, one needs to start their day with an optimistic approach towards the day.

8. **Accepting Criticism Skill:** Accepting criticism is not easy but by developing this particular skill, one will be able to open to constructive criticisms and improve themselves according to that criticism. An individual should keep their emotional side and accept the truth to work on it. Students have to understand that not only studies will give them success, they will also have to develop their skills.

Conclusion

Life skills are very important and integral part of educational system worldwide. Higher education has the potential to deliver skills and research for productivity and innovation. It is important to remember that Education with life skills is not another subject but it humanizes education. It helps to organize thinking and effort to achieve a goal. Once an Action Plan has been developed, especially in the curriculum, it can be developed spirally, in depth and width. A lot of thought requires to be given on how to bring in life skills education into the mainstream curriculum. Our educational policies and the subsequent curriculum frameworks all along have emphasized the need for Life skill Education. It is also true that in order to be effective; there must be clearly defined and definite focus, direction and commitment for fostering life skills. These can be acquired every moment and every day of our lives. Life skills are essentially those abilities that help promote overall wellbeing and competence in young people as they face the realities of life. They are the beginning of wisdom which focuses on behavior change or developmental approach designed to address a balance of three areas-knowledge, attitude and skills. These skills enable individuals to translate knowledge, attitude and values into actual abilities-i.e. what to do and how to do it, given the scope and opportunity to do so. Promoting efficient life skills training programme in higher education would thereby be an ode to the youth in the country. It would be a way of empowering youth to build their lives and their dreams. It would be a means of handholding them through the critical stages in their life and helping them tap their potential to the fullest. Thereby, it is hoped that the current education system with its oppressive rigidity would open up and make life skills education a part of its mainstream curriculum. This would enable the country to build individuals who believe in themselves, who are efficient leaders and administrators, who are able to understand their potentials and achieve them.

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**ROLE OF SHGs ON WOMEN ENTREPRENEURSHIP IN ANANTAPUR DISTRICT OF
ANDHRA PRADESH**

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Abstract

The paper aims to study about the SHGs functioning in Dhramavaram, Kothacheruvu of Anantapur District. Even though Anantapur is considered as drought prone area the level of participation of women in entrepreneurial activities is more. The basic occupation of the district is agriculture, the district is also famous for weaving of sarees. The women in rural areas are showing interest to become entrepreneurs because there is lot of financial facilities from the SHGs. SHGs are self-governed with decisions about production and marketing taken collectively, although the group leader is responsible for identifying potential marketing centers and consumer in formal groupss. Informal groups empower rural women to manage rural industries and make decisions collectively for their common economic interests. The encouragement of women towards entrepreneurship leads to the development of the nation as they constitute half of the population. The study reveals the reasons for which they wanted to become entrepreneurs, the problems faced by them in the context of carrying out the entrepreneurial activities and suggestions to overcome the problems.

Keywords: Self Help Groups, Entrepreneurship, Women Entrepreneurship

I. Introduction

The word 'entrepreneur' has been taken from the French language where it cradled and originally meant to designate an organizer of musical or other entertainments. Oxford English Dictionary (in1897) also defined an entrepreneur in similar way as "the director or a manager of a public musical institution, one who 'gets-up' entertainment, especially musical performance". In the early 16th century, it was applied to those who were engaged in military expeditions. It was extended to cover civil engineering activities such as construction and fortification in the 17th century. It was only in the beginning of the 18th century that the word was used to refer to economic aspects. The educated women do not want to limit their lives in the four walls of the house. They demand equal respect from their partners. However, Indian women have to go a long way to achieve equal rights and position because traditions are deep rooted in Indian society where the sociological set up has been a male dominated one. Women are considered as weaker sex and always made to depend on men folk in their family and outside, throughout their life. The Indian culture made them only subordinates and executors of the decisions made by other male members, in the basic family structure. While at least half the brainpower on earth belongs to women, women remain perhaps the world's most underutilized resource. Despite all the social hurdles, India is brimming with the success stories of women. She has competed with man and successfully stood up with him in every walk of life and business is no exception for this. These women leaders are assertive, persuasive and willing to take risks. They managed to survive and succeed in this cut throat competition with their hard work, diligence and perseverance. Ability to learn quickly from her abilities, her persuasiveness, open style of problem solving, willingness to take risks and chances, ability to motivate people, knowing how to win and lose gracefully are the strengths of the Indian women entrepreneur. The origin of SHGs is from the brainchild of Grameen Bank of Bangladesh, which was founded by Mohammed Yunus. SHGs were started and formed in 1975. In India NABARD had initiated in 1986-87. But the real effort was taken in 1991-92 from the linkage of SHGs with the banks. A SHG is a small economically homogeneous affinity group

of the rural poor voluntarily coming together to save small amount regularly, which are deposited in a common fund to meet members emergency needs and to provide collateral free loans decided by the group. SHGs are working in democratic manner. The upper limit of members in a group is restricted to 20. Among them a member is selected as an 'animator' and two members are selected as the representatives. The animator is selected for the period of two years. The group members meet every week. They discuss about the group savings, rotation of sangha funds, bank loan, repayment of loan, social and community action programmes.

Self Help Group and Entrepreneurship

Self help group and entrepreneurship are very much linked together, self help group draws mainly from the motivation and built confidence as being the part of the group. The entrepreneurship development is directly linked to the creation of the Self Help Group. The successful creation of the SHG eventually bolsters women to take initiative of an entrepreneur. Woman, while being in the family and limiting self from interacting with the large world and so with opportunities, are being provided with the financial, social and economic support from the group of self help, if not family. Virtual presence of the other group members help woman to come out of the gender segregated patriarchal walls of limitation. The outside world does provide an industrial climate to women where they can assert for self and start venture of their choice. The support of SHG also ensures the financial backing from the group and bank with which the SHG was associated with. Also on the other hand, the state and central government also plan for the upliftment of the processes of equitable economic development which can be gained through the active participation of women in either already job places for creating job for self and others. Hence, the plans of the state government for microfinance and other initiation for creating an atmosphere for the development empower women to take part in the initiatives of entrepreneurship.

Review of Literature

Self Help Groups are institutions of the women empowerment. Though they are spread all over the country but in Andhra Pradesh, these were formed under an experiment in rural development with the special focus on women empowerment. Galab and Rao (2007) assess the SHGs and found that the creation of such models of empowerment includes poorest of poor (like specially displaced persons, migrant agricultural labour). While within the gambit of organization in the large and small groups, Sangeeta Purushothaman (2007) concludes that it is better to organize grass root women's organization in order to help them to develop to negotiate development issues affecting them with the political class at the regional and state level. The another level of analysis of the state and central government in the promotion of such an organization of the women that promotes entrepreneurship development is studied by Seth (2001) and Verma (2007) also emphasizes the need of overhaul of existing structure and showing interest to become entrepreneurs because of availability of financial support from the SHGs, Government schemes are more. Among the selected mandals Dharmavaram is famous for weaving of sarees, C.K.Palli is famous for trading activities businesses. In present study is focused to know about the factors responsible to become women entrepreneurs.

Objectives of the Study

The study was planned with the following objectives:

1. To evaluate the factors responsible for encouraging women to become entrepreneurs
2. To understand the problems and prospectus encountered by women
3. To suggest suitable measures for strengthening women entrepreneurs

Methodology

The study is undertaken in the rural areas of Anantapur district. Dharmavaram & Kothacheruvu were selected from Anantapur district for the present study. Both primary and secondary data were used to gather information. Primary data is enumerated from a field survey in the study region. Secondary data is collected from NGOs' reports and other documents from DRDA, Government reports for the study. Convenience sampling is used for selection of groups. Due to the members are large in each group sample respondents were randomly selected for data collection. 100 SHG group members have been selected for the data collection from two areas of the Anantapur District. To draw the meaningful results statistical tools like tables, graphs, percentages and correlation were used.

Reasons For Becoming Women Entrepreneurs

The glass ceilings are shattered and women are found indulged in every line of business. The entry of women into business in India is traced out as an extension of their kitchen activities, mainly 3P's Pickle, Powder and Pappas. But with the spread of education and passage of time women started shifting from 3P's to modern 3E's i.e., Energy, Electronics and Engineering. Skill, knowledge and adaptability in business are the main reasons for women to emerge in to business ventures. Women Entrepreneur is a person who accepts challenging role to meet her personal needs and become economically independent. A strong desire to do something positive is an inbuilt quality of entrepreneurial women, who is capable of contributing values in both family and social life. With the advent of media, women are aware of their own traits, rights and also the work situations. The challenges and opportunities provided to the women of digital era are growing rapidly that the job seekers are turning into job creators and are flourishing as designers; interior decorators, exporters, publishers, garment manufacturers and still exploring new avenues of economic participation. The following are the reasons to women becoming entrepreneurs

- Innovative thinking
- Education and qualification
- Self identity and social status
- Employment to others
- Role model to others
- Government programmes and policies
- Support of family members
- Need for additional income
- Family occupation
- Economically independent

Problems Faced by Women Entrepreneurs

Basic problems faced by women entrepreneurs are listed below

- Male dominated society
- Mobility
- Lack of financial support
- Low risk bearing capacity
- Marketing problems
- Family tie ups
- Low faith of creditors
- Credit worthiness
- Limited managerial ability
- Lack of education

- Lack of self confidence
- Obsolescence of technology & resulting increase in cost of production
- Lack of entrepreneurial aptitude

Age Group of Women Entrepreneurs in Dharmavaram & Kothacheruvu.

Table 1:

Age (in years)	Dharmavaram		Kothacheruvu	
	Respondents	Percentage	Respondents	Percentage
21-30	22	22	35	35
31- 40	48	48	15	15
41- 50	20	20	20	20
Above 50	10	10	30	30
Total	100	100	100	100

Inference:

Most of the women entrepreneurs belong to the age of 31-40 in Dharmavaram, where as in Kothacheruvu it is 21-30.

Educational Qualifications of Women Entrepreneurs in Dharmavaram & Kothacheruvu

Table 2:

Educational qualification	Dharmavaram		Kothacheruvu	
	Respondents	Percentage	Respondents	Percentage
Illiterate	39	39	41	41
School level	24	24	22	22
Graduate	19	19	20	20
Post graduate	18	18	17	17
Total	100	100	100	100

Inference:

In both the selected sample mandals the women entrepreneurs are illiterate.

Marital Status of Women Entrepreneurs in Dharmavaram & Kothacheruvu

Table 3:

Marital status	Dharmavaram		Kothacheruvu	
	Respondents	Percentage	Respondents	Percentage
Unmarried	10	10	25	25
Married	20	20	40	40
Separated/Divorced	45	45	20	20
Widowed	25	25	15	15
Total	100	100	100	100

Inference:

Separated/Divorced women of Dharmavaram are showing to become as entrepreneurs but, in Kothacheruvu the women entrepreneurs are Married

Annual Income of Women Entrepreneurs in Dharmavaram & Kothacheruvu

Table 4:

Annual income	Dharmavaram		Kothacheruvu	
	Respondents	Percentage	Respondents	Percentage
Lessthan 20000	15	15	52	52
20000-25000	53	53	20	20
25000-50000	24	24	15	15
50000-100000	08	08	13	13
Total	100	100	100	100

Correlation value= -0.18107

The annual income range is more in Dharmavaram compared to Kothacheruvu . The correlation value between the two mandals is -0.18107

it means that there is a high degree of negative correlation exists between the income level of two sample selected mandals

Family Structure of Women Entrepreneurs in Dharmavaram & Kothacheruvu

Table 5:

Family structure	Dharmavaram		Kothacheruvu	
	Respondents	Percentage	Respondents	Percentage
Joint	15	15	20	20
Nuclear	85	85	80	80
Total	100	100	100	100

Inference:

In both the mandals women entrepreneurs prefer to live in nuclear family.

Reasons to Start Entrepreneurship by the Female in Dharmavaram & Kothacheruvu

Table 6:

Reasons	Dharmavaram		Kothacheruvu	
	Respondents	Percentage	Respondents	Percentage
Additional income	15	15	20	20
Family Responsibility	40	40	30	30
Hereditary	11	11	12	12
For leisure time	10	10	18	18
Death of Husband	14	14	20	20
Total	100	100	100	100

Inference:

In both the selected sample mandals the reason for becoming as women entrepreneurs is their family responsibility.

Motivators in Starting the Business in Dharmavaram & Kothacheruvu

Table 7:

Motivators	Dharmavaram		Kothacheruvu	
	Respondents	Percentage	Respondents	Percentage
Family members	26	26	26	26

Relatives/Friends	64	64	56	56
By yourself	10	10	18	18
Total	100	100	100	100

Inference:

Relatives/Friends are basic motivators in both mandals for women becoming as entrepreneurs

Problems Faced by Women Entrepreneurs in Dharmavaram & Kothacheruvu

Table 8:

Marketing problems	Dharmavaram		Kothacheruvu	
	Respondents	Percentage	Respondents	Percentage
Competitive price	10	10	09	09
Lackof advertisement	11	11	10	10
Sudden change in prices	05	05	09	09
Problem of finance	19	19	20	20
Mobility	10	10	08	08
Family ties	07	07	10	10
Male ego	15	15	12	12
Low risk bearing capacity	22	22	15	15
Resource problem	26	26	17	17
Total	100	100	100	100

Correlation value = 0.838101

Inference:

The major problem faced by the women entrepreneurs in Dharmavaram mandal is Resource Problem whereas in Kothacheruvu it is Problem of finance. The correlation value between the problems of two mandals is 0.838101 it means that there is moderate degree of corelation exists between the problems of two mandals.

Nature of Business Activities Preferred by Women in Dharmavaram & Kothacheruvu

Table 9:

Nature of Business activities preferred	Dharmavaram		Kothacheruvu	
	Respondents	Percentage	Respondents	Percentage
Business	25	25	20	20
Tailoring	15	15	25	25
Bakery	13	13	10	10
Handicraft Items	17	17	20	20
Saree weaving	30	30	25	25
Total	100	100	100	100

Inference:

In Dharmavaram mandal women are preferring to do Saree weaving but in the case of Kothacheruvu the women are preferring both Tailoring and Saree weaving as their profession

Problems Faced By Women Entrepreneurs

Basic problems faced by women entrepreneurs are listed below

- Male dominated society
- Mobility

- Lack of financial support
- Low risk bearing capacity
- Marketing problems
- Family tie ups
- Low faith of creditors
- Credit worthiness
- Limited managerial ability
- Lack of education
- Lack of self confidence
- Obsolescence of technology & resulting increase in cost of production
- Lack of entrepreneurial aptitude

Findings

1. In both of the mandals the women entrepreneurs belong to the age of 21-30
2. There is high rate of illiteracy in both mandals
3. In Kothacheruvu most of the women entrepreneurs are married where as in Dharmavaram most of the women entrepreneurs are divorced
4. The income earning range is more in Dharmavaram compared to the income earning range of women entrepreneurs in Kothacheruvu and their correlation is -0.18107
5. The major reason to start business in both the mandals is their family responsibility in order to help their there are becoming as entrepreneurs
6. The major motivators for starting business by women are their family members from this we can say that the family members are providing support to become entrepreneurs through this they have been showing interest to join in SHGs.
7. Majority of women preferred weaving of sarees as their profession as the District is famous for that

Suggestions For The Growth Of Women Entrepreneurs

Right efforts from all areas are required in the development of women entrepreneurs and their greater participation in the entrepreneurial activities. The following measures are suggested to empower the women to seize various opportunities and face challenges in business. There should be a continuous attempt to inspire, encourage, motivate and co-operate women entrepreneurs.

1. An Awareness programmed should be conducted on a mass scale with the intention of creating awareness among women about the various areas to conduct business
2. Attempts should be there to enhance the standards of education of women in general as well making effective provisions for their training, practical experience and personality development programmes, to improve their over-all personality standards.
3. Self help groups of women entrepreneurs to mobilize resources and pooling capital funds, in order to help the women in the field of industry, trade and commerce can also play a positive role to solve this problem.
4. International, National, Local trade fairs, Industrial exhibitions, seminars and conferences should be organized to help women to facilitate interaction with other women entrepreneurs.
5. Women in business should be offered soft loans & subsidies for encouraging them into industrial activities. The financial institutions should provide more working capital assistance both for small scale venture and large scale ventures.

Entrepreneurship is not a bed of roses to women. Women participation in many kinds of economic activities to complement to their family income, their participation in no way reduces their family duties.

The task of women has become more tedious and full of challenges. Let us all make efforts to help women rediscover her.

Conclusion

From my study I have come to know that the functioning of SHGs in Dharmavaram and Kothacheruvu are average. Still some of the women are not showing interest to become as entrepreneurs because of their environment which they have grown. The funds from the governments are not really reaching to the target group which they are granted for. However, there is a change in the mind set of the family members in supporting the children to become entrepreneurs

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- 4 Women Entrepreneurship Through Self

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ABSTRACT

Education is the most important invention of mankind. Man without education would still be living just like an animal. It is education, which transformed man from a mere “two legged animal” in to human. Education is a lifelong process which continuous from womb to tomb. Education is a tool for total development of human, if any aspect of human personality is ignored, it can result very adversely. Education enables one to lead a better physical, mental intellectual and spiritual life. Ethics deals with the morality. The ethics and moral values adept in Universities heavily affect the future leaders. Ethics education is the prospect for a new value alignment. Such education guarantees the training of both the student and the teacher, develops new technologies and a new vision and a new resources and a new system.

Key words: Higher Education, Human values, Professional Ethics.

Introduction:

Human values and Professional ethics refer to the quality of a person or an Organization or society at large. Basic inherent human values are the one which includes truth, honesty, loyalty, love, peace etc. because they bring out the goodness of human beings and large community. Hundreds of thousands of new students will begin college this fall, and most college and universities have designed elaborate orientation activities to induct beginning students into the academic and social cultural of their campuses. These orientation activities are usually crammed with advising and registration information, academic and social rituals, campus tours and welcoming activities designed to help new students get off to a good start in their academic study and navigate their ways around their new surroundings. Most colleges and universities also make an effort to transmit some important core ethical values that are central to the mission and social culture of the institution and help to define the institutions expectations for being an ethically responsible student and citizen on campus. Ethical values such as respect for others, honesty, self-discipline, hard work, love of learning and appreciation of diversity are some of the core values many colleges and universities prize. But how do institutions go about promoting these core values with new students and what are some effective educational approaches? We focus here on out of class activities since most students spend the majority of their time in this domain of college life and these activities are especially important for new students. Colleges and universities often seek to transmit ethical values to new students through orientation speeches, publications, convocations and other public statements.

Review of Literature:

Alexander, (2009); Curtis, (2010) Covers in their study that another important reason for urging that pre-service teachers engage with ethics education in teacher training programs is that teachers are now required to guide their students with the help of human rights, conflict resolution and social justice, matters included under the auspices of values education.

The study of **Chhonkar in (2014)** indicates that the code of professional ethics for the educators makes provision of framework for the standards and principles to guide them appropriately in involving their obligations towards students, parents, colleagues and communities states. The increased awareness of the ethical principles governing the teaching profession is regarded as indispensable in achieving the desired objectives and enhancing the overall system of education.

Himanshu Kumar Sharma (2015) States the importance of human values in modern era. It can be understood from the study that in the technological era, value crisis is one of the burning problems. To overcome these issues educators have an essential role to play. The study reveals that the teachers

should have an integrated perspective to nurture the hearts and minds of learners in a balanced way so as to retain human values within oneself.

Pallavi Gupta (2016) examines in her study that how and why the human values are consistently degraded in education system in India. It shows that higher education institutions lack to provide learning positive atmosphere, academic syllabus related to human values and extracurricular activities based on human values which lead to many societal issues in recent days. Hence, it states that it's the responsibility of the parents, teachers and society to inculcate human values among the students in educational institutions.

According to **Yadav, & Sunil, (2016)**, the recognition of moral values and professional ethics in the system of education in India are indispensable aspects. In order to promote enrichment of the system of education and enable the individuals to acquire an efficient understanding of academic concepts and achieve academic goals, it is necessary to generate awareness in terms of human values and professional ethics. With the help of moral values, one can acquire an efficient understanding in terms of what is appropriate and what is not appropriate for the person.

Venkataiah, (2000); Laxmi and Paul, (2018) Value education helps every one in improving the value system that any individual can adopt in their lives and puts it to use. The students should be motivated for independent decision making. They should be made responsible for their own actions and should learn to analyze if they go wrong which will help to develop decision making abilities and confidence in them. Teachers are the role model for adolescent learners says.

Higher Education in India:

Higher education is a leadership education Indian higher education system is the third largest system in the world, next to the China and United States of America. In India the higher education system has grown in an extraordinary way, particularly after Independence period, to become one of the largest system of its kind in the world. However, the system has many issues of concern at present, like financing and management including access, equity and relevance, re orientation of programmes by laying emphases on health consciousness, values and ethics and quality of higher education together with the assessment of institutions and their accreditation. These issues are important for the country, as it is now engaged in the use of higher education as a powerful tool to build a knowledge based information society of the 21st century.

Concept of Moral Values, Ethics and Education:

- ❖ **Moral values:** These are the set of some precious principles which helps a person in becoming a good human being these values involve a lot of factors like morality, respecting others, helping others, loving others etc. According to Jerry Springer: we are all born as empty vessels which can be shaped by moral values.
- ❖ **Ethics:** It is the branch of philosophy that deals with the morality. The word ethics has been derived from the Greek word 'ethos' which means character. Ethics covers the following dilemmas
 - a. How to live a good life?
 - b. What are our rights and responsibilities
 - c. The language of right and wrong etc.
- ❖ **Education:** The root of word education is derived from Latin words 'Educare' Educare' and 'Educatum'. The word 'Educare' means to bring up and to nourish. The word 'Educatum' means to train. So we can say that education is to bring up, to developing and shaping up the individual talent and his inner potentialities. According to Aristotle; 'Education' is an ornament in prosperity and a refuge in adversity.

Objective of the study

- To study the awareness about human values among teachers in higher educational institutions.

- To study the awareness about Leadership qualities among students in higher educational institutions.
- To identify the factors required to develop the professional ethics among the teachers in higher educational institutions.

Research Methodology

A secondary study has been done to understand the impact of moral values among the teachers in the educational institutions and how it helps to develop the professional ethics among them.

Data Collection: Secondary data collected through Journals, reviews, Chapter books and websites etc.

Discussions and Suggestions

1. **Role of teachers in Education:** A teacher's role in today's world is not only limited to classroom teaching and lecturing but it is far more than that. A teacher must understand that teaching involves wearing multiple hats to ensure that the educational institution runs smoothly and all students gets a quality education.
2. **Human values and Human Rights:** We know that our work is founded on values and principles set down in universal human rights. These rights must be promoted and defended in every phase of education and the teachers should adopt it.
3. **Professional Community:** It initiates ethical reflection and dialogue with the employees at work place. It works in a culture of openness and enables transparency and respects the competence of other professions and acknowledges the limits of one's own disciplinary supports. It takes responsibility when colleagues meet special challenges in their work takes responsibility to find good solutions.
4. **Leadership Education:** The popularity of leadership programs among college students and the intrinsic connections of ethical considerations to leadership roles and responsibilities make leadership education a powerful forum for character development.
5. **Student Activities Programming:** While student activities are often regarded as student entertainment, there is much about these campus activities that encourage moral and civic learning. Speaker programs bring to campus important leaders in the arts, politics and entertainment. Student galleries display the artistic creations of students, faculty, alumni and professional artists. Craft programs provide opportunities for students to develop talents and to explore the creative process. Coffee house, open mike programs and discussion roundtables give students opportunities to debate and discuss current topics and issues. A thoughtfully designed student activities program can contribute to the creation of a rich campus environment of intellectual and ethical reflection.
6. **Participation in student Governance Organizations and Activities:** Students often learn best by doing and there are few areas of campus life where students are given as much responsibility for independence and self-governance as in activities such as student government, residence halls government, student clubs and organizations, and student activities. In these leadership roles students have many opportunities to share in institutional governance by creating programs, policies and procedures, debating conflicting values, rendering fair and just decisions and bearing the consequences for the actions they take.

Conclusion

According to study of Rokeach, "Value is an enduring belief a specific mode of conduct or an end state of existence, along a continuum of relative importance". Every person need value in their lives to guide them in the right path, to learn the importance of certainty, goodness and beauty, give positive direction to life and bring joy, preserve our culture and heritage, bring changes in behavior towards positive thoughts and much more. To improve the professional institutions, human values play an important role which helps ot develop human values in future generations. Every teacher

must adopt the professional ethics between them because it ultimately affects the student's behavior. As a result we can lead a happy, peaceful and satisfied life throughout.

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శ్రీకృష్ణ దేవరాయ విశ్వవిద్యాలయం

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భావచింత ప్రత్యేక సంచిక

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**ఆదర్శ సమాజ నిర్మాణంలో వ్యక్తులు,
వ్యవస్థలు మరియు సాహిత్యం ప్రాధాన్యం**

**The Predominance of Individuals, Systems, and
Literature in the Construction of an Ideal Society**

అంతర్జాల జాతీయ పదస్సు

తేది: 29 & 30 ఏప్రిల్ 2022

నిర్వహణ :

సెంటర్ ఫర్ స్టడీ ఆఫ్ సోషల్ ఎక్స్క్లూజన్ అండ్ ఇంక్లూజన్ పాలసీ

**CENTRE FOR STUDY OF SOCIAL EXCLUSION
AND INCLUSIVE POLICY (CSSEIP)**

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స్త్రీవాద కవిత్వం - సాంఘిక చైతన్యం

- డా॥ కొయ్యల శ్రీనివాసులు, తెలుగు విభాగాధిపతి, యస్.టి.ఎస్.యస్. ప్రభుత్వ పి.జి.జి. కళాశాల, విజయవాడ

"పెమినిజం" అనే ఇంగ్లీషు పదం 'స్త్రీవాదం' అనే తెలుగు పదంగా అనువదించుకొని వాడుతున్నాము. మానవ సమాజంలో పరిణామంగా ఉన్న స్త్రీలు పురుషుల కంటే తక్కువ సాంఘిక స్థితిలో ఉండటాన్ని ప్రశ్నిస్తూ వాళ్ళ అభ్యుదయాన్ని, విముక్తిని వాంఛిస్తూ వచ్చిన స్త్రీవాద భావన పంచొమ్మదవ శతాబ్ది ఉత్తరాగ్ధానికి ఉద్యమ రూపాన్ని తీసుకొని విస్తరించింది. తెలుగు సాహిత్యంలో స్త్రీవాద భావన 1980వ దశకం నుండి ప్రారంభమైందని చెప్పవచ్చు. అంతకుముందు కందుకూరి వీరేశలింగం తెలుగు సాహిత్యంలో స్త్రీ జనోద్ధరణకు అకుంఠిత దీక్షతో స్త్రీల అభివృద్ధి కొరకు పత్రికలు స్థాపించి, స్త్రీ విద్య అవకాశాలను వాళ్ళికి చక్కాడంచారు. విశంతు పునర్వివాహం, చాల్య వివాహాలు మొదలైనవి ద్వారా స్త్రీల కోసం ఏడు దినాల పేపర్ అభివర సాధ్యమైంది.

రామప్రసాదు, గురజాడ అప్పారావు, చలం కట్టమంచి రామలింగారెడ్డి మొదలైనవారు సాహిత్యంలో గౌరవనీయ స్థానం కల్పించారు. కృత్తి, నారాయణ బాబు, తిలక్, దాశరథి, పట్నాని మొదలైనవారు కవులు తమ అభ్యుదయ కవిత్వంలో స్త్రీల సమస్యలు ప్రతిబింబించే విధంగా కవిత్వం రచించారు.

1960-1970దశకంలో రచయిత్రులు, కవయిత్రులు అనేకమైన రచనలు చేశారు. వర్ణాంతర వివాహాలు, సైమన్ పేర్లల్ని చదువు, (ఆచంట శారదాదేవి, ఆబూరి రాయారెడ్డి, డా॥ సి.కృషి, వాసిరెడ్డి వీరాదేవి) సంస్కారం వంటి ఇతివృత్తాలతో నవలలు, కథలు వ్రాశారు. వరకట్న సమస్యలు, కుటుంబాల్లో స్త్రీల కష్టాలు, అల్లాడతల్ల అరాట, పొరటాలు అన్నీ బోవన్నపల్లివాయి, ఇన్న అంజాలు స్ఫూరించినాగానీ స్త్రీ స్వేచ్ఛ, ఆర్థిక సమస్యలు, అసమానతలు, అణచివేతలు వంటివి రచనల్లో ఎక్కువగా లేవు. ముప్పాళ్ల రంగనాయకమ్మ 1978లో 'జానకి

విముక్తి' నవల రచించారు. స్త్రీ సాహిత్యంపై ఇందులో చిత్రించారు. ఎప్పుడో 1990 ముద్రాపకం అయిన అచ్చమంట 'అబలా పచ్చిపిత్త' మొదలైనవి రచించారు. అందులో స్త్రీల కష్టాలు, స్వేచ్ఛ అభివృద్ధి పురుషాధిక్యత, స్త్రీల బాదల గురించి చర్చించారు.

తెలుగులో 1980వ దశకం మొదటి ప్రార్థన కనిపిస్తుంది. స్త్రీవాద భావన కనిపిస్తుంది. సాహిత్యం, స్పష్టత గురించి సిమ్మనాగినిగారి సర్వేక్షణ చేశారు. "విశ్వస్వామ్య వ్యవస్థకు వాళ్ళ అభిమతం ఉన్న నవీపాక సంబంధాన్ని గుర్తించి, ప్రాథమంలో స్త్రీవాద సాహిత్యం పుట్టింది" అంటూ మూత్రాన్ని అనుసరించి తెలుగులో వచ్చిన సాహిత్యంలో అధికభాగం కవిత్వ ప్రాధాన్యత చేరుతుంది.

తెలుగులో తొలిస్త్రీవాద కవయిత్రుగా మేడ తిలక్ గుర్తింపు పొందారు. ఈమె 1979-1981ల మధ్య కవితలు కవిత్వాన్ని రచించి, చిన్న వయసులోనే మరణించారు. ఆమె కవితలు "శిలాలోలిత" అనే పేరుతో సంకలనం వెలువడింది. ఈ సంకలనానికి సంవత్సరపు ప్రతిష్టాత్మక "ప్రవర్ణ ప్రంట్" పుస్తకం వ్యాపాన్ని రచించారు. దేశ్కర్ రామారావు కవితలపై తన ప్రశంశాత్మక అభిప్రాయాన్ని వ్యక్తం చేశారు. "శిలాలోలిత రేవెలీ దేవి" పేరుతో వచ్చింది. అనుభవాల సాంద్రత తార్కిక చింతననావరించి ఉన్న ప్రపంచంతో సంబంధం కవిత్వంలో ఉన్నాయని "చేరా" వ్యాఖ్యానించారు. ఆమెలో అందజ్ఞాతి వారపత్రికలో ప్రచురితమైన "నానా (సావిత్రీ రచన) కవిత ఎంతోమందిని అకట్టుకుంది" అనేమటా మొగుడున్నారు. అవసరమైతే అవసరమేనని అన్వయం అన్నప్పుడే అనుమానమేనని

శ్రీకృష్ణదేవరాయ విశ్వవిద్యాలయం - ప్రత్యేక సంచిక, అగస్టు 2022



శ్రీశ్రీ కళావేదిక

అనంతపురము - 515 003, ఆంధ్రప్రదేశ్, ఇండియా.



భావచింత ప్రత్యేక సంచిక

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మహాకవి శ్రీశ్రీ జీవితం - సాహిత్యం

జాతీయ సదస్సు

తేది: 9 & 10 మే 2022



నిర్వహణ :

శ్రీశ్రీ కళావేదిక

శ్రీకృష్ణదేవరాయ విశ్వవిద్యాలయం శాఖ

అనంతపురం - 515 003.

శ్రీశ్రీ 'మహాప్రస్థానం'లో వ్యక్తపరచిన అభ్యుదయ భావనలు మహాప్రస్థానంలో అభ్యుదయ భావాలు

- డా॥ కొయ్య శ్రీనివాసులు, తెలుగు విభాగాధిపతి, యస్.బి.యస్.యస్. ప్రభుత్వ డిగ్రీ కళాశాల, కదిరి.

శ్రీశ్రీ రచించిన మహాప్రస్థానం 1950 సంవత్సరంలో పుస్తక రూపంగా వెలువడింది. ఇది 41 కవితా ఖండికల సంకలనం. మహాప్రస్థానంలోని కవితా ఖండికలను 1933 నుండి 1947 సంవత్సరాల మధ్యకాలంలో శ్రీశ్రీ రచించారు. శ్రీశ్రీ మహాప్రస్థానంలో పాటు ఖండవృత్తి, చరమ రాత్రి, చతురస్రం, మూడు పెల్లెలు, మరో ప్రస్థానం, వారం వారం, సిరిసిరి మొవ్వ, కతకం, ప్రాసక్రీడలు, లీమ రిశ్మలు (సిప్రానో), అనంతం, మరో ప్రపంచం (రేడియో నాటికల సంపుటి) మొదలైన రచనలు చేశారు. శ్రీశ్రీ రచనల్లో కథలు, నాటికలున్నాయి, సినిమా పాటలున్నాయి, నేర్పాటున్నాయి, వేచన గీతాలున్నాయి, న్యాపాలున్నాయి.

శ్రీశ్రీ రచనలన్నీ ఒక ఎత్తైతే మహాప్రస్థానం ఒకటి మరోక ఎత్తు. తెలుగు సాహిత్యంలో కవిత్వం భారతం, గోనలుద్దరిస్తే రంగవారిరామాయణం, శ్రీనాథుని కృంగార వైషదం, పాతన మహా భాగవతం, అన్నమయ్య పద కవితలు, పెద్దన మనుచరిత్ర, భట్టుమూర్తి వసుచరిత్ర, గురజాడ కవ్యాభిజ్ఞం, వేమన అటవెలదులు, ఉన్నవ వారి మాలవల్లిక ఎంతస్థానం ఉందో తెలుగు సాహిత్యంలో శ్రీశ్రీ మహాప్రస్థానానికి అంత స్థానం ఉంది.

మహా ప్రస్థానం తెలుగు సాహిత్యంలో అభ్యుదయ కవితా ప్రస్థానానికి తొలి దివిటిగా, సుప్రభాత గానంగా ప్రసిద్ధికెక్కిందని చెప్పవచ్చు. మహాప్రస్థానంలో మొదటి కవిత 'మహాప్రస్థానం'. ప్రస్థానం అంటే ప్రయాణం. మహాప్రస్థానం అంటే గొప్ప ప్రయాణం. గొప్పమార్పును తెచ్చిన ఆ మరోప్రపంచానికి వెళ్ళాలంటే సాధారణ

ప్రయాణం సరిపాదని మహాప్రస్థానం చేయాలని శ్రీశ్రీ భావించాడు.

మరో ప్రపంచం
మరో ప్రపంచం
మరో ప్రపంచం పిలిచింది
పదండి ముందుకు
పదండి త్రోసుకు
పోదాం, పోదాం పైపైకి!

ఇట్లు మరోప్రపంచం అంటే సామ్యవాద వ్యవస్థ, పదండి త్రోసుకు పోదాం అనడంలో సమయం వించి పాటుందో పరుగెత్తి నడవాలని శ్రీశ్రీ శ్రామిక వర్గాలలో ఉత్సాహాన్ని, ఆవేశాన్ని రగుల్చులిపాడు.

శ్రీశ్రీ రచించిన మహాప్రస్థానం అభ్యుదయ భావనలకు పాఠ్యగ్రంథం వంటిది. శ్రామికులను బూర్జువా వర్గం పై పట్టుదలతో, పగతో, ప్రతీకారంతో ఉర్రగతమని శ్రీశ్రీ ఇలా ఉద్ఘోషిస్తాడు.

శ్రామికుల పతిసూ
రేడుల పతిసూ
ధనంజయునిలా సాగండి
కనబడలేదా మరోప్రపంచపు
అగ్ని కిరీటపు ధగధగలు
ఎల్లలాపుటా విగవిగలు
హామజ్వాలల భుగభుగలు

ఓ శ్రామికులారా! మీరు శ్రామికులవలె, రేడు కుక్కల వలె, ధనంజయుని వలె ముందుకు సాగండి. శ్రమ పంపదను దోచుకునే బూర్జువాలపై పగబూని, పాముల

మహాకవి శ్రీశ్రీ కవితం-సాహిత్యం, శ్రీశ్రీవర్ధినియ పరిపూర్ణమయం - ప్రత్యేక సంచిక

వది కాటువేయాలని, రేడుకుళ్ళల్లా వెంటబడి తరమాలని ఉద్బోధ చేశారు.

శ్రీశ్రీ మహాప్రస్థానం సంకలనంలో మొదటి కవిత 'మహాప్రస్థానం' అయినా ముందుగా రచించిన కవిత 'అయిదేని' (1933). కొత్త చందస్సులో సరికొత్త వస్తువులో "వేసు సైతం ప్రపంచాగ్నికి, సమిదనొక్కటి అహంతివ్వాను" అని ప్రారంభమయ్యే ఈ అంకిత వారుక బాపకి దగ్గరగా ముత్యాలనిరం చందస్సులో రాయబడింది. అభ్యుదయ కవిత్వమునకు నూతన కవాలములు తెరచిన మొదటి గేయము అయిదేని.

వేసు సైతం
ప్రపంచాగ్ని
తల్లదీక్షి పల్లవిస్తాను
వేసు సైతం
విక్రమ వీణకు
తంబూనై మూర్ధనలు పాతాళం
వేసు సైతం
భువన భవనపు
బావుటానై సైకి లేస్తాను

"ఇక్కడ వేసు శ్రీశ్రీ కారు. శ్రీశ్రీ కంఠంకో పలుకుతున్న శ్రామికుడు ప్రపంచాభ్యుదయం కోసం అతడెన్నో త్యాగాలు చేశారు. ఎంతో కృషి చేశారు గతంలో. వేసు సైతం అనే నుడికారం అనవజాతి చరిత్రలో పేరుకు కూడా వచ్చుకుని ఒక సామాన్యుడికి ప్రాముఖ్యం కలిగిస్తోంది. తరతరాల నుండి ఇతడికి చరిత్రలో గుర్తింపు లేదు. ఇప్పుడితడు తెరగబడి తన ప్రాముఖ్యం గుర్తించ వలసిందిగా ఘోషిస్తున్నాడు" అన్న మీరియాల రామకృష్ణ వ్యాఖ్యానం ఎంతో నమూనీతంగా ఉంది.

మహాప్రస్థానంలో చాలామందిని అకర్షించిన కవితా అంకితంలో జగన్నాథుని రథచక్రాలు, దేవ చరిత్రలు, అద్వైతం, భక్తిజ్ఞ, ఋషిత్వం, చిత్తుపర్చియని.

తెలుగుసాహిత్యంలో మహాకవి శ్రీశ్రీకి విశిష్టమైన స్థానము ఉంది. అకాశపు దారులంట పాదావిధిగా

చెళ్ళిపోయే జగన్నాథ రథచక్రాలను, భూమార్గం వైపు మళ్ళించి, శ్రామిక వర్గానికి కవిత్వ వత్తుం కట్టించిన కవి శ్రీశ్రీ. శ్రీశ్రీ తెలుగు సాహిత్యంలో వర్ణ దృశ్యవానికి ద్వారం తెరచి, అభ్యుదయ కవిత్వానికి అభ్యుదయ్యారు. జగన్నాథుని రథచక్రాలు'లో పేడిత మానవులకు చైర్యాన్నివ్వా సాగిన ఈ కవితలో

"వతితులారా
భ్రష్టులారా
దిగా పడిన తమ్ములారా
మీ కోసం కలం వేట్టి
అకాశపు దారులంట
పాదావిధిగా చెళిపోయే
అరుచుకుంటూ చెళిపోయే
జగన్నాథుని రథచక్రాల
రథచక్రాలే
రథచక్ర ప్రళయ ఘోష
భూమార్గం పట్టిస్తాను
భూకంపం పుట్టిస్తాను"

సామ్యవాద సిద్ధాంత ప్రతిపాదనను ఈ అంకితలో వ్యక్తం చేస్తూ 'ఈ స్వప్నం విజయమవుతుంది, ఈ స్వప్నం ఋజువవుతుంది' అంటూ భవిష్యద్దర్శనం చేస్తూ 'ఈ లోకం మీదేనండి, ఈ రాజ్యం మీదేలండి' అని శ్రామికు షకి రాజ్యాధిపతిం చేస్తాను.

సామాన్య ప్రజల్ని గూర్చి పట్టించుకున్న సాహిత్యాన్ని అభ్యుదయ సాహిత్యం అంటారు. శ్రీశ్రీ 'అభ్యుదయం' కవితలో అభ్యుదయం పదానికి కొత్త అర్థాన్ని చెప్పాడు.

నేడే
ఈనాడే
జగమంతా బల వికర్షి
నరజాతికి పరివర్తన
నవతపన కుతనమయం- అభ్యుదయం"

సామాన్యుల్ని పట్టించుకోకపోతే సాహిత్యం వ్యర్థం అని చెబుతుంది అభ్యుదయ సాహిత్యం. జాగృతం చేసే భజల

కన్నాన్ని పట్టించుకున్న సాహిత్యం అభ్యుదయ సాహిత్యం.
శ్రీశ్రీది అభ్యుదయ వైఖరి కనుకనే మహాప్రస్థానం
అభ్యుదయ దృష్టిచే కలిగి ఉంది.

‘దేశ చరిత్రలు’ అను ఖండికలో చరిత్రను శ్రీశ్రీ కొత్త
కోణముతో విశ్లేషించాడు. ‘గతీదిన చరిత్ర అంతా వర్ణ
పాఠాలూ చరిత్ర’ అన్న కారణ మార్పు భావానికి
కవితాత్మక రసాభివ్యక్తికరతే ‘దేశ చరిత్రలు’ గేయము.
చారిత్రిక బొత్తకవారి పాదాన్ని పెరళంగా సామాన్య
పాఠకునికి హృదయాన్ని అతట్టుకునే విధంగా శ్రీశ్రీ రచిం
చాడు. కల్పరిత్యా ఈ గేయం ప్రత్యేకతను సంతరించు
కుంది. ప్రశ్నల పెరంపరను సందించి, సమాధానాలు
విద్వారించే పద్ధతిని కవి ఇందులో పాటించాడు.

“ఏ దేశ చరిత్ర చూసినా

ఏమున్నది గర్వకారణం

నరజాతి చరిత్ర సమస్తం

పరపితన పరిచయంతో” అనాదిగా చరిత్రలో
కనబడుతున్న అన్యాయాన్ని మోసాలను తీరని వ్యతిరే
వ్యక్తపరిచాడు. ఏ దేశచరిత్ర చూసినాగర్వకారణం ఏమీ
కనబడదు. నరజాతులు సమస్త చరిత్రలోనూ ఏడించడం
లోనే అనశ్చి కనబడుతుంది.

“చిరకాలం జరిగిన మోసం

బలవంతులు బౌద్ధవ్యాజూ

దనవంతుల పవ్వాణాలూ

ఇంకావా! ఇకపై చిల్లపు

“ఒక వ్యక్తిని మరొకవ్యక్తి

ఒక జాతిని వేరొక జాతి

ఏదీందే సాంఘిక దర్శనం

ఇంకావా! ఇకపై పొగడు”

ఒకటిని మరొకడు, ఒకజాతిని మరో జాతి ఏదీందే
సాంఘిక దర్శనం ఇంక ముందు సాగదని ఖరాఅందిగా
తేల్చి చెప్పాడు. అంతేగాకుండా

“నైలునదీ వాగుకకలో

సామాన్యుని జీవనమెట్టిది

తాజీమహల్ సిర్కావానికి

రాళ్ళిత్తిన కూలీదెవ్వరు?

వామోజ్యప్ప దండయాత్రలో

సామాన్యుల సాహసమెట్టిది

ప్రభుపెక్కిన పిల్లకి కాలోయ

అది మోసిన బోయాలెవ్వరు?

అంటూ చరిత్రకు కొత్త చాపిషమును కూడా చెప్పినాడు.
నైలునదీ వాగుకకలో సామాన్యుని జీవన పరిచానాన్ని
గూర్చి, తాజీమహల్ సిర్కావాంలో పాల్గొన్న కూలీల గూర్చి
చరిత్రలో రాయబడాలి. ప్రభువుల దండయాత్రలో
పాల్గొన్న సామాన్య సేనాయిల సాహసగాత్రాలు చరిత్ర
కెక్కింది.

ప్రభువుల పిల్లకి మోసిన బోయాల శ్రమగాత్రాలు
చరిత్రలో రిఖింపబడాలని అదే నిజమైన చరిత్రని ‘దేశ
చరిత్రలు’లో శ్రీశ్రీ నిర్వచించాడు. మానవజాతి చరిత్ర
అంతా వర్ణ సంఘర్షణ ఫలితమేయని విద్వాంశ సారము.
అందుకే శ్రీశ్రీ ‘పరస్పరం సంఘర్షించిన శత్రులలో చరిత్ర
పుట్టింది’ అని మార్కిస్టు దృక్పథాన్ని కవిస్మృతించాడు.
అందుకే మార్క్సిస్టు సిద్ధాంత సాదానికి, గతి కార్మిక బొత్తక
వాదానికి నిలుపుబడిన ‘దేశ చరిత్రలు’ కవితాఖండిక అని
విమర్శకుల భావన.

‘పేదల మీద, పీడితుల మీద జాతిని మోతమే కలి
గించే దిరాళ వాద కవిత్వం కాదు శ్రీశ్రీది. శ్రీశ్రీ మహా
ప్రస్థానంలో జాతు వార్షిన కవితా ఖండికలు అన్న
దయనీయ స్థితిలో ఉన్న ‘పేదల కొసం విద్వివ పంథాలో
నయం కట్టమని మేధావి పర్లాన్, మర్మకరగతి విద్యా
వంతుల్ని ఉశ్చేజపరుస్తుంది. “కనబడలేదా మరోధిపించపు
కుంకు మందే త్రోకాన్” అని ప్రశ్నించిన శ్రీశ్రీ “ఎముకలు
త్రుళ్ళిన పయస్ప ముళ్ళిన సామరులారా దావండి” అని
దూషించి “దెక్కురు మందే శత్రులు వందే ‘సైనికులారా
రారండి” అని అహ్వనించాడు. “పదండి ముందుకు
పదండి త్రోసుకు పోదాం ‘సైపైకి” అంటూ ‘సైనిక

సంగ్రామం సంగ్రామం
మాయంటావు? ఏయే
ఏమంటావు? అని హెచ్చరిక చేస్తాడు శ్రీశ్రీ.

దేశీయత, జాతీయతా పరిధులను దాటి అంతర్జాతీయ దృష్టికోణాన్ని అలవర్చుకున్నాడు శ్రీశ్రీ. కారణ మార్పు మాటలు అయిన "ప్రాచీనరీత్యంబే హిందూ నేషన్" స్ఫూర్తితో అవాటి ప్రపంచావళింతటికీ తొలి వజయంగా అకాశరయంగా మెరిసిన రహస్య, రెండో ప్రపంచ యుద్ధంలో రహస్య విజయాలను కీర్తిస్తూ 'గర్విండు రహస్య' అన్న కవితలో ఇలా వర్ణికాడు.

"ప్రపంచం వరివత్తుంగా ఉంది
కోటి గొంతులు నినచు కోరి రమ్మవ్వాలు
కోటి చేతులు నెమ్మ కోగిరిమ్మవ్వాలు"

అవి ప్రపంచ కార్మికుల, కర్షకుల, తారీకుల, పీడితుల తరఫున రహస్యం అహ్వానం వర్ణికాడు. ఈ అంతర్జాతీయ దృష్టికోణంతోనే

"దీనాలో రిక్తాదాలా
చెడలేకప్పు గవి పనిమనస్
బద్ధాయన పడ కళాసీ
అబగారిన్ అర్జులందరూ
హెరాచిస్ టాటి, జాబూ, సెగ్లో
అందొంతర వానాజాతులు
చారిత్రిక యధార్థ తత్వం
చాటిస్తారోక గొంతుకతో"

అవి ప్రకటించి విశాల విశ్వనీడిళ్ళపై తన అభ్యుదయ భావజాలాన్ని ప్రకటించాడు. మొత్తం మీద శ్రీశ్రీ తన మహాప్రస్థానంలో స్వల్ప మనస్తత్వం పై నిరసనగా గళవే వినిపిస్తూ, అబగారిన్ ప్రజల పట్ల అవగాహన కలిగిస్తూ, గణతాత్విక భౌతిక వాదాన్ని వర్ణిస్తూ, భ్రగతి విలోదక మనస్తత్వంపై తిరుగుబాటునూ ప్రకటిస్తూ అంతర్జాతీయ దృష్టినించో పతీతులకోసం కవిత్వం రచన చేశారని చెప్పవచ్చు.

అథాత గ్రంథాలు :

1. మహాప్రస్థానం - శ్రీశ్రీ (విశాలాంధ్ర పబ్లిషింగ్ హౌస్)
2. తెలుగు సాహిత్య సమీక్ష - డా॥ జి. నాగయ్య (రెండవ సంపుటం)
3. తెలుగు సాహిత్య చరిత్ర - డా॥ ద్వారా శాస్త్రి
4. తెలుగు సాహిత్య చరిత్ర - ప్రొఫెసర్ వెలమల సమ్మన్న
5. శ్రీశ్రీ - పీకేపీడియా



కథానిక లక్షణాల చట్రంలో 'సావుకూడు' కథానిక - ఒక విశ్లేషణ

- డా॥ కొయ్య శ్రీనివాసులు, తెలుగు విభాగాధిపతి, యస్.టి.యస్.యస్.ప్రభుత్వ డిగ్రీ కళాశాల, కదిరి.

ఆంగ్ల సాహిత్య ప్రభావంతో తెలుగులో అనేక నూతన సాహిత్య ప్రక్రియలు వెలువడ్డాయి. ఆ విధంగా వెలువడిన నూతన ప్రక్రియల్లో ఒకటి కథానిక ఆధునిక కాలంలో క్రీ.శ.1850 ప్రాంతం నుండి తెలుగు సాహిత్యంలో వచనములో కథాసాహిత్యం ప్రారంభమవుతుంది. పరవస్తు చిన్నయసూరి, కందుకూరి వీరేశలింగం, రఘుపతి వెంకటరత్నం నాయుడు, వేదం వేంకటరాయశాస్త్రి మొ॥వారు సంస్కృత సాహిత్యం నుండి అనేక కథలను అనువదించారు, అనుకరించారు. సంపూర్ణ ఆధునిక కథానిక లక్షణాలు కలిగిన రచన 1910 నుండే ప్రారంభమైందని చెప్పవచ్చు. గురజాడ 'దిద్దుబాటు' కథానిక మొదలుకుని తెలుగు సాహిత్యంలో ఈనాటి దాకా కొన్నివేల కథానికలు వచ్చాయి. ఇవి అన్నీ అనంత వైవిధ్యంతో కూడుకున్నవి. సాంఘిక, చారిత్రక, పౌరాణిక, రాజకీయ, ఆర్థిక, జానపద, దేశభక్తి, శృంగార, సంఘ సంస్కరణ, చిన్తాత్మక, ఆధిక్షేప, స్త్రీవాద, దళితవాద, హేతువాద, వైజ్ఞానిక మొ॥ ఇలా వివిధ రకాల బేధాలతో అనేక కథానికలు తెలుగు సాహిత్యంలో వచ్చినప్పటికీ సంపూర్ణ కథానిక లక్షణాల చట్రంలో నిలబడే కథలు కొన్ని వందలు మాత్రమే ఉండవచ్చు. ఆవిధంగా సంపూర్ణ కథానిక లక్షణాల చట్రంలో ఒరిగే ఒక కథానిక 'సావుకూడు' ఈ కథానిక సంపూర్ణ కథానిక లక్షణాల కోణంలో విశ్లేషణ చేయడమే ఈ వ్యాసం ఉద్దేశం.

'సావుకూడు' అనే కథానికను రచించినది బండి నారాయణ స్వామి గారు అనంతపురం పట్టణంలో 1952 జూన్ నెల 3న జన్మించాడు. ఆయన తల్లిదండ్రులు హైస్కూలరప్ప, పోలెరమ్మలు ఉపాధ్యయుడుగా పనిచేసి పదవీ విరమణ చేశారు. ఆయన నలభైదాకా కథానికలు, నాలుగు నవలలు రచించారు. ఆయన రచించిన కథా

నికలలో వానరాలె, నడక, తెల్ల దయ్యం, సావుకూడు మొ॥ కథలు స్వామి గారికి ఎంతో మంచి పేరు తెచ్చిపెట్టాయి. ఆయన రచించిన 'శస్త్రభూమి' నవలకు తానా సంస్థ 2017లో నిర్వహించిన నవలల పోటీలో బహుమతి పొందడమే గాక, కేంద్ర సాహిత్య అకాడమీ పురస్కారం కూడా లభించింది. ఆయన అనేక సాహితీ పురస్కారాలు అందుకున్నాడు. ఆయన రచనలపైన వామపక్ష భావజాలం, దళిత బహుజనవాదం ప్రభావం ఉంది.

కథానిక ప్రక్రియను పాశ్చాత్యులు, తెలుగు కవులు, సాహితీ విమర్శకులు మొ॥వారు నిర్వచించారు. ఆ నిర్వచనాలను పరిశీలించిన మీదట కథానికలో సర్వ సంపూర్ణంగా ఉండవలసిన లక్షణాలు ఆరు 1.సంక్లిప్తత, 2.ఏకాంశ వ్యగ్రత, 3.నిర్భరత, 4.స్వయం సమగ్రత, 5.ప్రతిపాద్య ప్రవణత, 6.సంవాద చాతుర్యం. ఈ ఆరు లక్షణాలను దృష్టిలో పెట్టుకుని కథకుడు కథానిక రాయాలి. ఇందులో ఏ ఒక్కదాన్ని ఉపేక్షించినా కథ రక్తి కట్టదు.

కథకుడు ఈ లక్షణాల్ని దృష్టిలో పెట్టుకుని కథ రాస్తే ఆ కథ మంచి కథ అవుతుంది. ఆ కథకుడు మంచి కథకుడు అవుతాడు.

బండి నారాయణ స్వామి గారు 'సావుకూడు' కథానికను సర్వ సంపూర్ణ కథానిక లక్షణాల చట్రంలో బిగించి రచించాడు. ఈ కథానికలో అనంతపురం ప్రజల జీవితం ఎంత దుర్భరంగా ఉంటుందో వారి జీవన విధానం ఎలా ఉంటుందో అనంతపురం జిల్లా మాండలికంలో కళ్యాణదుర్గం యాసలో రచించాడు.

'సావుకూడు' కథానికలో 'సంక్లిప్తత' లక్షణం :

సంక్లిప్తంగా వుండటం కథానిక ప్రధాన లక్షణం వస్తువు

లోనూ, సంఘటనల్లోనూ, పాత్రల్లోనూ, సంవాదాల్లోనూ, విస్తృతి లేకుండా స్వామి గారు 'సాపుకూడు' కథానికను హృద్యంగా తీర్చిదిద్దాడు.

అనంతపురం జిల్లాలో కరువు వచ్చింది. ప్రజలు గంజి తాగి, కలబంద గడ్డలు తవ్వకుని తిని బతుకుతున్నారు. గడ్డికి, గింజలకు కరువు వచ్చింది. మనుషులకు పనులు లేవు. రెండేళ్ళ నుంచి వానలు లేవు. మూడేళ్ళ నుంచి పంటలు లేవు. మంచి బట్టలు లేవు, పిల్లలకు పెళ్ళిళ్లు లేవు. ఆకలికి ఆగలేక ఆడవాళ్ళు మానం అమ్ము కుంటున్నారు. డొక్కల్లోకి మోకాళ్ళు ముడుచుకుని కూర్చుంటున్నారు.

ఈ కథానికలో స్వామి గారు పెద్దప్పయ్య కుటుంబం గురించి వివరించాడు. ఒక రోజు పెద్దప్పయ్య చని పోయాడు. చనిపోవడమంత అదృష్టం లేదనుకున్నారు. ఊరిలో కొందరు, కానీ పెద్దప్పయ్య తన కోరిక తీర కుండానే చనిపోయాడు. బతుకంతా కష్టపడి, ముగ్గురు కొడుకులను పెంచి, పెద్ద చేసిన పెద్దప్పయ్య తన కడసారి కోరిక తీరకుండానే చనిపోయాడు.

పెద్దప్పయ్య కొడుకులు ముగ్గురు, పెద్దకొడుకు పేరు మారెప్ప, రెండో కొడుకు నాగన్న, పెద్దప్పయ్య వారిద్దరికీ చెరోక ఐదెకరాల పొలం ఇచ్చాడు. తాను తన భార్య చిన్న కొడుకు దగ్గర ఉండాలని అనుకొని అతనికి ఇంకొక ఐదెకరాలు అదనంగా ఇచ్చాడు. వాళ్ళింట్లోనే ఉంటు న్నాడు.

పెద్దప్పయ్య మంచాన పడ్డాడు. పెద్దప్పయ్యకు మాంసం పైన, 'కల్లు' పైన మనసు పోయింది. పెద్దప్పయ్య వయసులో మంచి తిండి పుష్టి కలవాడు. ఈ విషయాన్ని స్వామి గారు పెద్దప్పయ్య పాత్రలో అనాటి ప్రజల తిండి పుష్టిని ప్రతిబింబింపజేశాడు.

పెద్దప్పయ్యను చూసి పోవడానికి వచ్చిన పెద్దకొడుకు మారెప్పతో చాలాసార్లు అడిగి నాలుగు రూపాయలు ఇప్పించుకుని సారాతాగాడు. ఈ విషయం తెలిసిన మారెప్ప పెండ్లాము నానాగొడవ చేసింది. రెండో కొడుకు

నాగన్నతో మంసం తినాలని అడిగితే ఆ కోరిక తీర్చలేక పోయాడు.

ఈ కథానికలో పెద్దప్పయ్య తిండి పుష్టి గురించి, ఆయన ముగ్గురు కొడుకుల దీనావస్థ గురించి వివరించి కరువు పరిస్థితులలో అనాటి ప్రజలందరూ చాలామటుకు పెద్దప్పయ్య కుటుంబం లాంటివే నని స్వామి గారి భావన. కరువు సమయంలో పెద్దప్పయ్య ఆఖరి కోరిక తీరక చనిపోయాడు. మాంసం అంటే బెమ్మెత్తి చని పోయాడు.

పెద్దప్పయ్య కర్మకాండలో కొడుకులు ముగ్గురు మూడు సూర్య పెట్టి గొరి కొని పెద్దకర్మను పూర్తి చేశారు. చివరలో పెద్దప్పయ్య పెండ్లాము భర్తపోయిన బాధకంటే, ఎవరెవరో వచ్చి గొంతు వరకు తిన్నారు. నాకు మాత్రం పులుసు పోశారు తప్ప నాలుగు ముక్కలు వేయలేదు. మీయమ్మ కడుపు కాలా అంటూ శాపనార్థాలు పెట్టింది. ఆకలి, కోరికలు మానవ సంబంధాలను కూడా మరచి పోయేలా చేస్తాయన్న విషయాన్ని చాలా హృద్యంగా సన్నివేశ కల్పన చేశాడు బండి నారాయణ స్వామి గారు.

ఈ కథానికలో పెద్దప్పయ్య, పెద్దప్పయ్య కొడుకులు, కరువు చిత్రణ, పెద్దప్పయ్య రెండో కొడుకు నాగన్న పెండ్లాము ఆరోగ్యం బాగా చేయిస్తానంటే వేరే వాడితో లేచిపోవడం పెద్దప్పయ్య మాంసం కోసం బెమిసి పోవడం, కడసారి కోరిక తీరకపోవడం, పెద్దప్పయ్య చనిపోయిన తర్వాత పెద్దమనుసుల సూచనతో మారెప్ప పెద్ద కర్మకు ఖర్చు పెట్టడం, పెద్ద కర్మ రోజున గొరి కోయడం, పెద్దప్పయ్య పెండ్లాము మొగుడు పోయి నాడని బాధపడకుండా, నా మొగాన నీళ్ళు చారు పోసినారు. ముక్కలంతా ఎవరెవరో తినిపోయినారు అని శాపనార్థం పెడుతుంది.

బండి నారాయణ స్వామి గారు 'సాపుకూడు' కథానికలో అనవసర విషయాల జోలికి పోకుండా కథను నడిపించాడు. సంక్షిప్త కథానికకు ప్రధాన లక్షణం

అందుకే కథానిక రచయితకు చాలా సంయమనం అవసరం.

'సావుకూడు' కథానికలో 'ఏకాంశ వ్యగ్రత' :

మొత్తం కథానిక అంతకూ ఒకే ప్రధానాంశం లక్ష్యంగా ఉండాలి. దీన్నే వస్త్రైక్యం అంటారు. ప్రారంభంలో కథకుడు ఈ విషయం మీద ప్రధానంగా దృష్టిపెడతాడో అదే విషయాన్ని దారి మళ్ళించకూడదు. కథలో అక్కడక్కడ ఇతర విషయాలు వచ్చినా ప్రధాన విషయం మరుగున పడి పోకుండా చూసుకోవడం కథకుడి ప్రధాన లక్ష్యం కావాలి.

'సావుకూడు' కథానికలో వస్త్రైక్యం ఉంది. కరువు వలన కుటుంబాలు ఎలా చితికి పోతాయో, మానవుడు ఆకలికి, అవసరాలకు ప్రాముఖ్యం ఇచ్చినట్లుగా మానవ సంబంధాలకు ప్రాధాన్యం ఇవ్వడని తెలియజెప్పడమే కథానిక ఉద్దేశం. కరువు చిత్రణ ద్వారా కరువులో పెద్దప్పయ్య లాంటి వ్యక్తులు కడసారి కోరిక తీరకుండానే చనిపోవడం, తండ్రి అంత్యక్రియల సమయంలోనూ, పెద్ద దినము నాడు పెద్దప్పయ్య కుటుంబ సభ్యుల ప్రవర్తన, ఆనాటి కరువు మానవ సంబంధాలను ఎంత దారుణంగా దెబ్బతీసిందో రచయిత స్వామి గారు కరువు చిత్రణ మీద మాత్రమే తన దృష్టిని వుంచి 'సావుకూడు' కథానికలో వస్త్రైక్యాన్ని సాధించాడు.

'సావుకూడు' కథానికలో 'నిర్భరత' :

కథానిక చదివేటప్పుడు రెప్పుడూ కానీ, రాసేటప్పుడు మనస్సుకు ఏమరుపాటు కానీ రాసేయని లక్షణాన్ని నిర్భరత అంటారు. రచయిత కథ చెప్పేటప్పుడు మనస్సులో మరో అంశానికి చోటు ఇవ్వకూడదు. కథ చదివేటప్పుడు పాఠకుడు విసుగు చెందకుండా ఉండాలంటే కథలో 'నిర్భరత' ఉండాలి.

సావుకూడు కథానికలో స్వామి గారు నిర్భరత లక్షణాన్ని వందశాతం పాటించాడు. కథను ఆసాంతం చదివేలా చేస్తుంది. పాఠకున్ని 'సావుకూడు' కథానిక ఏకబిగిని

చదివిస్తుంది. ఆలోచింపజేస్తుంది. పెద్దప్పయ్య తిండి పుష్టి కలవాడు. కొత్తగా పెళ్ళయిన రోజుల్లో పెద్దప్పయ్య తన పెండ్లాము ఎన్ని ముద్దలు పెడితే అన్ని ముద్దలు తానే తినేవాడు. పెండ్లాము ఆకలిని గమనించని తిండిపాతు పెద్దప్పయ్య. పెద్దప్పయ్య పెండ్లాము బానకడుపోనికి ఇచ్చి చేశారని, పెళ్ళానికి కూడు ఎయ్యని మొగునితో కాపురం ఎట్లా చేసేదని ఎక్కిళ్ళు పెట్టింది, పుట్టింటికి వెళ్ళిపోయింది.

పెద్దమనుషులు పెద్దప్పయ్యని పంచాయితీకి పిలిపించారు. 'పెండ్లానికి కూడు ఎందుకు పెట్టలేదని' ప్రశ్నించారు. పెద్దప్పయ్యకి అర్థం కాలేదు. తనకు తెలియదని అది పెట్టింది తాను తిన్నానని, తాను తినొద్దు అనలేదని పెద్దప్పయ్య బదులు చెప్పాడు. చివరకు పెద్దమనుషులు 'కరువులో పుట్టాము. ఎంత తిన్నా కడుపులు నిండవు, కడుపునిండా తినడానికి కుబేరులకు కాము, కడుపు ఎండగట్టలేనోడివి పెండ్లాన్ని ఎల పోషిస్తావు? పిల్లలు పుడితే ఎలా సాకుతావు' అంటూ హితవు చెప్పారు. ఈ అంశమే గాకుండా పెద్దప్పయ్య అనారోగ్యంతో మంచం మీదున్నాడు. మాంసం గురించిన కలవరింత పాఠకులను కథను ఆసాంతం చదివేలా జీవితాంతం గుర్తుకు పెట్టుకొనేలా చేస్తుంది.

'సావుకూడు' కథానికలో 'స్వయం సమగ్రతా లక్షణం':

కథలోని వస్తువు దానికదే సమగ్రంగా వుండాలి. అవసరమైందేదో కొరవడినట్లు కానీ, అనవసరమైంది చోటు చేసుకున్నట్లుగా పాఠకునికి అనిపించకూడదు. కథానిక పరిమాణంలో నవల కన్నా చాలా చిన్నది కానీ స్వయం సమగ్రత అనేది కథానికలో ఖచ్చితంగా ఉండాలని లక్షణం.

'సావుకూడు' కథానికలో వస్తువు స్వయం సమగ్రంగా ఉంది. కరువు చిత్రణ, పెద్దప్పయ్య సంసారం, అతని సంతానం, పెద్దప్పయ్య కడసారి కోరిక నెరవేరక పోవడం.

పెద్దప్పయ్య చనిపోయిన తర్వాత అంత్యక్రియలు, పెద్దప్పయ్య పెద్దదినము నాడు ముసలి గొర్రెను కోయడం, పెద్దదినము అయిన మూడు రోజులకు పెద్దప్పయ్య పెండ్లాము ఏడవడం మొదలు పెట్టింది. 'ఎవరెవరో వచ్చి గొంతు వరకు తిన్నారు. నామగాన నాలుగు తునకలు వెయ్యలేదు, పులుసు పోశారు, మీయమ్మ కడుపుకాలా' అంటూ శాపనార్థాలు పెట్టింది. ఈ విధంగా సావుకూడు కథానికలో 'స్వయం సమగ్రత' అనే కథానిక లక్షణం పుష్కలంగా ఉంది.

'సావుకూడు' కథానికలో 'ప్రతిపాద్య ప్రవణత' :

ప్రతిపాదించదలచుకొన్న అంశాన్ని దృష్టిలో పెట్టుకొని దాని వికాసానికి అనుగుణంగా రచన సాగించాలి. సావుకూడు కథానికలో అనంతపురం జిల్లా గ్రామీణ జీవనాన్ని కరువు ఏ విధంగా దెబ్బతీసిందో, మానవత్వాన్ని కూడా ఏవిధంగా మంట కలిపిందో చాలా అద్భుతంగా చిత్రించాడు బండి నారాయణ స్వామి గారు. కరువు సీమలో ప్రజల జీవితం ఎంత దుర్భరంగా ఉంటుందో, వారి జీవన విధానం ఎలా ఉంటుందో స్వామి గారు 'సావుకూడు' కథానికలో పాఠకుల మనోనేత్రాల ముందు నిలిపారు. ఆకలి మనుషులను ఎలా శాసిస్తుందో, మారుస్తుందో ఈ కథలో ప్రతిపాదించారు. తను ప్రతి పాదించదలచుకున్న కరువు చిత్రణను పెద్దప్పయ్య పాత్ర ద్వారా, అతని కుటుంబ సభ్యులు, పెద్దమనుషులు, బంధువులు, పాత్రల ద్వారా సావుకూడు కథానికా వికాసానికి అనుగుణంగా రచన సాగించాడు.

'సావుకూడు' కథానికలో 'సంవాద చాతుర్యం :

సంభాషణా రూపంలో సాగే వాక్యాలు ఒకానొక ప్రధానాంశాన్ని అవిష్కరించేటట్లుగానో, ఒకానొక పాత్ర వ్యక్తిత్వాన్ని ప్రదర్శించేటట్లు గానో ఉండాలి. ప్రతి సంభాషణ కథకు ప్రయోజనం కలిగించే విధంగా వుండాలి. కథలో సంభాషణలు క్లుప్తంగా, నిత్యజీవిత వ్యవహారానికి దగ్గరగా వుండాలి. ఈ సంభాషణలు ప్రజా జీవనాన్ని ప్రతిబింబించాలి. భాష సరళంగా, సుందరంగా

వుండాలి. భాషా శైలి పాఠకుల్ని ఆకట్టుకొనే విధంగా వుండాలి. ఈ విషయాల్లో కథకుడు జాగ్రత్త వహిస్తే కథ రక్తికట్టుతుంది.

సావుకూడు కథానికలో కథకుడు బండినారాయణ స్వామి గారు సంవాద చాతుర్యాన్ని తనదైన శైలిలో రచించి కథకు ప్రాణం పోశాడు. దానికి కొన్ని ఉదాహరణలు చూద్దాము.

"ఇప్పటికి నెలదినాల కిందట - ముద్ద పెట్టి సాకే సిన్న కొడుకు ఇంట్లో మంచమెక్కె ముసిలోడు. అప్పుడు పెద్దకొడుకు మారిప్ప నాయనను చూసి మాట్లాడించి పోదమని వచ్చె. ఎట్లుంది నాయనా పానానికి?" అని అడిగె

"ఇంక ఎక్కువనాల్లు బతకనానేను" అనె ముసిలోడు

"అవేం మాటలు నాయనా?" అంటూ మనసు నొచ్చుకొనే కొడుకు

"నిజం నాయనా! నా శరీరం బాధ నాకు తెలుసు" అంటూ కంటతడి పెట్టుకుని. రోవంత సుస్తీ సేసి పైసురుకు లేస్తే అమెరికాకు పొయ్యేవాల్లు ఉండారు. పానం మీదకి వస్తే పక్క ఊరికి బస్సెక్కిపోయి ఒక సూది వేయించుకునే దానికి దుడ్లు లేవు. వయసు పానమైతే. ఎట్లబ్బా రోగ మొచ్చింది. మందులకు దడ్లు లేవు" అని సంత చేయ్యొచ్చు.

"ముసలి పానములే ఈ పొద్దు కాకపోతే రేపన్నా పొయ్యేది" అంటూ సాగే సంభాషణ సావుకూడు కథానికను పాఠకుడు ఊపిరిబిగబెట్టి చదివేలా చేస్తుంది.

"ఈ పొద్దో రేపో సచ్చిపోతాడనుకున్న ముసిలోడు కడుపులో కల్లు పడేటప్పటికి లేచి కూర్చుండె."

"బోలే గట్టి పానమబ్బా ముసిలోనిది! మనం సావల్పిందే గాని ముసిలోడు సావడు" అని ఊర్లో అంతా నవ్వుకుండిరి!"

"ముసిలోడు నిజంగా సచ్చిపోతాడనుకుని ఊరకే

నాలుగు రూపాయలు ఇస్తేనే? బుద్ధిలేని నా కొడుకుని ఎనకా ముందూ ఆలోచించకుండా తొందరపడితి" అనుకుంటే పెద్దకొడుకు మారెప్ప.

కథకుడు స్వామి గారు సంభాషణ చాతుర్యంతో కథకు ప్రాణం పోశాడు. అనంతపురం జిల్లా మాండలిక శైలిలో సాగే సంభాషణలు కథలో చెప్పదలచుకున్న కరువు వ్రజల జీవితాలను ఎలా ఆడుకుంటుందో, ఆకలి మనుషులను ఎలా శాసిస్తుందో, మారుస్తుందో, మానవ సంబంధాలపై ఎలాంటి మార్పు చూపిస్తుందో చక్కగా నాటకీయతతో పాఠకులపై ముద్రవేశాడు. తెలుగు కథానిక ప్రక్రియలో నూటికి నూరు శాతం కథానిక

లక్షణాలు కలిగిన కథలు చాలా తక్కువ. ఏదో ఒక లక్షణం లోపిస్తుంటుంది కానీ స్వామి గారి సాపుకూడు కథానికలో పాల్లు పోకుండా అటు పాశ్చాత్యులు, ఇటు తెలుగు సాహితీ విమర్శకులు అంగీకరించిన కథానిక లక్షణాలు అన్నీ వున్న సంపూర్ణ కథానిక ఇది. పాఠకులు ఎన్నో కథలను చదువుతుంటారు. సంపూర్ణ కథా లక్షణాలతో వచ్చిన కథానికలు పాఠకుల మనోఫలాకాలపై ముద్రితమై ఉంటాయి. ఆవిధంగా సాపుకూడు కథానిక సంపూర్ణ కథానిక లక్షణాలు కలిగి వుండడం వల్ల తెలుగు సాహితీ కథానిక చరిత్రలో గుర్తించుకోదగ్గ కథగా పాఠకుల మదిలో నిలిచిపోతుంది.

ఆధార గ్రంథాలు :

1. తెలుగు సాహిత్య చరిత్ర - ప్రొఫెసర్ వెలమల సిమ్మన్న
2. 'సాపుకూడు' కథానిక - బండి నారాయణ స్వామి (సాహితీనందనం నుండి)
3. బండి నారాయణ స్వామి - వికీపీడియా
4. కథానిక స్వరూప స్వభావాలు - పొరంకి దక్షిణామూర్తి.

★ ★ ★

70. మహాభారతంలో ఆదర్శపాత్ర - మహానుభావుడు విదురుడు - రామకృష్ణ ఇదుకుబ్జ	316
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82. నన్నయ అంధ్రమహాభారత అవతారిక - సామాజిక సాంస్కృతిక దృక్పథం

డా॥ కొయ్య శ్రీనివాసులు, తెలుగు విభాగాధిపతి & రెక్టర్, యన్.టి.యన్.యస్. ప్రభుత్వ
కళాశాల, కదిరి, ఫోన్ నెం. 9492825280 & 7013334182

ఒక కవి ఏ ప్రయోజనం కోసం, ఏదని ప్రేరణతో, ఏ పరిస్థితుల్లో కావ్య రచన చేస్తున్నాడో వివరించే కావ్యభాగం, లేదా కావ్యగుంధంలో మొత్తం పేద కావ్యం ఏవిధంగా అవతరించిందో తెలియజేయడమే అవతారిక. కవి తన కావ్యాన్ని ఎందుకు రాస్తున్నాడో, ఎవరు రాయమన్నారో, ఎవరికి అంకితం ఇస్తున్నాడో, రచనాశైలి ఏవిధంగా ఉంటుందో తెలియజేస్తూ రచించిన భాగాన్ని అవతారిక అంటారు. దీన్నే కావ్యవతారిక అని కూడా అంటారు. అవతారికను ఇప్పుడు వివరించాలి, పేదన, ఆరోగ్యము అని కూడా విలుస్తారు, కావ్య అవతారికల వల్ల కోస్తా ముట్టమైన అంశాలు తెలుస్తాయి. అవి

1. శృంగార - అశని వాంఛ - కవితలు - సంకల్పము
2. శృంగార వివరాలు
3. అపేక్షితు వృత్తి - విధానాలు
4. కవితా రీతులు - అప్రీహియాలు
5. దారిశ్రుత అంశాలు
6. మనవి - శుభముల ప్రస్తావన - కవితా వాతావరణం
7. రాక్షసికవృత్తి అంశాలు
8. అశని కవ్వంలోల్లాలు అశని కవ్వం కవితలు ప్రస్తావన
9. కొందరు భాగ్యవృత్తిని వివరాలు
10. సాహిత్య సామాజిక, దారిశ్రుత అంశాలు.

తెలుగులో నన్నయ భారతం మొదటి గ్రంథం అలాంటి అవతారికలో 'అవతారిక' అని భాగం, అది తరువాత కావ్యల్లోని అవతారికలకు మార్గదర్శకం చేసింది. ఇది తెలుగులో అవతారికలకు ఒక అదనపు మార్గదర్శకం చేసింది.

కావ్యాన్ని ఒక ప్రాధికా శ్రేణితో అనుభవించడం సంస్కృత కావ్యాలలో వదిలివేయబడింది. కానీ ఒక కావ్యం రాయడానికి కవి అనుభవం, ప్రేరణ, పోషకం, పేర్కొనడం, ప్రాధికారములను స్వీకరించడం, సమాధానం చేసిన వారిని కావ్యరచనకు సమకాలీన కవి పుంగవులను ప్రస్తుతించడం మొదలైన అంశాలతో కూడిన 'అవతారిక' భాగాన్ని ప్రవేశపెట్టడం అనే ప్రక్రియను చేపట్టింది మొత్తం నన్నయ. అది అనంత నన్నయ కావ్యాలలో నుండి తెలుగులోకి వచ్చిన కవి సంప్రదాయంగా భావించబడుతుంది.

మొదటనే కావ్యాలలో అవతారిక మంగళ శ్రేణితో అనుభవమవుతుంది. 'నర్మకథాచో శుభానం కోరుతోవరం ఈ మంగళ శ్రేణి మొత్తం లక్ష్యం. రాక్షసికీలు ఈ మంగళ శ్రేణిలను 'అశీర్వాదం క్రియమోకర్షి దగ్గితో' వారి శత్రువులతో' అని పేర్కొన్నారు. అంటే ఈ మంగళశ్రేణి అశీర్వాదం అందించే విధంగానూ, భగవంతునికీ సహచర్యవ్యవస్థలూ గానీ, ఆ కావ్యభాగం సూచిస్తున్నట్లుగా అంశాలని రాక్షసికీలు అప్రీహియం. ఈ మంగళ శ్రేణినికీ కావ్య లక్ష్యాలను పెంచడం పేర్కొన్నారు.

కర్పూర వసంత రాయలు - సినారె సాహితీ వైభవం

- శ్రీయ్యశ్రీనివాసులు, తెలుగు విభాగాధిపతి & రెక్టరర్, యస్.టి.యస్.యస్ ప్రభుత్వ కళాశాల, కదిరి.

బహుముఖ ప్రజ్ఞాశాలి సింగిరెడ్డి నారాయణ రెడ్డి, సి.నారాయణ రెడ్డిగా, 'సినారె'గా సుప్రసిద్ధులు. పద్యం, గేయం, వచనకావ్యాలు, నాటికలు, గజళ్లు, ముక్తకాలు, అనువాదాలు, విమర్శ, పరిశోధన, బుర్రకథ, యాత్రా సాహిత్యం, ఇలా అనేక ప్రక్రియల్లో ఎనభైకి పైగా రచనలు చేసిన సాహితీ సార్వభౌముడు సినారె. సి.నారాయణ రెడ్డి సినమా పాటల రచయితగా కూడా లబ్ధ ప్రతిష్ఠుడు. సినారె తెలుగు సినమాకు 3500లకు పైగా పాటలు రచించి సినమా పాటల సాహిత్యాన్ని సుసంపన్నం చేసి సినీ అన్నమయ్యగా పేరు గడించాడు.

సి. నారాయణ రెడ్డి, కరీంనగర్ జిల్లా సిరిసిల్లా తాలూకా హనుమాజీపేట గ్రామంలో 29-07-1931న జన్మించారు. తండ్రి మల్లారెడ్డి రైతు, తల్లి బుచ్చమ్మ గృహిణి. ఉన్నత చదువులు చదివిన సినారె గారు ఎన్నో ఉన్నత పదవులు, బహుమతులు పొందాడు. భారతదేశంలో సాహిత్యంలో ఉన్నత పురస్కారమైన జ్ఞానపీఠ పురస్కారం (1988) కూడా పొందిన సాహితీ కృషివలుడు సినారె. 1992లో భారత ప్రభుత్వ 'పద్మభూషణ్'తో సత్కరించింది.

సి.నారాయణ రెడ్డి గారు చిన్ననాట నుండే కవితా రచన మొదలు పెట్టినారు. సినారె గారు 1953లో 'నవ్వని పువ్వు' సంగీత నృత్య నాటిక ప్రచురించారు. అది మొదలు చనిపోయే దాకా నిరంతరం రచనలు చేశారు.

“ఊపిరాడడం లేదు - ఉక్క పోస్తోంది ఏసిగదిలో”

కారణం తెలిసిపోయింది - కవిత రాయలేదు ఇవాళ”
కవిత్యం రాయనిదే ఉండలేని సింగిరెడ్డి నారాయణ రెడ్డి 2017 జూన్ 12న మరణించేంత వరకు కవితా వ్యాసంగం లోనే గడిపాడు.

సి.నారాయణ రెడ్డి రచనలన్నీ అత్యుత్తమ శ్రేణికి చెందినవే. కానీ ఆయన రచనల్లో అత్యంత ఆకర్షణీయ

మైన రచన 'కర్పూర వసంతరాయలు' ఈ కథా గేయ కావ్యాన్ని సినారె గారు 1957లో ప్రచురించారు. ఈ గేయ కావ్యాన్ని ప్రసిద్ధ చరిత్రకారుడు మల్లంపల్లి సోమశేఖర శర్మకు అంకిత మిచ్చాడు నారాయణ రెడ్డి గారు. ఈ గేయకావ్యాన్ని సినారె గారు తన సొంత గొతుకతో ఎంతో ఇష్టంగా ఆలపించేవారు.

కర్పూర వసంతరాయలు రెడ్డిరాజుల చరిత్రకీ సంబంధించిన శృంగార రసప్రధానమైన అయిదాశ్వాసాల కథాగేయ కావ్యం. ఇది ఆధునిక యుగమున వెలువడిన గేయ ప్రబంధముగ కీర్తిని సంపాదించుకొంది. హృద్యమైన వర్ణనలు, సరసమైన సన్నివేశాలు, రమ్యమైన శబ్ద ప్రయోగాలు ఈ గేయ ప్రబంధాన్ని విశిష్ట కృతిగా తెలుగు సాహిత్యంలో నిలబెట్టాయి. మాత్రా ఛందస్సులో రచింపబడ్డ ఈ కృతిలో సినారె మాత్రా ఛందస్సులో 'సరిగమలు' అడుకున్నారు. సాహితీ ప్రియులను చక్కని ఊహలోకంలో విహరింపజేసే రసాత్మక కావ్యము కర్పూర వసంతరాయలు.

కర్పూర వసంతరాయలులో ఒక చారిత్రక ఇతివృత్త శకలాన్ని ఆధారంగా తీసుకొని దాని చుట్టూ అల్లిన అందమైన కథ వుంటుంది. చారిత్రక ఆధారాలు ఉన్న ఈ కావ్యంలో కుమార గిరి రెడ్డి, లకుమ, రాణి ప్రధాన పాత్రలు. కుమారగిరి రెడ్డి, లకుమలు చారిత్రక వ్యక్తులైనా రాణి పాత్ర మాత్రం చరిత్రలో కనిపించనిది. అనురాగానికి, ధర్మానికి మధ్య లకుమ అనుభవించిన సంఘర్షణ కావ్యంలో ఆల్ట్రాహితిం. ప్రజాశ్రేయస్సు కోసం ఆమె కథ విషాదాంతంగా ముగుస్తుంది. కావ్యనాయిక లకుమ ఒక నాట్యకత్తి, ఈమె నాట్యం కారణంగానే రెడ్డి రాజైన కుమారగిరి రెడ్డి గారు 'వసంత రాజ్యం' అనే నాట్య శాస్త్రాన్ని రాయగలిగాడు. “నేటికినీ లకుమ అందెల

ఝుణ్ణత్కారముల వినిపించు కొండవీటను వీచు వాయువులు” అని ఆమెకు శాశ్వతత్వాన్ని ఆపాదిస్తాడు సినారె గారు కర్పూర వసంతరాయలు గేయ కావ్యంలో.

కర్పూర వసంతరాయలు శృంగార రస ప్రధానం గానూ, అంగరసాలుగా కరుణ, వీర రసాలను వెలిగించిన ఉదాత్తరచన. ఇది అయిదాశ్వాసాల గేయ కావ్యం. మొదటి ఆశ్వాసంలో వసంతోత్సవాల్లో నాట్యం చేసే లకుమను రాజు చూడడం జరుగుతుంది. రెండవ ఆశ్వాసంలో లకుమ పట్ల రాజు, రాజు పట్ల లకుమ విరహాన్ని పొందుతుంది. మూడవ ఆశ్వాసంలో లకుమను రాజనర్తకిగా చేసి ఆమెను వెంట తీసుకొని రాజు తీర్థయాత్రలకు వెళతాడు. నాల్గవ ఆశ్వాసంలో ప్రత్యేకంగా నిర్మించిన కేళీ మందిరంలో లకుమ నాట్యాన్ని చూస్తూ ఆమె లోకంగా, ఆమె ప్రాణంగా బతుకుతూ ‘వసంత రాజీయం’ అనే నాట్య గ్రంథాన్ని రాజు రచించాడు. ఐదవ ఆశ్వాసంలో లకుమ సాంగత్యంలో రాజు రాజ్యాన్ని మరచిపోయాడని రాణి కలతపడి, రాజ్య క్షేమం దృష్ట్యా రాజును విడిచి పెట్టమని రాణి లకుమను ప్రాధేయ పడగా, లకుమ ప్రాణత్యాగం చేస్తుంది.

జయ జయ సమగ్రాంధ్ర - సర్వం సహా భార
సంభరణ శేషాహి రూపా! అంటూ

(రాజు కుమారగిరి రెడ్డి వసంతోత్సవాల్లో
పాల్గొనడానికి వెళ్తుంటే)

వందిమాగధులు చేసిన స్తోత్రముతో కావ్యం ప్రారంభ మవుతుంది. మొదటి ఆశ్వాసంలో వసంతోత్సవాల నిర్వహణ, లకుమ నృత్యం సన్నివేశాలు ప్రధానం.

వసంతోత్సవాల్లో పాల్గొనడానికి రాజును చూచి “పంచభూతములొక్కపరి ఓ వసంత ప్రభూ! యంచు మైమరచిపోయి శబ్దించినవి” అంటాడు కవి.

రాజు కుమారగిరి రెడ్డి ఒక ఏనుగు మీద ఎక్కి సాగి పోతున్నాడు - ఐరావతం మీద ఉన్న ఇంద్రుడిలా! పైగా శచీసమేతుడైన ఇంద్రుడిలా, ఆ ఏనుగుపై సతీ సమేతుడై ఆసీనుడైన రాజు వెంట బావ కాటమవేముడు,

మంత్రులు, దండనాథులు, అశ్వ, పదాతి బలంతో పాటు ఇసుక వేస్తే రాలనంత జనం బయలు దేరింది. రాజు పరివారం నగర ఉద్యాన వనంలోని మన్మథ పూజా మంటపానికి చేరుకున్నారు. పూజకు వేళయిందని విప్రులు రాజుకు సూచనలు చేశారు. అప్పుడు రాజు

“అక్షతవిడి విఘ్నేశున కంజవిందె - శివునిపైన
హిమాంబువులు చిల్కరించె

గుప్పెడంత కుంకుమ పాడి - గుప్పెను అచ్చరల పైన

దోసెడన్ని పూవులెత్తి - పోసెను మధుమూర్తిపైన
మన్మథ పూజ ముగించాడు రాజు. ఈ మన్మథ పూజను రాజు ప్రారంభించింది చైత్రశుద్ధ త్రయోదశినాడు. వసంతోత్సవాలు ఈ త్రయోదశితో ప్రారంభం నగరోద్ధావనంలో మన్మథ పూజతో ఈ ఉత్సవాలు మొదలయ్యాయి. ఈ వసంతోత్సవంలో ఒకరి మీద ఒకరు పరిమళాలు చల్లుకోవడం. రాజు వసంతోత్సవాలు ఆరంభిస్తూ మృగమరం. శ్రీచందనం దోసిళ్ళతో ఎత్తి ప్రజలమీద చల్లాడు. అప్పుడు ప్రజలు ఒకరి మీద ఒకరు కర్పూరం చల్లుకున్నారు. కళ్ళల్లో కాళ్ళిర ధూళిని కొట్టుకున్నారు. ప్రాడాంగనలు కొత్త కోడళ్ళను చేరి చెవుల్లో పన్నీరు చిలికి వాళ్ళకు దొరక్కుండా పరుగో పరుగు

“ఎటు చూచిననూ కపురమే గంధమే - ఏదెసను
ఆనందమే అందమే

కర్పూర కస్తూరి - కా చందనములతో

నేలయే కాదు నిం - గియు పరిమళించినది.

అది నగరోద్ధావనం అందులో అందమైన పాలరాతి వేదిక. అక్కడ వసంతోత్సవ నృత్యము. నీల మేఘము రీతి కన్పించే తెర, ఆ తెర తొలగగా, మెరుపులా మెరుస్తుంది ఒక నర్తకి. ఆమెయే లకుమ. లకుమ నృత్యము కవి వర్ణనలలోనే చదవాలి తప్ప ఊరికే చెబితే చాలదు. ఆమె లావణ్యము, నాట్యకోశలాన్ని చూసి

“తన పైన పారిజాతములు - జల జల కురిసి
నటుల పూలకించె - నాయవనీపతి”

నృత్యము సాగగా, సాగగా

“ప్రభువు తన్మయుడయ్యే - ప్రభువు చిన్మయుడయ్యే
ప్రభువు లకుమాలగ్న - పంచ ప్రాణుడయ్యే”

ఆనంద పరవశుడైన రాజు, ఒళ్ళు తెలియక నర్తకి దగ్గరికి వెళ్ళబోతాడు. రాజు లేవకుండా రాణి అతని భుజం మీద చేయి మోపింది. రాణి అలా ఆపడం అసూయ వల్లకాదు, మర్యాద పాటించడం కోసం రాణి అలా చేసింది. మహారాజు లకుమ నాట్య కౌశలాన్ని మెచ్చి తన మెడలోని రత్నహారమును తీసి నర్తకి మెడలో వేస్తాడు రాజు కర్పూర వసంతరాయలు. దండతో పాటు అతని చేతులు కూడా ఒక్క క్షణం దండలా అమరుతాయి ఆమె కంఠసేమను. అంటే రాజు రెండు చేతులకు ఆభరణాలు న్నాయి. అవి కూడా లకుమకు అలంకారమే! అప్పుడు జనుల హర్షద్వానాలు ఆకాశాన్ని అంటుతాయి. అయితే లకుమ ముగ్ధకదా!

“సిగ్గుతో తలవాల్చి - మొగ్గయ్యెన్మన లకుమ” మరి రాణి సంగతి “నవ్వలేక లోన నవ్వుకొన్నది రాణి”

ఇక చంద్రుడైతే - “నింగిలో తారాధినేత పల్పని మొయిలు

ముసుగు తెరతోడ మోమును చాటు చేసికొనె”

రెండవ ఆశ్వాసంలో కర్పూర వసంతరాయలుగా బిరుదాంకితుడైన కుమారగిరి రెడ్డి రాజు అనుభవించిన విరహవేదనతో పాటు లకుమ అనుభవించిన విరహ వేదన, వర్షనా ప్రధానమైన సంఘటనలతో పాటు లకుమను రజనర్తకిగా చేయాలన్న ఆలోచనతో రాజు తన మంత్రి కాటయ వేమారెడ్డిని పిలిపించి “ఆమెను రాజనర్తకిగా చేయగనఖిలాషము నాకున్నది” అంటూ తగిన ముహూర్తం పెట్టించమని చెప్పడం వంటి విషయ ప్రధాన ఘటనలకు ద్వితీయ శ్వాసం ఆలవాలమైంది. సి.నారాయణరెడ్డి గారి కవితామృతానికి ఒక మచ్చు తునక ద్వితీయాశ్వాసం, ఇందులోని విరహ వర్ణనలు ప్రబంధ కవుల కైలికి ధీటుగా రచించాడు సినారె.

వసంతోత్సవాల్లో భాగంగా నర్తకి లకుమ నాట్యం రాజును బాగా ఆకర్షించింది. కనులు మూసినా, తెరచినా లకుమా స్వరూపమే గుర్తొస్తోంది.

“నాటి రేయి కుమారగిరి రా - జ్యోతి కన్నుల రెప్పవాలదు

ఎప్పుడో దాటిన దర్శరాత్రము - ఎగయు ఊహల రెక్కవాలదు”

అందుకే పాన్సుపై చల్లిన మల్లెపువ్వులు వసంత రాయలకు పల్లెరు కాయల్లగా తోచినాయి. ఆనాటి రాత్రి రాజు విరహావస్థ చెప్పనలవి కాలేదు.

“ఈ ప్రక్కన పారలె - ఆ ప్రక్కన పారలె

పాన్సుగాదు చంద్ర నిప్పు - పై అతడు దారలె”

రాజు నిదుర పట్టక పక్కమీద నుంచి లేచాడు. ఆ పక్కకు తిరిగి చూస్తే తననే చూస్తున్న రాణి కనిపించింది. అప్పుడు రాజు రాణి తనను, తన వికారాలను గమనిస్తోందా అనుకున్నాడు. తిరిగి పడుకున్నాడు. నిదుర పట్టి పట్టని కలలో లకుమ గురించే కలకన్నాడు.

“రాజు కనులు విప్పి చూచె - లకుమ లేదు, రాణి తోచె శ్రుంగి, చేతిలోని రాణి - కొంగు నంత జోవిడిచె”

ఇంతలో వైతాళికుల మేలు కొలుపులు వినిపించాయి. రాజు విరహావస్థను కవితామృతంతో, వర్ణనాచాతుర్యంతో రసవద్దట్టంగా చిత్రించాడు.

అక్కడ రాజమందిరంలో వసంతరాయుని విరహ వేదన, ఇక్కడ తనపాన్సుపై లకుమ విరహ వేదన

“ఇచట రాజును బోలె లకుమయు - అచట వెర్రిగ పారలె పాన్సున

ఆమెకు అదే ఆద్దరాతిరి - అవేతారలు అదే జాబిలి”

“ఎప్పుడు చూచిన చంద్రుడేమరి - ఎప్పుడు పూచిన తారలేనే డెందుకో అవి యెల్ల అమ్మత - స్యందులై డెందము గలంచెను”

లకుమ కూడా రాజు వలె విరహవేదనకు గురియై నిదుర పట్టిపట్టని కలలో రాజును గురించి కల కనింది.

“ప్రాకే నా పాము మెడపై - లకుమ ఒడలెల్ల జడుపై
కెప్పుమని కేక నిడెను - ఉవ్వెత్తు ఎగిసి పడెను”
లకుమ కల చెదిరింది. రత్నహారం ఉంది. మెరుస్తున్న
ఆ హారాన్ని కనులకు అడ్డుకొని ముద్దు పెట్టుకుంది.

రాజుకు వసంతోత్సవ వేళ లకుమా నాట్యం మదిలో
చెదరి పోలేదు. నిత్యం రాజు మదిలో లకుమా నామ
స్మరణే. అందుకే రాజు అస్థాన నర్తకిగా నియమిద్దామని
కాటయ నేమునితో చెప్పడం, ఆయన మనసు అంగీక
రించపోయినా రాజు మాటకు ఎదురు చెప్పలేదు. అస్థాన
నర్తకిగా లకుమను నియమించిన వార్త

“లకుమకావార్త - కల్వ నెలంత కంటి పా
పల పైన పాలవె - న్నెల సోకి నటులయ్యె”

కాని రాణికి మాత్రం ఆ వార్త

“రాణి కావార్తక - ల్వ నెలంత చెవులలో
ఖర కరుని ఆశ్వరిం - ఖల చప్పుడుగ తోచె”

మూడవ అశ్వాసంలో తన మిత్రుడు, శ్రేయోభిలాషి
కాటమ వేమునితో సంప్రదించి లకుమను రాజనర్తకిగా
పట్టం కట్టిస్తాడు. ఆ తరువాత వసంతరాయలు లకుమ
తన వెంటరాగా, ఆహోబిల క్షేత్రానికి యాత్ర వెళ్ళి అక్కడ
చెంచులక్ష్మి సమేత నరసింహస్వామిని ఆరాధిస్తాడు.
స్వామి ముందు లకుమ అందమైన చెంచెతగా నృత్యం
చేస్తుంది.

“మోముపై శ్రీగంధ - మున్న దెక్కడిదిరా సింగా?
పూల పాడి తప్పయే - ముందునే? నా సామిరంగా
తలపైన కురులు చి - క్కులు చిక్కులై పోయేనేలా?
పులితోడ పోట్లాడ - వలసి వచ్చెనె చారుశిలా”

ఈ విధంగా నృత్యం చేసిన తర్వాత, లకుమ,
రాయలు స్వామిని దర్శించుకున్నారు. ఉగ్ర నరసింహ
మూర్తి రూపము చూడడం తోనే లకుమ బెదిరిపోయి
మూర్చిల్లి పోతుండగా రాజు భుజం మీద ఓరిగింది. రాజు
లకుమను రెండు చేతులతో ఒడిచి పట్టుకొని లేవ దీశాడు.
ఆ దృశ్యం

“రాజును లకుమయు గుండెలు - రాచి కొనగ
చూచికొనిరి

ఆ చూపులు విడిపోవుట - కై మోములు దించుకొనిరి”
అందరూ ఆఖరిసారిగా ఆహోబిల నృసింహస్వామికి
దండం పెట్టుకున్నారు. అక్కడ నుండి దక్షిణ కాశీగా
పేరొందిన ద్రాక్షారామానికి వయనం అయ్యారు.

“పూల వింటి దొర నిల్వన - కాలిపావ నెట్లు సైతు
శివ గిరిజల బిగి కౌగిలి - చెదరిపావ నెట్లు సూతు
అని” శివుని కౌగిటిలో పార్వతిలాగా, పార్వతి కౌగిటిలో
శివుని లాగా నా కౌగిటిలో నీవు, నీ కౌగిటిలో నేను
అంటాడు. కానీ, వెంటనే ‘ఏ మన్నాను! ఏమన్నాను’ అని
తత్తరపడతాడు, పరిజనులు, విభ్రాంతులవుతారు.

వారి ప్రేమ దాచడానికి ఇక వారికి శక్యం కాదు. తన
యత్నంలో మునిగిన లకుమ రాజును గట్టిగా కౌగి
లించుకుంటుంది. అప్పుడు లకుమ ప్రయవచనాలు ఇలా
ఉన్నాయి.

“నాదేవరా! నా గుండెయ - పాదున రతనాల మొల్క
నా మనసే పంజరమ్ము - గా మెలగిన రామచిల్క!”
పట్టి, పట్టి ఏడుస్తుంది లకుమ. అప్పుడు వసంతరాయలను
మనసారా కౌగిలించుకుంటుంది అప్పుడు

“రాజు మరల లకుమా! యని - ప్రాణ పంచకం
నదించగా పిల్చెను”

చతుర్థాశ్వాసంలో లకుమ సమేతంగా రాచనగరుకు
తిరిగి వచ్చిన కుమారగిరి రాయల నడవడిక ప్రజలకు
నచ్చదు, రాజు పక్క వుండ వలసిన మహారాణి స్థానంలో
ఒక రాజనర్తకి ఉండడాన్ని ప్రజలు గుసగుస
లాడుకుంటారు.

చతుర్థాశ్వాసంలో వసంతరాయలు లకుమకై
రమ్యమైన కేళీమందిరమును నిర్మిస్తాడు. ఈ సందర్భంలో
సినారె వర్ణనలు ఎంతో సహజత్వంతో, చమత్కారంగా
ఉంటాయి. వసంతరాయలు రాజ్యాన్ని విస్మరించి,
అందరినీ నిర్లక్ష్యం చేసి, లకుమయే లోకంగా, ఆమె

నాట్యన్ని దర్శిస్తూ, ఆమె శరీరాన్ని అనుభవిస్తూ

“లకుమయే గానమ్ము లకుమయే ప్రాణమ్ము
లకుమయే నాదబిందు కళానిధానమ్ము”

రాజుకు రోజూ అస్తమానం లకుమ తోనే కళాకేళి, లకుమ కనులు మోడ్చితే రాయలకు రాత్రి, ఆమె కనులు విరిస్తే వగలు, లకుమయే లోకమైతే, అతనికి సూర్యనితో పనేమిటి. అనంతకోటి బ్రహ్మాండం, నిఖిల సృష్టి అంతా లకుమలోనే! ఆమెకంటే అద్భుతమైన ‘వసంతరాజీయం’ అనే నాట్య శాస్త్ర గ్రంథాన్ని రాశాడు.

రాజు ఆజ్ఞతో కాటయ వేముడు విజయనగరం మీదకు దండు వెళ్ళి, విజయుడై తిరిగివస్తాడు.

“కాటవేముడు నూత్న సౌధము - కలయజూచుట గుర్తు పట్టిన

రాయడాకని నడిగె హరిహర - రాయలకు కుశలమా? బావా?

“నెలల కరబడి జరిగినట్టి ఆ - నిన్ జతుండై హరిహరుడు నన్ శరణువేడి అనుంగుపుత్రిని - హరిహరాంబను కాన్కవెట్టెను” అంతట కొంతకాలానికి

“వాసరమ్ములు గడచిపోయెను - మాసములు గమయించిపోయెను

రాణి వేదన గుండెలో పెను - రాచపుండుగ మారి పోయెను”

“రాయడు వేశ్యలోలుండని - రాజ్యములో గుసగుస పెచ్చెను రాయడు లకుమాదాసుండని - రచ్చలపై చర్చలు రెచ్చెను”

ఈ విధంగా రాణి మనోవేదనకు లోనై ఆరోగ్యం చెడింది. కాటయ వేముడు రాజు భవకేళి మందిరానికి వెళ్ళి వసంతరాయా! రాజ్యానికి మీరు కొంత దూర మవడంవల్ల ప్రజల్లో అశాంతి వ్రబలి, శత్రురాజుల ప్రాబల్యం పెరిగింది. ఇక రాణి విషయం, ఆమె మంచాన పడింది. మీ దర్శన భాగ్యానికి మంత్రులు, అధికారులు ఎదురు చూస్తున్నారు. మీరొక్కసారి కొలువుకు రండి, మిగిలిన విషయాలు నేను చూసుకొంటాను అన్నాడు కాటయ వేముడు. రాజు సరే అన్నాడు. కాటయ వేముడు పొంగి పోయాడు కానీ రాజు మాత్రం

“బంగారు సంకెలలో తన - పాణి యుగ్మమరికి నటుల ఓటు వడుచు రాయండా - నాటి నిశీభము నీడైనను”

పంచామాశ్వాసంలో కథాగతిని సినారె వేగంగా నడిపాడు. కాటమవేమునికి రాజు ఆస్థానానికి వస్తాను అని మాట ఇచ్చాడే గానీ, లకుమను విడిచి ఆస్థానానికి వెళ్ళాలనిపించలేదు. లకుమ పక్కన లేని క్షణాలు భారమైన యుగాలుగా గడుస్తాయి. ఏదో విధంగా చివరకు రాజు సభకు విచ్చేశాడు. ఒక్కసారిగా ‘జయ జయ కొమరగిరి ధరేశ్వర’ అంటూ సభికులు స్తుతి గావించారు. రాజు సింహాసనంపై కూర్చున్నాడు. సభనంతా కలయ జూచి మౌనంగా కొంచెం సేపు ఉన్నాడు. ఇంతలో ఎవరో రాజుకు చెప్పారు ‘లకుమ కాలు బెణికిందని’ రాజు సభాస్థలిని వదిలి కేళిమందిరానికి వెళ్ళాడు. అప్పుడు సభికులు

“ఒక నర్తకికి కార్తెణుకుదేమి - ఎకిమీడు పర్వరెత్తుట ఏమి ఒక చిన్న ఘటన జరుగుట యేమి? - ఒడ్డెలగమ్ము వీడుట యేమి?

సభకిది తిరస్కారం - సభ్యతకిది సీక్కారము”

అంటూ సభికులు గుసగుస లాడుతూ నిష్క్రమించారు. కాటయ వేముడు అవమనా వడ్డాడు. రాజు కేళి మందిరంలో లకుమ చరణాలకు రాజు అశ్రుబిందువులతో భాష్పాభిషేకం చేస్తున్నాడు.

“ప్రియా! నీదు కల్పాత్రమే - బెణికి పోవలేదు నుమా! నాజీవ నవామ్మత భాం - డమే తొణికినది లకుమా!

చిన్న పిల్లాడిలా బావురుమంటూ బాధపడుతున్న రాజును లకుమ ఓదారుస్తోంది. నొప్పేమీ లేదని, తగ్గి పోతుందని నమ్ముదాయించింది. ఈ విధంగా ప్రేమ లోకంలో మునిగి తేలుతున్నారు లకుమ, వసంత రాయలు.

రాజు కొలువు విడిచి, తిరిగి కేళిమందిరానికి వెళ్ళిపోయాడని తెలిసినప్పటి నుంచి రాణి మనసు మనసులో లేదు. కానీ తన గోడు ఎవరు పట్టించు

కుంటారు? మంచంపై ఉన్న రాణిని చూడడానికి కాటయ వేముడు వచ్చాడు. అప్పుడు కాటయ వేమునితో

“ఇన్ని నాళ్ళుగ నా యెదను దహి - యించు బాధను దాచి యుంచితి

ఈ దినమ్మున మాత్రమన్నా - ఏలకో చలియించి పోయితి”

అంటూ తన బాధనంతా వెళ్ళ గక్కింది. వెంటనే కాటయ వేముడు రాజు దగ్గరికి వెళ్ళి రాణి గారి ఆరోగ్యం బాగాలేదని, మీరు ఆమెను ఒకసారి వచ్చి చూడాలని, మీరు చూడకపోతే ఆమె మనకు దక్కదనే విషయం చెప్పాడు. కాటయ వేముని మాటలు రాజు గుండెను తాకాయి. అటు చూస్తే రాణి, ఇటు చూస్తే లకుమ ఎంచుకునే సమస్య తగిలింది రాజుకు జవాబు లేదను కుని కటయ వేముడు వెనుదిరిగాడు. రాణి అనారోగ్యం విషయం తెలిసిన లకుమ చాలా బాధపడింది. కాటయ వేముడు రాణి దగ్గరికి వెళ్ళి విషయం చెప్పాడు. కన్నీళ్ళు కార్చాడు. రాణి బాధ చెప్పనలవి కాదు!

రాణి ముసుగు వేసుకొని చెలికత్తెలతో బయల్దేరింది లకుమ ఇంటికి, తలుపు తట్టి లకుమా! అని పిలిచింది. లకుమ లేచింది. అప్పుడు రాణి లకుమతో

“సేయిన్ ఒక ఘోరభారము - మోపగా వచ్చితిని చెల్లీ

పాలముంతువో! నీటముంతువో - బాధ్యతను గమనించి తల్లీ”

ఈ మాటలు లకుమ గుండెల్లో బాకుల్లా దూసు కెళ్ళాయి. ముసుగులో ఉన్న రాణి వెళ్ళిపోయింది.

“ఎటుల వాగ్దానమ్ము తీర్చును - ఎటుల రాయని వీడనేర్చును ఎందుకీ హృదయమ్ము నిచ్చితి - నీశ్వరా! ఈ సాని దానికి”.....

అంటూ లకుమ ఓ నిర్ణయానికి వచ్చింది. పొద్దు పొడిచింది. రాజు ముందు స్వత్యం చేసింది. నాట్యం చేస్తూ చేస్తూ పిడిబాకును తీసి పొడుచుకుంది. రాజు ఆశ్చర్యపోయాడు. క్షణంలో రాజు ఒడిలో లకుమ కన్ను మూసింది. రాజు గుండె చెరువైంది. గుండెలో దిగివున్న పిడిబాకును రాజు తీశాడు. ఆ పిడికివున్న ఉత్తరం చదువుకున్నాడు. తిరిగి రాణిని, రాజ్యాన్ని చూసుకోమన్నది ఆ ఉత్తరం సారాంశం. లకుమ మరణించడంతో రాజు అంతఃపురానికి చేరుకున్నాడు రాజు. భర్తను తిరిగి దారికి తెచ్చుకునేందుకు రాణి తన బాధ్యతను నెరవేర్చింది.

సినారె గారు ఈ కావ్యం రాయటానికి రాజ నర్తకి లకుమ, కర్పూర వసంతరాయలు బిరుదాంకితుడైన కుమారగిరి రాయలు. వీరి సైమ వృత్తాంతంలో రాణి పాత్ర కల్పిత పాత్ర. కానీ కాటయవేముని పాత్ర మాత్రం చరిత్రలో ఉన్నది. సినారె రచించిన కావ్యాలలో అత్యుత్తమ గేయకావ్యం కర్పూర వసంతరాయలు. దీని లోని ప్రతి గేయము పాఠకునికి రసానుభూతిని ప్రసాదిస్తుంది. ఈ చక్కని మధురమైన గేయ కావ్యాన్ని ఎన్నిసార్లు చదివినా తనివి తీరదు. ఈ మధురమైన గేయ కావ్యాన్ని సి.నారాయణ రెడ్డి గారు తన మధురమైన కంఠంతో ఆలపించిన రికార్డింగ్ ఆడియోతో ఈ గేయ కావ్యం మరింత అమరత్వాన్ని పొందింది. ఈ గేయ కావ్యం చదివినప్పుడల్లా రసహృదయులను ఒక స్వప్న లోకంలో విహరింపజేస్తుంది. సినారె రచించిన సాహిత్యం లోనే గాకుండా తెలుగు కావ్య జగత్తులో ‘కర్పూర వసంత రాయలు’ ఒక అమర కావ్యం.

ఆధార గ్రంథాలు :

1. కర్పూర వసంతరాయలు (గేయ కావ్యం) - డా॥ సి.నారాయణ రెడ్డి, (మనస్విని ప్రచురణాలు, హైదరాబాద్) (ఐదవ ఎడిషన్ - 2000).
2. సి.నారాయణ రెడ్డి కర్పూర వసంతరాయలు (కావ్యపరిచయం) - ఆచంట జానకిరామ్.
3. తెలుగు సాహిత్య చరిత్ర - డా॥ద్వై.నా.శాస్త్రి
4. సి.నారాయణ రెడ్డి - వికీపీడియా

★

మహాకవి, కళాప్రపూర్ణ, పద్మభూషణ్
డా. బోయి భమస్థ జవితరం - సాహిత్యం



శ్రీశ్రీ కళావేదిక శ్రీకృష్ణదేవరాయ విశ్వవిద్యాలయం శాఖ-అనంతపురం

జాతీయ సదస్సు - ప్రత్యేక సంచిక



నిర్వహణ
శ్రీశ్రీ కళావేదిక
 సాహిత్యసంశోధనా సాహిత్యవేదిక



PHYTOSOCIOLOGICAL ATTRIBUTES OF CLIMBER SPECIES IN NALLAMALAIS, INDIA.

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Abstract- Nallamalais is one of the Centres of Plant Diversity sites in India which encompasses various lifeforms. Of which Climbers are one of the most neglected. Phytosociological attributes were used to know the status of climber species. The total number of individuals of climbers reported in the study area was 319 of which *Gymnema sylvestre* as the most important species followed by *Asparagus racemosus* and *Cajanus scarabaeoides*. The lowest IVI value (1.91) was observed in six species including *Aspidoteris cordata*.

Key words: Nallamalais, CPD site, Climber species, IVI, *Gymnema sylvestre*.

INTRODUCTION

Biodiversity is essential for human and economic well-being and for the ecosystem function and stability. Forests can release the stored carbon as CO₂ that form nearly 17-25% of the total greenhouse gas emissions, at the same time forest conservation, afforestation, reforestation and sustainable forest management can curb about 25% of emissions. Biodiversity interacting with the physical environment forms the foundation of sustainable development. Biodiversity resources, mapping their geographical distribution and quantitative estimation of their natural stands is perhaps the most important information needed for any country in the post-CBD era. The worldwide destruction of the natural environment by population explosion, urbanization, industrialization and habitat fragmentation has led to a tremendous loss of biological diversity over the past few decades and hence warrants immediate attention especially on the forestry sector as they harbor amazing biodiversity and have a critical role on global climate change scenario.

World's forests extended over 4 billion hectares; corresponding to 31 percent of the total land area or an average of 0.6 ha per capita (FAO, 2020) has become a critical part of the international climate change agenda. Tropical forests in India comprising over 60% deciduous forests are poorly understood in terms of phytodiversity, phytosociology and quantification regimes. Analysis of the quantitative relationship among the plant species growing in an area reflects structural property of the community. Phytosociological investigation of vegetation serves as a pre-requisite for investigating the details of primary productivity of ecosystems.

In peninsular India, quantitative phytodiversity inventories are available from the forests of the Western Ghats, whereas study on Eastern Ghats is lacking. The wide range of topography, varied climate favours luxuriant growth of vegetation and forest. It remains as a neglected area with very few attempts made for such studies in Eastern Ghats of Tamil Nadu (Kadavul and Parthasarathy, 1999a & b; Chittibabu and Parasarathy, 2000). Hence, the present study was undertaken to determine the structural and floristic composition of climber diversity in Nallamalais. The study area for the present work is considered as one of the significant biodiversity rich areas in Southern Eastern Ghats. Nallamalais one of the Centres of Plant Diversity (CPD) in India. It represents diversified habitats and supports a wide array of plant and animal life and provides basic livelihood for tribal and rural communities. Kumar & Bhanja (1992) produced a seed manual for forest trees of Andhra Pradesh. Sandhya Rani & Pullaiah (2002) reported 560 tree taxa from eastern Ghats. Suryanarayana et al., (2002) inventoried the plant wealth of Veligonda hill ranges and reported 1004 species belonging to 558 genera and 149 families. Studies on plant resources include Ellis (1982, 1987, 1990), Reddy et al., (1998), Pullaiah et al., (2007). Thualsi Rao et al., (2007), Reddy et al., (2007), Raju and Pullaiah (1995) surveyed the Flora of Kurnool district and reported 1064 species of which 208 are trees covering 194 from Nallamalais of Kurnool district. Pullaiah and Sandhya Rani (1999) made the floristic studies on trees of Andhra Pradesh and reported 531 tree species covering over 200 trees of Nallamalais.

While working on Flora of Andhra Pradesh, Pullaiah and Chennaiah (1997), Pullaiah and Ali Moulali (1997), Pullaiah (1997) and Pullaiah and Karuppusamy (2008) reported 2601 species, of which 531 are trees, Sunitha (2002) surveyed the sacred groves of Kurnool district and reported 138 tree taxa, of which 119 are from Nallamalais. She made over 100 additions of the Nallamalais after Raju & Pullaiah (1995) of which 18 are trees. Shali Saheb (2008) studies the medicinal plants of Nallamalais and reported 501 taxa of which 137 are trees. Khadar Basha (2009) was studied quantitative assessment of Nallamalais and reported 249 tree species. Most of the studies have followed the plot methods including square plots of 100x100cm (Gentry, 1988); 10x10m (Shalisaheb, 2008) to rectangular plots 10x10m by Boom (1986). Shah Hussain et al., (2008) describes the species composition. Shali Saheb (2008) analysed the medicinal plant diversity in three one-hectare plots through ten quadrants of 10x10m and recorded 135 species belonging to 110 genera 45 families. Khadar Basha (2009) recorded a total of 249 tree species from 175 grids comprising 237 species belonging to 139 genera and 54 families.

Climbers are one of the most interesting group of plants Species which are most neglected. These climbers contribute largely to the charm of our landscape by the manner in which they climb over trees, rocks. They also play a part in ancient historical buildings which their attraction to the green veil which covers their structural defects making them a perfect beauty in our eyes.

Climbers show great diversity in their climbing mechanism depending on which they are classified as root climbers, hook climbers, tendrill climbers, leaf or stem climbers. Only few studies were carried out on climbers. Pandey et al., (2005), studies medicinal climbers in flora of Gujarat. 81 climbers were recorded by Jangid and Sharma (2011), Ghosh and Mukherjee (2006), recorded 149 herbacious climbers and 79 lianas from North Andaman covering 55 families while Mahajan (2006), reported 31 taxa used by tribal people of Nimar region in Madhya Pradesh to cure various human ailments. Earlier studies on plant resources of Nallamalais include Ellis (1987), Kumar (1995), Goud (1997), Thulasi Rao et al., (2007), Shali Saheb (2008) studied the medicinal plants Nallamalais and reported 501 taxa. Shali Saheb (2014), studies medicinal climbers of Nallamalais reported 92 species belonging to 27 families. Shali saheb et.al (2023) reported the diversity of shrubs of the Nallamalais forest the TNI value was 606, the abundance value of the shrubs is 210.22. No comprehensive work is available for phytosociology of climbers in the study area, therefore, the objective of the present paper is to Study of phytosociological attributes of climbers plant resources in Nallamalais.

STUDY AREA

Nallamalais, one of the Centres of Plant Diversity (CPD) (WWF & IUCN, 1995) is located in the Central Eastern Ghats between latitudes 15°20' - 16°30' N and longitude 78°30' - 80°10' E in Andhra Pradesh, Telangana states extended to an area of 7640 sq km. Nallamalais cover five districts, viz. Kurnool, Prakasam, Guntur, of Andhra Pradesh, Mahaboob Nagar, and Nalgonda of Telangana. The hills cluster near Gundlābrahmeswaram, which is the nucleus of the Nallamalais appearing as a plateau. The vegetation of the Nallamalais is broadly categorized into 3 types; moist deciduous, dry deciduous, scrub type forests. Most primitive tribes, Chenchus and Sugalis live in Nallamalais. From times immemorial the forests of Nallamalais have been inhabited by Chenchus, an aboriginal and oldest tribe of South India. An ecological meaning is attributed to the word "Chenchu" by interpreting that a person who lives under a chettu (tree) is a Chenchu. They are experts in collection of honey, wild fruits and plant crude drugs. Sugalis also known as Lambadis and Banjara are largely found in the Nallamalais forest. These tribes in the study area have rich traditional botanical knowledge and still dependent on wild medicinal plant resources for curing their ailments.

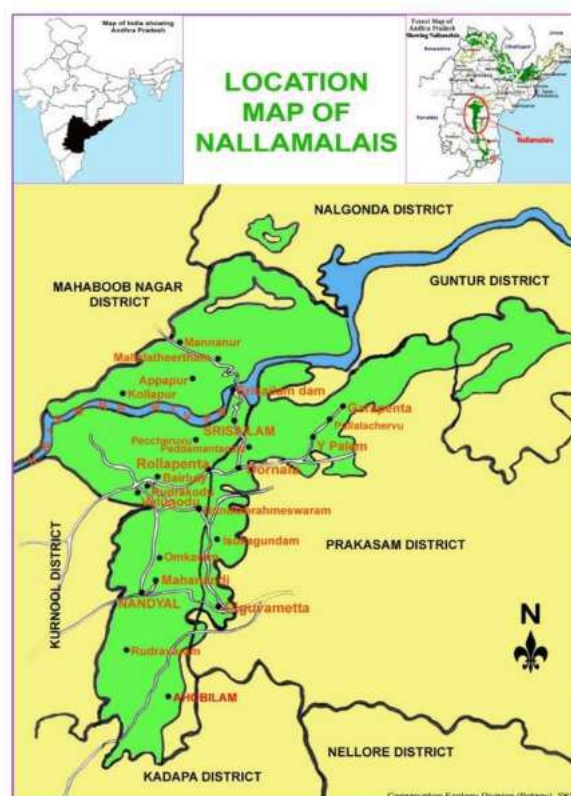


Figure: 1. Map of Nallamalais

METHODOLOGY

The main objective of the present paper to provide a study on phytosociological attributes of climbers random sampling method.

QUANTITATIVE STUDIES

The field work plan carried out in Nallamalais was by lying of 50 quadrates in the study area. Each quadrate size is 20x20m. All life forms of plants such as trees, shrubs, climbers and herbs were enumerated. All trees were enumerated in 20x20m quadrates.

shrubs and climbers in 5x5m nested plot and herbs were studies in nested 1mx1m plot. The field work was carried out in two seasons to cover all the vegetation and phenology of climbers.

Importance Value Index (IVI)

IVI = Relative dominance + Relative density + Relative frequency

Diversity Indices: Species diversity indices namely Shannon-Wiener index (Shannon and Weiner, 1962), Simpson index (Simpson, 1949) and Margalef Index (Margalef, 1980) were calculated.

Dominance Indices (Simpson 1949): It is a measure of dominance since it weighted towards the abundances of commonest species. It is estimated by using following formula:

$$D = \sum (ni/N)^2 \text{ or } Pi^2$$

Shannon-Wiener index: It is a measure of the average degree of 'uncertainty' in predicting to what species an individual chosen at random from a collection of S species and N individuals will belong. It is estimated by using following formula:

$$H' = -\sum (ni/N) \ln (ni/N)$$

Where, ni = number of individuals belonging to the ith species

N = Total number of individuals in the sample.

RESULTS AND DISCUSSION

The total number of individuals (TNI), number of quadrates in which species occurred, and the quantitative characters like abundance (A), density (D), frequency (F), relative abundance (RA), relative density (RD), relative frequency (RF) and importance value index (IVI) (Fig. 5) for climbers were presented in **Table-1**

Abundance: The total number of individuals (TNI) of climbers in the study site was 319. The total abundance value for climbers is about 134.15, with an average of 2.63. *Gymnema sylvestre* (44.5) was recorded as the high abundant species and the lowest abundance was recorded for 7 species including *Oianthus disciflorus* with 1.0.

Density: The total density of 51 climbers is 6.38, with an average of 0.12. The highest density value was recorded for *Gymnema sylvestre* (0.7) and the lowest density was recorded for 6 species including *Puraria tuberosa* (0.02).

Frequency: The total frequency for all the climbers is 234, with an average of 4.5. The high frequency value was recorded for *Cajanus scarabaeoides* and *Decalepis hamiltonii* with 14 and least frequency was observed in 22 taxa with 2 (e.g. *Piper attenuatum*).

Importance Value Index (IVI): Importance Value Index of individual climbers encountered in the sampled quadrates was identified *Gymnema sylvestre* (20.91) as the most important species followed by *Asparagus racemosus* (13.88) and *Cajanus scarabaeoides* (13.54). The lowest IVI value (1.91) was observed in six species including *Aspidoteris cordata*. The top 10 dominant IVI climbers are presented in **Fig.2**

Diversity indices: The Simpson Index is 0.9609, Shannon-Wiener Index is 3.562.

Figure: 2. Top 10 IVI Climber species of Nallamalais

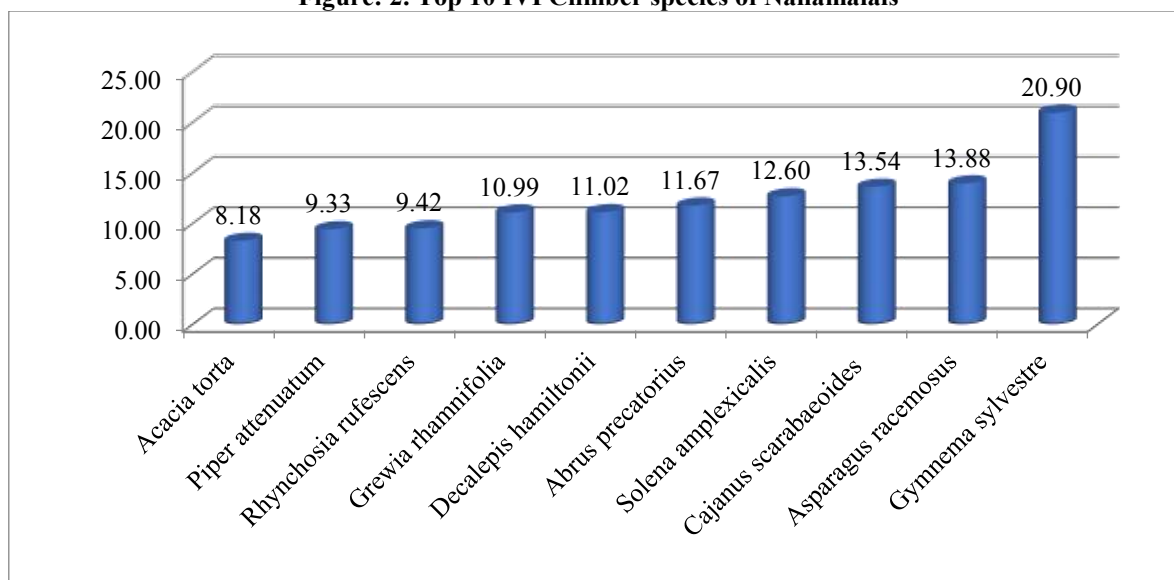


Table. 1. Phytosociological attributes of climbers

S.No.	Name of the taxon	TNI	Q	A	D	F	RA	RD	RF	IVI	A/F
1	<i>Abrus precatorius</i>	16	5	3.20	0.32	10	2.39	5.02	4.27	11.67	0.32
2	<i>Abrus pulchellus</i>	1	1	1.00	0.02	2	0.75	0.31	0.85	1.91	0.50
3	<i>Acacia caesia</i>	5	3	1.67	0.1	6	1.24	1.57	2.56	5.37	0.28
4	<i>Acacia intsia</i>	7	2	3.50	0.14	4	2.61	2.19	1.71	6.51	0.88

5	<i>Acacia torta</i>	10	3	3.33	0.2	6	2.48	3.13	2.56	8.18	0.56
6	<i>Ampelocissus latifolia</i>	5	2	2.50	0.1	4	1.86	1.57	1.71	5.14	0.63
7	<i>Ampelocissus tomentosa</i>	2	1	2.00	0.04	2	1.49	0.63	0.85	2.97	1.00
8	<i>Argyreia cuneata</i>	4	2	2.00	0.08	4	1.49	1.25	1.71	4.45	0.50
9	<i>Argyreia nervosa</i>	5	2	2.50	0.1	4	1.86	1.57	1.71	5.14	0.63
10	<i>Asparagus racemosus</i>	20	6	3.33	0.4	12	2.48	6.27	5.13	13.88	0.28
11	<i>Aspidoteris cordata</i>	1	1	1.00	0.02	2	0.75	0.31	0.85	1.91	0.50
12	<i>Bauhinia vahlii</i>	2	1	2.00	0.04	2	1.49	0.63	0.85	2.97	1.00
13	<i>Cajanus scarabaeoides</i>	18	7	2.57	0.36	14	1.92	5.64	5.98	13.54	0.18
14	<i>Capparis sepiaria</i>	1	1	1.00	0.02	2	0.75	0.31	0.85	1.91	0.50
15	<i>Cayratia auriculata</i>	2	1	2.00	0.04	2	1.49	0.63	0.85	2.97	1.00
16	<i>Cayratia pedata</i>	4	3	1.33	0.08	6	0.99	1.25	2.56	4.81	0.22
17	<i>Celastrus paniculata</i>	3	2	1.50	0.06	4	1.12	0.94	1.71	3.77	0.38
18	<i>Cissampelos perira</i>	8	3	2.67	0.16	6	1.99	2.51	2.56	7.06	0.44
19	<i>Cissus quadrangularis</i>	4	2	2.00	0.08	4	1.49	1.25	1.71	4.45	0.50
20	<i>Combretum albidum</i>	7	2	3.50	0.14	4	2.61	2.19	1.71	6.51	0.88
21	<i>Corallocarpus epigaeus</i>	2	1	2.00	0.04	2	1.49	0.63	0.85	2.97	1.00
22	<i>Decalepis hamiltonii</i>	12	7	1.71	0.24	14	1.28	3.76	5.98	11.02	0.12
23	<i>Dioscorea bulbifera</i>	9	4	2.25	0.18	8	1.68	2.82	3.42	7.92	0.28
24	<i>Dioscorea oppositifolia</i>	4	1	4.00	0.08	2	2.98	1.25	0.85	5.09	2.00
25	<i>Dioscorea pentaphylla</i>	2	2	1.00	0.04	4	0.75	0.63	1.71	3.08	0.25
26	<i>Dioscorea pubera</i>	4	1	4.00	0.08	2	2.98	1.25	0.85	5.09	2.00
27	<i>Grewia rhamnifolia</i>	15	3	5.00	0.3	6	3.73	4.70	2.56	10.99	0.83
28	<i>Gymnema sylvestre</i>	35	4	8.75	0.7	8	6.52	10.97	3.42	20.91	1.09
29	<i>Gymnopetalum cochinechinensis</i>	3	1	3.00	0.06	2	2.24	0.94	0.85	4.03	1.50
30	<i>Hemidesmus indicus</i>	7	5	1.40	0.14	10	1.04	2.19	4.27	7.51	0.14
31	<i>Ipomoea barlerioides</i>	4	2	2.00	0.08	4	1.49	1.25	1.71	4.45	0.50
32	<i>Jacquenmontia paniculata</i>	6	3	2.00	0.12	6	1.49	1.88	2.56	5.94	0.33
33	<i>Jasminum angustifolia</i>	3	1	3.00	0.06	2	2.24	0.94	0.85	4.03	1.50
34	<i>Jasminum auriculatum</i>	4	1	4.00	0.08	2	2.98	1.25	0.85	5.09	2.00
35	<i>Jasminum roxburghianum</i>	2	1	2.00	0.04	2	1.49	0.63	0.85	2.97	1.00
36	<i>Maynia hwatariana</i>	3	1	3.00	0.06	2	2.24	0.94	0.85	4.03	1.50
37	<i>Oianthus disciflorus</i>	1	1	1.00	0.02	2	0.75	0.31	0.85	1.91	0.50
38	<i>Olex scandens</i>	1	1	1.00	0.02	2	0.75	0.31	0.85	1.91	0.50
39	<i>Piper attenuatum</i>	8	1	8.00	0.16	2	5.96	2.51	0.85	9.33	4.00
40	<i>Pterolobium hexapetalum</i>	3	1	3.00	0.06	2	2.24	0.94	0.85	4.03	1.50
41	<i>Puraria tuberosa</i>	1	1	1.00	0.02	2	0.75	0.31	0.85	1.91	0.50
42	<i>Rhynchosia rufescens</i>	12	4	3.00	0.24	8	2.24	3.76	3.42	9.42	0.38
43	<i>Rhynchosia suaveolens</i>	4	1	4.00	0.08	2	2.98	1.25	0.85	5.09	2.00
44	<i>Rivea hypocyrtiformis</i>	7	3	2.33	0.14	6	1.74	2.19	2.56	6.50	0.39

45	<i>Sarcostemma acidum</i>	3	1	3.00	0.06	2	2.24	0.94	0.85	4.03	1.50
46	<i>Secamone emetica</i>	2	1	2.00	0.04	2	1.49	0.63	0.85	2.97	1.00
47	<i>Smilax zeylanica</i>	4	2	2.00	0.08	4	1.49	1.25	1.71	4.45	0.50
48	<i>Solena amplexicalis</i>	18	5	3.60	0.36	10	2.68	5.64	4.27	12.60	0.36
49	<i>Thunbergia fragrans</i>	6	3	2.00	0.12	6	1.49	1.88	2.56	5.94	0.33
50	<i>Ventilago denticulata</i>	3	2	1.50	0.06	4	1.12	0.94	1.71	3.77	0.38
51	<i>Ziziphus oenoplea</i>	6	2	3.00	0.12	4	2.24	1.88	1.71	5.83	0.75
		319		134.15	6.38	234	100.00	100.00	100.00	300.00	

TNI- Total Number of Individuals, **Q-** Number of quadrates, **A-** Abundance, **D-** Density, **F-** Frequency, **RA-** Relative Abundance, **RD-** Relative Density, **RF-** Relative Frequency, **IVI-** Importance Value Index, **A/F-** Abundance/Frequency Ratio.

CONCLUSIONS

Forests that are relatively undisturbed seem to possess these varied habitat conditions more upon certain specific areas should be with limited human and grazing disturbance to conserve these taxa. Nallamalais is a protected area needs further attention in terms of conserving valuable climbers species. Good marketing avenues have to be created for the local communities regarding climbers of medicinal value. Intensive training programmes have to be organized for tribal and other communities by governmental and non-governmental agencies regarding the sustainable collection, utilization and conservation of climbers resources. A highly coordinated action-oriented multi-disciplinary approach on plant resources conservation integrating the forest department, non-governmental organizations, scientific bodies and research institutions with the co-operation of local communities should be implemented

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INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

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MARK TWAIN – THE GREATEST NOVELIST OF AMERICA

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Abstract:

Samuel Langhorne Clemens (Mark Twain) is an American author of such classics as *The Adventures of Tom Sawyer*, *The Adventures of Huckleberry Finn*, *The Innocents Abroad* and so on. Although the great American novelist is remembered for his humorous and satirical aspects yet he is the most original and a remarkable writer in every manner. He was a moralist at heart. He was great writer of great thoughts. He all the time used to insist that his task was not creating buffoonery but instructing the people. For this purpose he chose burlesque, feeling that the public is to be coaxed and tickled into understanding. The present article peeps into the greatness of the this American literary legend by lightly touching upon all the literary techniques that he employed to put the American novel on the highest pedestal.

Key words: Humour – characterization – satire - Mark Twain's greatness - American novel.

Samuel Langhorne Clemens better known as Mark Twain is one of the best loved writers of America, immediately popular in his own days. In this regard he has been luckier than most popular writers who fell into obscurity immediately after their death, but Twain remains even today, years after his death as one of the greatest figures of American literature and his fame seems to be in no danger. Marks Twain's appeal to the readers is based on various factors. Some see his greatness in his humour which is definitely one of the reasons for his popularity. Others feel that it is the least of his attractive features when compared with the other grate features of his works. In this regard Joha Eskine and W.P. Trent feel, "Mark Twain is more certain of remembrance as a novelist that as a humorists".¹

The term humour is something that has varying connotation to different people. John Palmer remarks in his book, *Comedy the curse of Bible* came true actually when mankind began to laugh. An instance that strikes to people of one country as funny may appear devoid of all fun to people of another. Marks Twain's humour, at least many portions of it, will probably recede beyond general appreciation. But as a novelist he will always be loved by his readers and the other novelist. All his works are master pieces. Infact they become models for Twain's successors. This fact was well said by Bernard Shaw, when he puts it about Twain as, "I am persuaded that the future historian of America will find your works as indispensable to him as a French historian finds the political tracts of Voltaire".²

It is true that, Marks Twain started his career as a humorous writer. After a chequered career- he worked as a printer's devil, journeyman printer, steamboat pilot, and soldier and he went out to the Far West. It was there that Marks Twain finally got into journalism of the masculine humorous sort which flourished in the Far West. It was in Nevada and California that Marks Twain's humour of which we have evidence during the whole of his

adolescence came to the fore front and it is a notable fact that almost every man of a literary tendency who was brought into contact with those pioneer conditions became a humorist.

Mark Twain's first story, The Celebrated Jumping Frog won him recognition all over the country. He was sent abroad by the editorial staff of the newspaper for which he wrote his sketches. The idea was that he should report the trip humorously and the result was The Innocents Abroad, which firmly established his fame. The book is one of the finest example of the old extravagant American humour. In The Adventures of Tom Swayyer and The Adventure of Huckleberry Finn, Mark Twain's delightful humour is seen in abundance. Even his trip around the world was delightful to his audience and none who heard him could forget his unique drollery. In spite of his prodigious appeal as a humorist, it must be borne in mind that Mark Twain was reluctant to adopt the humorist's career and that he was in revolt against a role which, as he vaguely felt, had been thrust upon him. Twain in fact wanted to become a remarkable writer in every manner and he did become. This fact was well balancedly said by Howells, the well known American critic and novelists as, "Mark Twain is not merely a great humourist, he is a remarkable fellow in a very different way".³

If it is Mark Twain's humour alone that made him known and loved as a writer, had he no other qualities, he might by now have been almost forgotten like the many American jokers who have gone out of fashion, like Joseph Billingses or Artemus Ward. There were occasions when Mark Twain's humour affects his work adversely. His masterpiece Huckleberry Finn, for instance particularly in the chapters concerning the rescue of Jim contained passages of broad humour and parody which frequently clashed in tone with the style of the long oral tale used throughout the volume. But this book like many others of Mark Twain's had qualities which triumphed over such minor faults. It is to these qualities that we should attribute Marks Twain's perennial fame as a novelist.

Mark Twain's personal traits have contributed to his becoming almost a legend. He was both a personality and a personage. The stories about him are endless. His liking for cats, his addiction to tobacco and whisky and billiards, his passion for dressing in white, his willingness to back inventions, his colourful profanity, his fondness for hoaxes his hatred of intolerance and cruelty and despotism, and his personal kindnesses are well known. In the writings of this beloved American author, his personality was an important element.

Gifted with a marvelous mimetic ability, Mark Twain was a superb story-teller. This enabled him to hold his readers enthralled, and to entertain audiences in his home and in public auditoriums with equal facility. Mark Twain as a literary artist was an adept at carefully leading his readers and audience through calculated effects and contrived suspense to effective climaxes. He was a consummate master of the tall tale tradition, as proved by his stories about the Jumping Frog and the Blue Jay. These along with, The Man that Corrupted Handleyburg, are imperishable narratives of American literatures. Beginning with The Adventures of Tom Swayer, Mark Twain showed himself to be a novelist of the first rank. The books that followed fulfilled the expectation created by this work. This truth has been immortalized in letters when Bernard Shaw the Irish playwright and critic puts about Twain's greatness as, "by far the greatest American writer".⁴

The greatest success of Mark Twain as a novelist is his genius for creating memorable characters and for breathing the life into them. Perhaps his portrait gallery is small, but it is memorable. Tom Swayer, Huckleberry Finn and the runaway nigger Jim, colonel Sellers and Roxy are unforgettable characters in the world of literature. Mark Twain is a remarkable analyzer of characters. Tom Swayer proves his phenomenal understanding of the American small boy, and of those aspects of human nature which expand in the small, wide-settled villages of inland America. The tramp, the loafer, the peddler all the local characters that might have significance in the eyes of the small boy, are represented with fascinating realism, as well as the more respectable but less interesting domestic characters, but of all them viewed at all times through the eyes of the boy. As for Huck Finn, this romantic young outcast with his secret wisdom and his much envied freedom is one of the most real figures of fiction. Aunt Polly, widow Douglas, Aunt Sally. Uncle Silas are all vividly drawn characters. Yet more interesting are the lowdown humbugs and frauds who get on board Huck's and Jim's canoe. Vonnegut Jr. Kurt, the celebrated American novelist says that in the works of Mark Twain we can see more America and its immortalized characters. Here he says this phenomenon as, "Twain was good with crowds that he became in competition with singers and dancers and actors and acrobats, one of the most popular performers of his times. It is so unusual and so

psychologically unlikely for a great writer to be great performer too, that I can of only two similar cases - Homer's, perhaps and Moliere's." ⁵

As a painter of manners and customs, Mark Twain is unrivalled. He has observed everything, landscape, environments, physical characteristics of the inhabitants, ways of life, customs, beliefs and superstitions. Through him we know the little Missouri town, asleep on the banks of the river, with its houses rising in steps from the levee, surrounded by its circle of wooded hills terminating near the Mississippi in sheer cliffs pierced by caves. American landscape assumes for readers, native and foreign, a vividness and reality that is rarely seen in other writers. No other American writer has so faithfully described the Mississippi river with its rapids and its half-submerged logs faired by the navigators, the wooded isles and dismal cotton plantations of the south. The Arkansas farm introduced in Huckleberry Finn; is minutely described. The novelist does not omit the clean rooms, the floors covered with rugs, the heart framed in well scrubbed red brick, the naïve knick-knacks on the mantelpie and the popular prints on the wall. The entire West flies past the reader in a succession of precise, faithful images. In this context it is very pertinent to quote W.H. Vogel Bach when he says about this faithful and truthful depiction as, "There is more America in Mark Twain's books than in any others ... It is their immortality." ⁶

Mark Twain's realism in depiction does not stop at externals. In describing scenes that he knew he often relies on memory and hence he interprets reality and to a certain extent colours it his realism in the photographic realism of Theodore Dreiser. The American journalist of the naturalistic school. For this reason, of all Mark Twain's books those that posterity will best remember are Tom Sawyer, Life on the Mississippi and above all Huckleberry Finn.

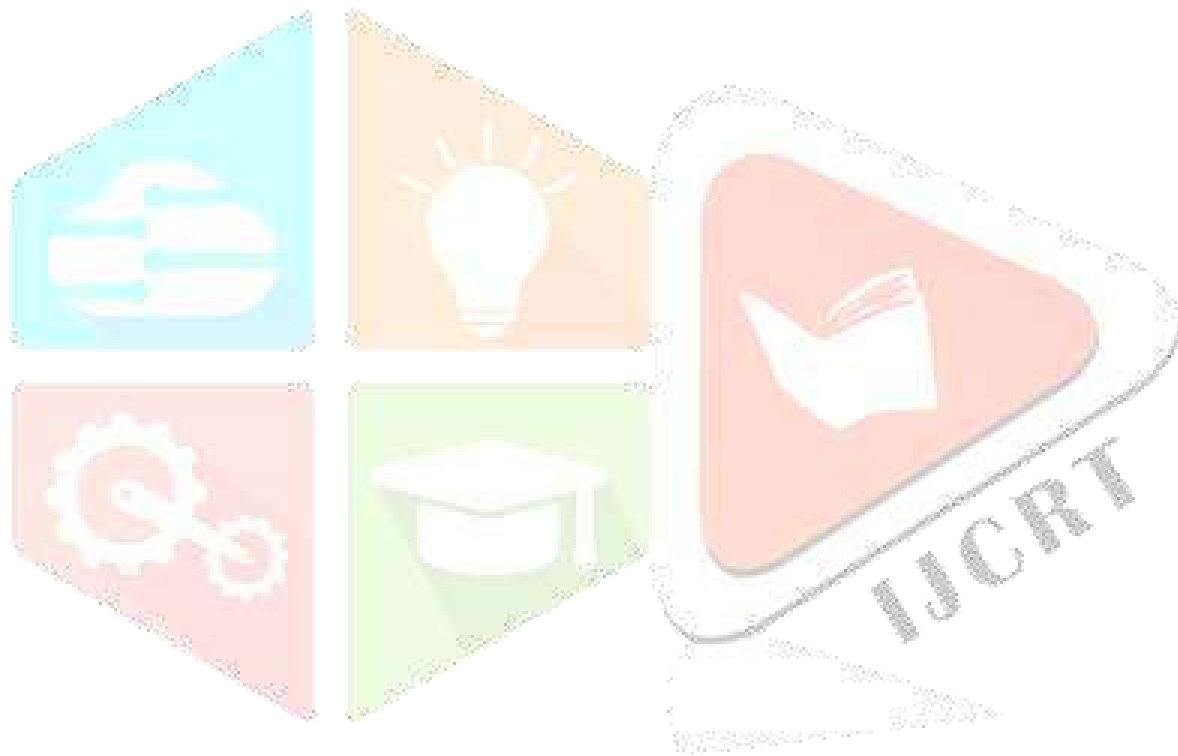
Mark Twain did not stop with depicting social customs and manners. He went a step further and satirised them. Especially for depicting such an irksome and irritating things, which of course is a reality. His beautiful novel and one of the world's greatest novel, Adventures of Huckleberry Finn has been banished and Mark Twain himself was branded as a ruffian and his novel was banished from the stands by District Court and the Court felt the novel was unfit for reading. The court also felt that too much freedom given to American Citizen is one of the reasons for such writings. The District Court feels, "An incarnation of the better side of the ruffians that is one result of the independence of Americans". ⁷

One of the great things that Mark Twain achieved in Huckleberry Finn and other novels is the creation of a prose style suited to the American ethos. Though many writers before Twain had tried to exploit the possibilities of the American idiom, it was only in his hands that we get a rich style with simplicity and informality of phrases, bold and incongruous simplicity and flavored colloquialisms. In his hands comic jargon and dialect became a finished literary weapon, unemphatic, visual, and deceptively simple, sounding like speech and yet not quite the same. His basic reliance on colloquial idiom encouraged many later writers who, but for his example would not have dared to deviate from this literary style of his contemporaries.

As a thinker, Mark Twain is rather disappointing. He was full of prejudices and in his likes and his dislikes he tended to be irrational. He had minor artistic lapses too, for he was seldom a disciplined writer, but these faults fade into insignificance when compared with the overwhelming greatness of Mark Twain, the buoyant story-teller, the delineator of character and the master of idiomatic prose. Optimist and pessimist, dupe of his own emotions, or coerced by his audience, Mark Twain does not appear to the American reader as a man of letters imprisoned by the demands of his vocation, but rather as a free spirit to whom one turns in order to breathe the virile, joyous, healthy atmosphere of an America which has disappeared. He survives as the evocator, the poet of a unique phase of American experience. There is an understanding between him and his public, just as it was there during his lifetime. He continues to have an almost seductive charm for his readers. The reasons for his success are sentimental, America sees him with real affection, as the first of her writers to draw from the American soil, the material for an original and lasting work. Twain is a God to them. They rever him like they innocently rever the God. Not only the Americans even great writers across the world rever and respect Twain, like a God. Rudyard Kipling, the British Nobel Laureate fondly remembers and respects Twain as, "I love to think of the great and godlike Clemens". ⁸ Such is the name and fame commanded across the world by Mark Twain. That is why, Mark Twain is considered the greatest novelist of America.

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IMPORTANCE OF EMOTIONAL INTELLIGENCE AT WORKPLACE

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“The mind is its own place, and in itself can make a heaven of hell, a hell of heaven.” — John Milton:

Abstract

Emotional intelligence helps you build stronger relationships, succeed at school, work place and achieve your career and personal goals. It can also help you to connect with your feelings, and make good decisions. It is the ability to understand, and manage your emotions in positive ways to relieve stress, communicate effectively, empathize with others, overcome challenges and resolve conflict. Few people who are academically brilliant are socially inept and unsuccessful at work or in their personal relationships. Intellectual ability is not enough to achieve success in life. Your Intelligence Quotient (IQ) can help you get into college but your Emotional Quotient (EQ) that will help you manage the stress and emotions when facing your final exams. Emotional intelligence is a set of emotional and social skills that collectively establish how well we are. Emotional intelligence help to get success in life and work, to pursue and express ourselves, develop and maintain social relationships, use emotional information, cope with challenges, in an effective and meaningful way.

Key Words: career, challenges, decision, emotional, intelligence, professional, relationship

Importance of Emotional Intelligence

You probably know people who are academically brilliant and yet are socially unskilled and unsuccessful at work or in their personal relationships. Intellectual ability or your intelligence

quotient (IQ) isn't enough on its own to achieve success in life. Your IQ can help you get into college, but it's your EQ that will help you manage the stress and emotions

Emotional Intelligence is the summative of abilities, competencies and skills that signify a collection of knowledge in order to cope with life effectively. Therefore, it is closely related to the personal and professional growth of the individuals who have to take decisions under stressful and difficult situations.

IQ v/s EQ

EQ

- ❖ not fixed
- ❖ can be improved throughout life

IQ

- ❖ established by Mid teens
- ❖ cant increase
- ❖ predicts only 10% to 20% of life success
- ❖ how to increase your EQ

Building Emotional Intelligence

Emotional intelligence is a person's Ability to understand their own emotions. the emotions of other's and to act appropriately using the emotions. Emotional intelligence never stops growing.

- **self awareness** recognising internal feeling
- **managing emotion** finding ways to handle emotions that are appropriate to the situation
- **motivation** using self control to channel emotions toward a goal
- **empathy** understanding the emotional perspective of other people
- **handling relationship** using personal information and information about others to handle social relationships and to develop interpersonal skills

Some researchers suggest that emotional intelligence can be learned and strengthened, while others claim it is an inborn characteristic.

1. **Knowing one's emotions.** People with greater certainty of their moods and feelings are better navigators of their lives. They can take good decisions and set realistic expectations.
2. **Managing emotions:** People who have ability to cope with adverse or distressing emotions can soothe themselves at the appropriate time. They show a form of "stress" hardiness.
3. **Motivating oneself:** People with the capacity for self-efficacy not only manifest emotional self-control, but also use this to accomplish specific pre-set goals. This ability to stifle impulsiveness underlies accomplishments of all sorts.
4. **Recognizing emotions in others.** People with the ability to distinguish other's emotions based on situational and expressive cues possess information which can be used to create desirable outcomes. Empathetic abilities come with the capacity to not only recognize but also share the emotions felt by others.
5. **Handling relationships.** People with this skill can get things done with and through others. Over time, the consistent capacity to handle relationships will create leadership opportunities for the individual with this competence.

Emotional Intelligence Has Five Main Elements Of Emotional Intelligence:

These skills in emotional intelligence are vital for successful leadership. Self-awareness and its representative competencies of accurate self-assessment and self-confidence help emotionally intelligent decision-makers to determine their appropriate role in the decision-making process. Self-management and its behavioural components of self-control, trustworthiness, conscientiousness, adaptability, achievement drive and initiative are significant emotional intelligence skills for decision-makers (Goleman, 2001). Self-awareness.

1. Self-regulation.
2. Motivation.
3. Empathy.
4. Social skills.

As an administrator and leader, one should manage these elements.

1. **Self-awareness:** If people are self-aware, they always know their feelings and how emotions affect the people around them. Being self-aware people are in administrator or leadership position also means having a clear picture of their strengths and weaknesses.
2. **Self-regulation:** administrators and leaders who regulate themselves successfully hardly verbally attack others, make rushed or emotional decisions, stereotype people, or compromise their values. Self-regulation is all about staying in control. This element of emotional intelligence also covers administrators and leader's flexibility and commitment to personal accountability. To improve ability to self-regulate, person must know values, Hold himself accountable, and Practice being calm
3. **Motivation:** Self-motivated administrators and leaders regularly work toward their goals. And they have extremely high standards for the quality of their work.
4. **Empathy:** Empathy is critical to manage a successful team or organization. Administrators and leaders with empathy have the ability to put themselves in someone else's situation. They support and develop the people on their team, challenge others who are acting unfairly, give constructive feedback, and listen to those who need it.
5. **Social skills:** Administrators and leaders must develop social skills. People who do well in this element of emotional intelligence are great communicators. They are just as open to hearing bad news as good news, and they are experts at getting their team to support them and be excited about a new mission or project. Administrators who have good social skills are

also good at managing change and resolving conflicts tactfully.

Managing your emotions at work

We are emotional human beings. It is hard for us, not to be emotional. while it is generally good to be in touch with our emotions and to not suppress them, there are situations where we must somehow manage our emotions especially well. That's notably the case at work.

Emotional outbursts at work could be due directly to work-related matters or to stressors from our personal life spilling into our work life. Handling our emotions at work is often seen as a measure of our professionalism. The most common negative emotions experienced at work are frustration, worry, anger, dislike and unhappiness.

10 STRATEGIES TO MANAGE NEGATIVE EMOTIONS AT WORK**1. Compartmentalisation**

Try and leave personal matters and issues at home. When you commute to work, use that time to tell your mind to let go. You can also compartmentalise work-related stressors so that your emotions at work don't spill over into your personal life too.

2. Deep breathing & relaxation techniques

- a) This will help with emotions like anxiety, worry, frustration and anger.
- b) Take deep breaths, inhaling and exhaling slowly until you calm down. Slowly count to 10.
- c) You can take a walk to cool down, and listen to some relaxing music.
- d) Talk to someone who can help you calm down.

3. The 10-second rule

- a) This is especially helpful if you are feeling angry, frustrated or even irate.
- b) If you feel your temper rising, try and count to 10 to recompose yourself.
- c) If possible, excuse yourself from the situation to get some distance but do reassure the other party that you will come back to deal with the matter.

4. Clarify

It is good to clarify before reacting, in the event that it could be a simple misunderstanding or miscommunication.

5. Blast your anger through exercise

- a) Instead of losing your cool, plan on hitting the treadmill or going to a kick-boxing class to let the anger out of your system.
- b) Exercise is also a good way to get a solid dose of mood-enhancing endorphins.
- c) In addition, exercise will help to release any physical tension in your body.

6. Never reply or make a decision when angry

- a) In this day of instant communication, it's easy to just shoot off an email or text that you may regret later.
- b) Never let your anger or unhappiness cloud your judgement.
- c) Hold off all communication while you are still angry. You can type it first but save it as a draft and sleep on it for a day. Re-read it the next day or even let someone you trust take a look at it before you send it.

7. Know your triggers

- a) It helps when you are able to recognise what upsets or angers you.
- b) This way, you can prepare yourself to remain calm and plan your reaction should the situation occur.
- c) You may even be able to anticipate the other party's reaction.

8. Be respectful

- a) Treat your colleagues the same way you would like to be treated yourself.
- b) If the person is rude, there's no need to reciprocate. We can stay gracious and just be firm and assertive without being aggressive. Often, rude people will calm down if they don't get a reaction from you and realise that they are the only one shouting in the room

9. Apologise for any emotional outburst

- a) Sometimes our emotions do get the better of us.
- b) If you do have an emotional outburst, apologise immediately to the person and perhaps to those around you who have heard it.
- c) You need not explain yourself or be defensive. Just a simple “I am sorry. I reacted badly” would make a big difference.

10. Never bring your negative emotions home

- a) It is good practice to let go of any anger, frustration and unhappiness at the end of every workday.
- b) Harboursing negative emotions allows them to fester like mould, bringing you to a breaking point. So it's best to empty the emotional “trash can” on a daily basis, to prevent overwhelm.
- c) You can use the compartmentalisation method mentioned above, or you can plan to engage in enjoyable activities after work with your friends and family.

Common Negative Emotions at Work

1. Frustration/irritation.
2. Worry/nervousness.
3. Anger/aggravation.
4. Dislike.
5. Disappointment/unhappiness.

1. Frustration/Irritation

Frustration usually occurs when you feel stuck or trapped, or unable to move forward in some way. It could be caused by a colleague blocking your favourite project, a boss who is too disorganized to get to your meeting on time, or simply being on hold on the phone for a long time.

Whatever the reason, it's important to deal with feelings of frustration quickly, because they can easily lead to more negative emotions, such as anger.

Here are some suggestions for dealing with frustration:

- a) **Stop and evaluate** – One of the best things you can do is mentally stop yourself, and look at the situation. Ask yourself why you feel frustrated. Write it down, and be specific. Then think of one positive thing about your current situation. For instance, if your boss is late for your meeting, then you have more time to prepare. Or, you could use this time to relax a little.
- b) **Find something positive about the situation** – Thinking about a positive aspect of your situation often makes you look at things in a different way. This small change in your thinking can improve your mood. When it's people who are causing your frustration, they're probably not doing it deliberately to annoy you. And if it's a thing that's bothering you – well, it's certainly not personal! Don't get mad, just move on.
- c) **Remember the last time you felt frustrated** – The last time you were frustrated about something, the situation probably worked out just fine after a while, right? Your feelings of frustration or irritation probably didn't do much to solve the problem then, which means they're not doing anything for you right now.

2. Worry/Nervousness

With all the fear and anxiety that comes with increasing numbers of layoffs, it's no wonder that many people worry about their jobs. But this worry can easily get out of control, if you allow it, and this can impact not only your mental health, but also your productivity, and your willingness to take risks at work.

Try these tips to deal with worrying:

- a) **Don't be surrounded with worry and anxiety** – For example, if co-workers gather in the break room to gossip and talk about job cuts, then don't go there and worry with everyone else. Worrying tends to lead to more worrying, and that isn't good for anyone.
- b) **Try deep-breathing exercises** – This helps slow your breathing and your heart rate. Breathe in slowly for five seconds, then breathe out slowly for five seconds. Focus on your breathing, and nothing else. Do this at least five times. For more on this, read our article on Physical Relaxation Techniques.
- c) **Focus on how to improve the situation** – If you fear being laid off, and you sit there and worry, that probably won't help you keep your job. Instead, why not brainstorm ways to bring in more business, and show how valuable you are to the company?
- d) **Write down your worries in a worry log** – If you find that worries are churning around inside your mind, write them down in a notebook or "worry log," and then schedule a time to deal with them. Before that time, you can forget about these worries, knowing that you'll deal with them. When it comes to the time you've scheduled, conduct a proper risk analysis around these things, and take whatever actions are necessary to mitigate any risks. When you're worried and nervous about something, it can knock your self confidence..

3. Anger/Aggravation

Out-of-control anger is perhaps the most destructive emotion that people experience in the workplace. It's also the emotion that most of us don't handle very well. If you have trouble managing your temper at work, then learning to control it is one of the best things you can do if you want to keep your job.

Try these suggestions to control your anger:

- a) **Watch for early signs of anger** – Only you know the danger signs when anger is building, so learn to recognize them when they begin. Stopping your anger early is key. Remember, you can choose how you react in a situation. Just because your first instinct is to become angry doesn't mean it's the correct response.
- b) **If you start to get angry, stop what you're doing** – Close your eyes, and practice the deep-breathing exercise we described earlier. This interrupts your angry thoughts, and it helps put you back on a more positive path.
- c) **Picture yourself when you're angry** – If you imagine how you look and behave while you're angry, it gives you some perspective on the situation. For instance, if you're about to shout at your co-worker, imagine how you would look. Is your face red? Are you waving your arms around? Would you want to work with someone like that? Probably not.

4. Dislike

We've probably all had to work with someone we don't like. But it's important to be professional, no matter what.

Here are some ideas for working with people you dislike:

- a) **Be respectful** – If you have to work with someone you don't get along with, then it's time to set aside your pride and ego. Treat the person with courtesy and respect, as you would treat anyone else. Just because this person behaves in an unprofessional manner, that doesn't mean you should as well.
- b) **Be assertive** – If the other person is rude and unprofessional, then firmly explain that you refuse to be treated that way, and calmly leave the situation. Remember, set the example.

5. Disappointment/Unhappiness

Dealing with disappointment or unhappiness at work can be difficult. Of all the emotions you might feel at work, these are the most likely to impact your productivity. If you've just suffered a major disappointment, your energy will probably be low, you might be afraid to take another risk, and all of that may hold you back from achieving.

Here are some proactive steps you can take to cope with disappointment and unhappiness:

- a) **Look at your mindset** – Take a moment to realize that things won't always go your way. If they did, life would be a straight road instead of one with hills and valleys, ups and downs, right? And it's the hills and valleys that often make life so interesting.
- b) **Adjust your goal** – If you're disappointed that you didn't reach a goal, that doesn't mean the goal is no longer reachable. Keep the goal, but make a small change
- c) **Record your thoughts** – Write down exactly what is making you unhappy. Is it a co-worker? Is it your job? Do you have too much to do? Once you identify the problem, start brainstorming ways to solve it or work around it. Remember, you always have the power to change your situation.
- d) **Smile!** – Strange as it may sound, forcing a smile – or even a grimace – onto your face can often make you feel happy (this is one of the strange ways in which we humans are "wired.") Try it – you may be surprised!

Managing emotions in the workplace

1. Coping mechanisms for employee emotions

Coping mechanisms are the tools and strategies we use to deal with stress in our lives. Our various ways of coping eventually create a coping strategy.

You can cope with stress in positive or negative ways. A negative coping strategy might be to ignore your problems and emotions, hoping they work themselves out. But that can be bad for your health. Positive coping strategies allow you to deal with stress in healthy ways.

2. Managing your own emotions

The best thing you can do to combat negative moral emotions and their repercussions is understand how to deal with emotions. Take the Recognize, Understand, Manage approach when dealing with emotions at work.

3. Recognize

When emotions start to bubble up, don't panic. Take a deep breath and recognize the emotion for what it is. Don't react immediately. Instead try to put a label on what it is you're feeling. Determine when you became aware of the feeling and what triggered it. Don't judge yourself for how you feel.

4. Understand

After you've named your emotions, focus on the "why" behind them. Dig deep and try to discover their origin.

Follow them down the pathway to where you are now with questions like these:

- a) If you feel upset, what is causing you to feel that way?
- b) Are your emotions coming from something within you, or something external?

If it's a familiar emotion, think about other times you've felt this emotion and how you previously responded.

- a) What went well?
- b) What didn't?
- c) How do you want to respond differently in this moment?

5. Manage

Once you've taken time to cool down and reflect, the third and final step is managing the situation. You need to figure out how you are going to respond, if at all.

There are no hard and fast rules for how to respond, but here are a few things to consider:

- a) Do you still feel the need to address the situation?
- b) Is it possible you overreacted?
- c) Are there things that need to be resolved before you can move forward?
- d) What will you say when you do address the situation? What might others involved say?
- e) What did you learn from this situation that you can apply to future situations like it?

Dealing with employee emotions: 4 tips for leaders

“As more and more Artificial Intelligence is entering into the world, more and more Emotional Intelligence must enter into leadership.”- Amit Ray

Regardless of how well you handle your own emotions, you can't control the emotions of others. But it is important to learn how to acknowledge them and respond appropriately. Unresolved issues can lead to decreased productivity, damaged relationships, and lowered engagement.

The following Tips are to be followed while dealing with employees' emotions and start building a stronger emotional culture at work:

1. Allow for mistakes.

No one is perfect—plain and simple. Mistakes are inevitable and, although they don't need to be simply accepted, they also aren't grounds for a scolding. Berating or punishing employees can cause humiliation and hostility.

Calmly correcting or excusing the rare mistake is a great way to build trust. In fact, helping reduce negative emotions with transparency, open communication, and authenticity will lead to better relationships with your employees.

2. Build a culture of trust.

Sharing emotions, especially uncomfortable ones, is one way to show vulnerability. But we can't be vulnerable if we don't trust the people that we're sharing our stories with. Everyone in your organization should feel comfortable being themselves and expressing their emotions. It's not enough just to let employees know they can share their feelings—you must be willing to be the example too. When employees can witness a culture of honesty and compassion, they'll be able to understand and adapt to others' emotions.

3. Be present.

When managers and leaders are unavailable, employees may feel anxious and undervalued. Make time to connect with your team to instil confidence in your employees, their work, and their performance. Empowering your team members to stay connected in this way helps build positive relationships. Recommend meeting once a week—even for a quick check-in. These meetings offer employees an opportunity to ask questions, provide updates, raise concerns, and provide feedback. These are perfect times to celebrate successes to increase positive emotions in the workplace.

4. Listen more than you talk.

Most times, employees who experience negative emotions aren't searching for solutions. They want to express themselves and release their pent-up emotions. Listening to your employees allows them to get it all out there and makes them feel cared for and heard. It also establishes you as a trusted resource who can be depended on. When dealing with someone else's emotions, strive to understand what they are feeling and why. Ask them how they are feeling and if they are okay. If they don't want to talk or say everything is fine, respect their wishes and don't pressure them any further. If they do want to talk it out, find a quiet space and listen.

Conclusion

To summarize, Emotional intelligence is the ability to identify and understand emotions and their impact on behaviour and attitudes. Those who have a high degree of emotional intelligence are in tune with both their own emotions and the emotions of other people with whom they come in contact. Manage the stress and emotions when facing your final exams emotional intelligence is a set of emotional and social skills that collectively establish how well we are and it is your predictor of success in life and work to pursue and express ourselves to develop and maintain social relationships. Recently, focus on understanding emotions in organizations has resulted in increased attention to the role of Emotional Intelligence. Your employees are only human, and humans are emotional creatures. Addressing emotions is important for recognizing your employees for who they are and improving your emotional culture Emotional outbursts at work could be due directly to work-related matters or to stressors from our personal life spilling into our work life. Handling our emotions at work is often seen as a measure of our professionalism

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EVOLUTION OF WOMEN IN THE WRITINGS OF SUDHA MURTHY

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Abstract

Feminism is the fight for women's equal rights such as the right to equal pay and treatment. It is not to be confused with making women do what is seen as Men's roles, like lifting heavy things. Women deserve to be treated as equals, because they are also capable of doing the better roles. History of Literature has observed the women's participation being evolved through centuries. The yester year women's journey has been very critical and disrespectful which they have patiently handled. Recently, Indian English fiction has been trying to give expression to the Indian experience of the modern predicaments. Fiction by women writers constitutes a major segment of the contemporary writing in Indian English. Women have experienced all the criticism and persisted with their extreme journey. Today Women have come a long way emerging as a strong soul in the society. Sudha Murthy, a well-known prolific author whose books in Kannada and English have been the best-sellers. She has written novels, technical books, travelogues, collections of short stories and non-fictional pieces. Her books have been translated into major Indian languages. "the mother i never knew" is the book that comprises of two novellas that explore quests by two men- each searching for a mother he never knew that he had.

Key Words: feminism, heritage, modernity, problems, rights, society, tradition, women

Introduction

Murthy's novels reveal that she is an outstanding feminist championing the cause of women's liberty and rights. An intense awareness of her identity as a women and her attention to feminine problems are discovered in her fictions. She presents the real world raising serious questions about contemporary attitudes to men, women and marriage. She analyses the actual social and emotional bonds that bind women. They confront a tradition - oriented society and learn to live under the waves of heritage and modernity.

The protagonist of Sudha Murthy's presented mostly as willing to accept any change in their lifestyle. She is able to read the inner mind of these women and portrays their psychological and emotional imbalances. Her books are all about the importance of one's identity with specific identity to women. It portrays how a woman sacrifices so many things for her family, however doesn't receive any respect and equal importance. At the end it teaches every woman should be independent and treated equally neither inferior nor superior.

One of the important aspects which Sudha Murthy highlights is that there was a limit which one could be obedient and submissive, but once that limit was crossed, the individual's happiness become more essential. The protagonists leave the family for not to earn more money, but she needs space and self- respect. Indian woman are known for their extreme patience and determination. They are all in fact guided by the spirit even if the ironic equilibrium between faith and disbelief. Murthy is definitely a writer with a purpose.

"Though you reach the sky- make sure your feet is always grounded" is an important message



delivered by Sudha Murthy. You should have experience some difficulties in life because continuous success makes a person arrogant, continuous failures makes a person diffident, occasional failures and fair amount of success makes an individual more mature. So you must undergo some difficulties, some helplessness, observe people and have sympathy makes a person very matured. She compares herself to a tree, which does not keep its fruits to itself, and at the same time, finds fulfillment in these acts of selflessness.

Sudha Murthy, a disciplined writer never misrepresented the power of freedom on her protagonists like have extra marital relationship with others and lesbian experience with her mates. Murthy clearly voiced by her novels that the present age women have realized that they are not helpless and are not dependent. They sense that a woman is an equal competent just like a man. Today a woman has also become a direct money earner and she is not only limited to household works. The novels show how women always gain self-esteem in facing the hard times of their lives, assert their individuality and aspire self-reliance through education. They are clever of being independent and leading lives on their own. To find their identity in their own way, her female characters break all restraints of customs and traditions that tie them in the quandaries and rein in their freedoms and rights. They are not against the entire social system and values but are not ready to accept them as they are. Her female characters are modern, strong and take bold decisions to survive in society. This secures her position in literature as a feminist novelist. In her novels, she has exhibited the new slant of the married woman. When they have a possibility they strive and discover their happiness. Sudha Murthy says, women have to balance family and work, everywhere in the world. The women protagonists in her novels are victimized by the patriarchy. During the difficult circumstances they rise by asserting themselves as individuals and choose to live their own life, overcome the struggle and emerge as victorious women.

Sudha Murthy's "Mahashweta" this novel is a story of an unfortunate woman, Anupama who realizes her inner strength and courage in her tough times and questions about her justice. The purpose of this paper is to expose that throughout the novel, the character Anupama get enlightened from within. This novel portrays how women become self-esteemed while facing the challenges and adverse conditions of their life.

Anupama living in autocracy of patriarchal society and suffered from male domination, her dilemma about her tragic situation when her husband Anand left her alone in her disease is evident from the following quote:

"Was it my fault that I got this white patch? Is it my fault that I am a poorman's daughter? Now that you are here, answer me."

A great transformation from within happened in the character Anupama, when she was left alone by everyone in her disease of leukoderma. Anupama can be termed as a new woman who is ready to accept the reality of her life and remain firm in her trying times. She following the right path struggles with the adversities of her life.

Anupama can be said as a strong woman who is ready to challenge the difficulties of her life very bravely. She is shown as very courageous not a coward woman embracing the tyranny

of patriarchal society. This novel exposes how a woman like Anupama suffered under the tyranny of

patriarchal society. In the patriarchal society, men misuses their power is shown clearly in this novel. Anupama is a woman who wanted to live her life with self-esteem and not a dependent valueless and helpless life.

Portrayal of women character in the novel “the mother i never knew”

Sudha Murthy’s novel “the mother i never knew” comprises two novellas that explore quests by two men each searching for a mother he never knew he had. Here, in the proposed paper entitled, “A critical study of Women characters in SudhaMurthy’s -the mother I never knew” the first part has been analysed. Venkatesh, a bank manager, stumbles upon his lookalike one fine day. When he probes further, he discovers his father’s hidden past, includes an abandoned wife and child. Venkatesh is determined to make amends to his impoverished stepmother- and taken steps to repay his father’s debt. Sudha Murthy introduced the female characters Champakka, Indiramma, Bhagirathi, Shanta and Gowri’ in the first part. These characters are critically explored in this research paper.

Champakka

Venkatesh’s grandmother, Champakka, a loud mouthed old widowed women, lived solely for the sake of her son, faced a tough life to raised her son like how the tigress protect her cubs likewise she protected her son from all the problems and happily ruled the whole family, but sometimes dominates the family members.

Indiramma

On the other hand, Venkatesh’s mother, Indiramma, portrayed as quite, innocent and submissive. She passes her time, by knitting, embroidering painting and indulging herself in order to avoid any confrontations with others. The work of Betty Friedan, *The Feminine Mystique*, is the main source of information on the condition of these housewives. She defines house wife as: The home maker, the nurturer, the creator of children’s environment is the constant recreator of culture, civilization and virtue.

Bhagirathi

Sudha Murthy framed the character Bhagirathi- a teenage mother and a widow- was bound by customs and traditions thought that her husband is dead, which was not true, and shaved her head to be considered purified, thus clearing her husband’s path to heaven. In the beginning she had no desire to live, decided not to stay in her village mainly due to the gossiping about her modesty. She is afraid that her life and that of her son’s life would be worse than a dog’s, if she stays in the village. Here Sudha Murthy opined that ‘We cannot change the society and people. This has been going on since the ancient times. It’s always a goat that is victimized and not a tiger’. Bhagirathi, struggled a lot and has overcome many difficulties to raise her son. She decided to leave the village and started working as cooking maid in many houses for meager salary for many years.

Due to her hard work, she raised her son to become a primary school teacher and made him to lead a decent family life. Lorraine Toussaint a Trinidadian-American actress and producer says, “We all have a dark side. Most of us go through life avoiding direct confrontation with that aspect of ourselves, which I call the shadow self. There is a reason why it carries a great deal of energy”. A woman is usually meek and humble that’s the reason many of our women suffered a lot. They quietly bowed down and accepted injustices heaped upon them by men and fate. Sudha Murthy had not only written a children stories but she has also exposed the patriarchal control in our country and the tolerance of women in ignorance through her novels. To quote from Simone de Beauvoir’s book titled ‘*The Second Sex*’ wherein she asserts that: “Once she ceases to be a parasite, the system based on her dependence crumble, between her and the universe there is no longer any need for a masculine mediator”. In all her novels, she shows a survival path to the female protagonist’s that women can lead a successful life with sincere and hard work, without the help of those who made

them ill treatment.

Shanta

Venkatesh's wife, Shanta, ran the house very efficiently, handled the family finances better than an investment banker. She is always conscious of her appearances and proud to be a lady's club president. Active investor of the stock market because of her sound knowledge in business, she always speaks to the point.

Gauri

Gauri -Venkatesh's daughter, she was quiet and intelligent girl and also an eternal optimist. She could make anyone feel better. Venkatesh always loved her because of her intelligence, calm and ability to remain silent in any situation that brings success and peace to her life. She always spent very good time and frank discussion with her father. She always follows her conscience. In one occasion when her father undergone a tough situation to pay his father's debt, she decided to give forty five lakhs from her account, which was invested in a fixed deposit by her mother in her name to avoid income tax, or may be for her marriage and thus saved her father from a major problem. Here, Sudha Murthy tries to explain that the today's generation is much wiser than the people in the ancient time of her age. A good narration between father and daughter from the book:

Her father asked her, 'Gauri, your mother will find out about this. You know that. What will you do then?' She replied, 'I have not stolen this money Anna, nor have I given it away to a cause that I don't believe in. I am not afraid of her or anyone else. No matter people say, I'll always follow my conscience.'

Venkatesh asked, 'Why did you do this Gauri?' She replied, 'That's so easy Anna. You want to pay back a debt that your father owes somebody. I want to pay back a debt that my father owes too'

Here Sudha Murthy described the nature of a modern girl and her perception towards her vision of family life. Through the characters Shanta and Gowri, it shows the sophisticated, business background, status of family members. They live their life for earning more and more money and no intimacy between the family members, indicating the modern false life style. The novel also showcases individualities of the modern women's rights by describing an independent, skilled and gifted female protagonist's like Shanta and Gauri.

When analyzing the female characters of Sudha Murthy's the mother I never knew, she portrays the sufferings of women at the medieval period and the courage of women in modern age. The patriarchal society considers a wife as a slave to her husband and so she must endure all his atrocities. But these days women ready to follow their conscience to decide their life. As described in the novel, a wife must have the determination to live without her husband if the situation really demands. She must have the willpower to bring up her children with confidence. Among all literary genres, novel reflects the contemporary social conditions in a realistic manner. The portrayal of woman in novels is also governed by the prevailing attitude towards women in society and the author's response to it. The status of women has been rapidly changing and the novelists capture this transition in their novels. Swami Vivekananda, throughout his life, strived to uplift the plight of women, in particular Indian women.

Fictional works, but particularly novel, for being capable of allowing more comprehensive handling of the issues pertaining to women than any other mode of expression, echoes the victimization and subjugation of women more effectively. It is noteworthy that not all the authors of feminist novels are women, there are men also who champion the cause of feminism and through their works try to put forward a body of thought and practice that recognises, criticises and seeks to change inequalities based on gender. But this is also true that women novelists, themselves representing society's marginalised and silenced half and having a deep insight into the female psyche, more authentically

present woman's side of life. With a voice of their own they offer a diverse range of feminine experience. In the last few decades a significant number of women novelists has contributed to the enrichment of literature especially feminist novels. Doris Lessing, Anita Desai, Mahasweta Devi, Buchi Emecheta, Margaret Atwood, Toni Morrison are but a few to name. Through sexual awakening, sexual victimization, sexual discrimination, suffering, pain, struggle, agony, helplessness and exploitation, their female characters learn of the gendered oppressions that work through their bodies.

Gifted with great creative genius, these women novelists take up cudgels against women's suppression and exploitation by patriarchal social system and eloquently voice the question of self-definition by exploring the violent and subtle ways in which patriarchy silences female sexuality to overpower and curb women's voice. By exploring and sharing a range of victimization; of female figures in their works, these novelists have not only exposed how female sexuality and bodies are defined but also controlled and exploited by men. They have invigorated the realistic novel by using it as a tool to expose how gendered oppressions are inflicted upon women by men under the guise of socio-cultural and religious traditions. Grappling with themes of women's existence, survival and identity, women writers in their novels often feature women as ones ready to make their own decisions, to express their personal choices and also prepared to deal with the consequences of their choices, decisions and actions.

Conclusion

Sudha Murthy tries to reflect the rich formative literary and spiritual instincts of woman personality by the novel *Mahashweta*. She also stresses on the transitory nature of physical beauty whereas emphasizes on womanish indomitable courageous spirit. She tries to spread the message of the women to recognize the tremendous force of her inner source of fountain of the heart and soul. Role of women in literature as a reflection to their roles in the society, As a mirror to the society, literature has always reflected the change in the representation of women that history has chronicled. Modern literature has served to give voice to women's rights with the emergence of feminist pioneers.

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A Study on Food Adulterants and its impact on human health

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Abstract:

Food adulteration is a global issue and underdeveloped countries are more vulnerable to it due to a lack of monitoring and legislation. Food adulteration has been a source of concern since the dawn of civilization as it not only lowers the quality of food products but also has a number of negative health consequences. However, this is one of the most widespread phenomenon that has gone unnoticed in many countries. Unfortunately, contrary to popular assumption for milk adulterants can offer major health risks leading to lethal infections. This study provides a full discussion of common milk adulterants as well as various methods for detecting the adulterants both qualitatively and statistically. Concerns about food safety and regulation have resulted in the development of several approaches for adulterant detection in food, such as physical, biochemical/immunological and molecular techniques. This study is structured to be an 'adulterant-based' study rather than a 'techniques-based' one, with qualitative detection methods enlisted for the majority of frequent adulterants and quantitative detection methods limited to a few key milk adulterants. Aside from standard procedures, significant advancements in these detection techniques have also been reported.

This review aims to add to the body of information about potential milk adulterants and detection methods.

Key word: Milk processing, Adulteration, food safety, detection methods, adulterants

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I. Introduction:

Since the discovery of Melamine contamination in Chinese newborn milk products in 2008, concerns about milk and dairy product adulteration spread across the globe (**Xin & Stone, 2008**). The history of adulterated milk, however it is very old. According to reports, the Swiss Milk Scandal claimed 8000 infant lives in New York alone in 1850. Milk is regarded as the "perfect diet" since it contains a wealth of nutrients that are needed by both infants and adults. It is a top source of vitamins, minerals, fat, carbohydrates, and protein. Unfortunately, adulteration of milk is fairly simple to do everywhere in the world. Possible causes It may have several causes, such as an imbalance between supply and demand, the perishable nature of milk, poor client purchasing power, and a lack of appropriate diagnostic tests (**Kamthania et al., 2014**). Food fraud has an economic incentive, but it has genuine public health implications (**Singh & Gandhi, 2015**). Due to a lack of appropriate law enforcement and adequate monitoring, the issue is substantially worse in developing and poor nations. Chemical reactions make it simple to qualitatively detect adulterants in milk, although quantitative detections are more difficult and varied. Quantitative detection methods vary depending on the type of adulterants found in milk. Examples include Liquid Chromatography (LC) and Enzyme-Linked Immunosorbent Assay (ELISA), which are frequently used to identify foreign proteins; Polymerase Chain Reaction (PCR) and polyacrylamide gel electrophoresis (PAGE), which are frequently used to identify adulterants in milk of a particular species. Techniques for detecting milk adulteration must be exceedingly precise and swift since fraudsters have dodged punishment by claiming that more traditional detection methods are ineffective (**Garcia et al., 2012**).

II. Materials & Methods

Food items such as milk, butter, mustard oil, honey, pulses, wheat flour, black pepper, chilli powder, and coffee powder were obtained from various departmental and local grocery stores. Some reagents, such as Iodine reagent, Concentrated HCl, Sucrose, 0.5N ethanolic KOH, Concentrated HNO₃, Solvent ether, Resorcinol, Carbon tetra-chloride (CCl₄), and

Chloroform, were gathered and utilized in biochemical experiments. Adulterants are detected using qualitative assays. We created specific reagents based on the sample for qualitative analysis in order to evaluate the colour change or appearance of the sample in response to adulterants present in the sample. Adulterants in milk will turn blue with prepared Iodine reagents, adulterants in butter will turn maroon with concentrated HCl and a pinch of sucrose, adulterants edible oil will appear turbid and will separate, yellow, orange, or crimson colour lower acid layer with prepared reagents for two types of adulteration, adulterants honey will turn cherry red with prepared reagents, adulterants honey will turn cherry red with prepared reagents.

➤ Food adulteration in India

Food adulteration cases were consistently on the rise, according to the Food Safety and Security Authority of India (FSSAI). Tamil Nadu, Jharkhand and Uttar Pradesh had the greatest percentage of tampered samples. From the 2461 samples collected, 485 in the National Capital were contaminated. (<https://fmtmagazine.in>).

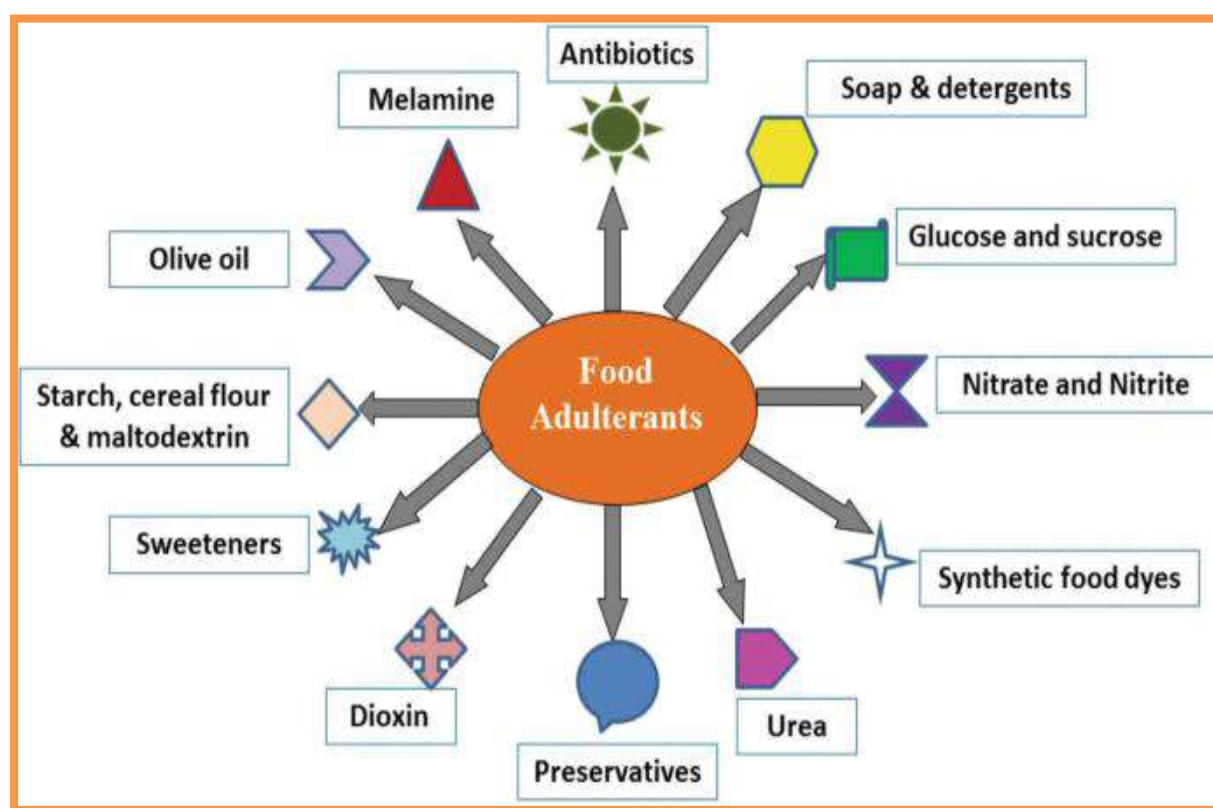
III. Types of adulteration and food items

A variety of conditions, including excessive demand or seasonality in supply, can lead to the contamination of various food products and/or beverages. Numerous authors claim that (El-loly *et al.*, (2013) and Narayan (2014)) adulterations might be planned, unintentional, or accidental.

Intentional/deliberate Adulteration:

This Adulteration is a sort of adulteration when ingredients are purposefully added to food products to increase its volume and boost the quantity of their important elements. Due to the substantial nutrient removal from food and the inclusion of foreign substances, it is detrimental (Awasthi *et al.*, 2014).

Source: <https://link.springer.com>



A. Incidental/unknown adulteration

This kind of adulteration results from poor hygienic conditions for food and drink goods from the production site to the dining table. Since any substance other than its original is extraneous to the product, examples include residual pesticides from cans, rodent droppings, preservatives, mercury from effluents, lead from water etc., (Narayan, 2014) and Asrat and Yi. However, the ways the products are produced, handled, passed, processed, stored, transported and marketed may be the places where they were contaminated or adulterated (2014).

A. Food items and adulterants:

A variety of foods and beverages are vulnerable to adulteration. Finding food that is free from one or more adulterants, whether it is in the form of wheat, pulses, oil, fruits, vegetables, milk, sweets, spices, tea, coffee, honey, bakery goods, chocolate or fruit juice is challenging (Aladdin 2012). About 90% of unbranded, loose types of food such as cake used as a protein supplement for breastfeeding animals are contaminated. Food and beverage adulteration can be found in four main areas, including milk and milk products, fats and oils, food grains and others (items with both animal and plant origins) adulteration, respectively.

Results and Discussion:

Food item	Adulterant	Propose	Disease
Milk	Starch	To increase volume	Stamoch disorder
Ghee	Vanaspati	To increase the volume	Belly fat increase
Black pepper	Papaya seeds	To increase volume	Psychological disorder
Sugar	Chalk powder	To weight increase	Stomach disorder
Mustard seeds	Agremone seeds	To weight increase	Psychological disorder
Beverages	Metanil yellow	To develop colour	Carcinogenic
Bura sugar	Whashig soda	To increase weight	Stomach disorder
Wheat	Dhatura seeds	To increase weight	Psychological disorder
Rice	Boric acid	To preservation	Gastric problem
Milk	Formaldehyde	To preservation	Carcinogenic
Jaggery	Washing soda,	To preservation	Vomiting and other Stomach disorders
Honey	Molasses, dextrose, sugar and corn syrups	To preservation	Stomach disorders
Dal /pulses	Yellow colour	To develop colour	Carcinogenic
Chilies powder	Brick powder	To increase weight	Stomach disorder

1. Milk & Milk products adulteration

Milk adulteration entails both the addition of water and the removal of milk's healthy fats. Milk is preserved with several preservatives, including formalin and certain antibiotics, to lengthen its shelf life (Chanda *et al.*, 2012). Since fresh milk is pure and free of adulterants when it comes out of the udder, but can be contaminated by bacteria, yeast, fungi and dust (Dehinenet *et al.*, 2013) (Awan *et al.*, 2014).

Adulteration of Fats and Oils

Adulteration of edible oils and fats is a significant problem. The major reason for adulteration is deceit, which boosts their income by increasing its volume and prevents an unintentional quality check on dubious products (Pitts *et al.*, 2007). Food is frequently contaminated to satisfy the wants of an expanding population (Yadav, 2018).

Food grains adulteration:

Adding sand or crushed stone to cereal grains increases their weight, which is known as adulteration. The plastic beads are similar to grains in size and colour then combined with cereal grains and legumes. To make grains heavier, water is sometimes sprinkled on them.

2. Other Adulterations

Adulteration of other foods (foods made from animals or plants) is also common. Red chilli powder is frequently used with brick powder, and tea leaves are frequently combined with expired tea leaves. Honey adulteration with synthetic honey (based on C4 plant sugars) has increased.

3. Reasons for Food Adulteration

A technique used as part of a business strategy to achieve a trader's profit goal. A lack of effective government activities and a lack of food laws. Food demand has increased due to a population that is expanding quickly. Broad popular ignorance of and disregard for proper food consumption. To raise the amount of food production and sales in the face of food insecurity to make food appealing and a replica of a dish that is popular.

Controlling methods of Food Adulteration

1. Steps to consider when transporting and storing food products:

The major threat to food grains, legumes and spices is insect infestation brought on by the humid and unsanitary conditions of the warehouse. Extra care must be taken to avoid grain rotting during the rainy season and in places with high humidity. Create a warehouse with the correct storage conditions to reduce contamination risk.

2. Steps to consider while processing food products include:

It is best to prevent outbreaks of Salmonella, E. coli, and Campylobacter. Sanitation and cleaning standards must be met in the machinery's design. Spend money on pest identification and monitoring. To lessen the risk of contamination, it is important to prioritise safe waste disposal.

3. Steps to take care of while packaging food products:

With regard to allergen information, food goods should be appropriately labelled. Contamination by microbes and chemicals should be avoided during packaging. The ink that was used to print on the packaging shouldn't contain any hazardous substances. It is necessary to implement regulations governing food packaging. Maintaining a clean workplace should be the primary goal.

The health impacts of contaminated food:

We must have all noticed that compared to ten years ago, there are now more people raising concerns about food adulteration. The cause is straightforward: as working people with hectic lives, we are looking for quick fixes. People used to grind their own spices and grow vegetables in their courtyards back in the day, but who has time for that these days? Let's first understand the negative impacts of food adulteration before learning how to avoid it without interfering with our hectic routines.

4. Increase in the impurity of food

Food contamination tends to grow when it is adulterated. The limits for dangerous consumption increase as impurity levels climb. Although you might not notice the effects right away, adulteration is a long-term danger to our health. I would advise you to create your own goods, but if it is too much work, it is best to buy organic or from the farmers themselves.

5. Nutritional deficiency

Adulterated food is devoid of nutrients and tastes different from unadulterated food. We jeopardize both our taste senses and our health by eating tainted food. Fresh food has a quick and favorable impact on our health.

6. Causes a variety of diseases

Food adulteration has been connected to a number of chronic illnesses, including food poisoning, lathyrism, cancer, vomiting, dysentery, joint discomfort, and diseases of the liver, stomach, or joints. Numerous potential future health concerns are caused by the minerals, chemicals, and low-quality additives added to food goods. According to several studies, some contaminated food products can cause abortions or brain damage.

7. Effects of adulteration:

Because of issues with adulteration of the food products we consume on a regular basis are unsafe and unclean to use (**Asrat *et al.*, 2012**). Food adulteration has emerged as a significant issue in recent years and eating such food increases the risk of major illnesses like cancer, diarrhea, asthma, and ulcers. Food adulteration affects producers and farmers, processors or manufacturers/enterprises, consumers and the government in general very seriously.

8. Effects on farmers and producers

The weakest link in the supply chain of an industry can be damaged by adulteration, which not only affects large corporations but also farmers or producers (**such as dairy, honey, coffee, wheat, etc.**). In the midst of the crisis, many farmers experienced significant losses, cost increases due to feed expenses, milk cow shortages brought on by mass sales or slaughter, as in the case of the China dairy scandal, and a lack of consumer interest in the produced (**Qian *et al.*, 2011**).

9. Effects on consumers

Some of the harmful effects of food adulteration include diarrhea, stomach disorders, giddiness, joint pain, liver disorders, dropsy, gastrointestinal problems, respiratory distress, edema, cardiac arrest, glaucoma, eyesight problems, headaches, cancer, anemia, insomnia,

muscular paralysis, and brain damage. Fruits and vegetables contain a number of harmful compounds and colours **Anita and Neetu 2013**. Copper sulphate, mangoes, and bananas all contain calcium carbide. Oxytocin is a hormone that helps pumpkin, watermelon, brinjal, gourds, and cucumber grow.

Adulteration Issues:

The information and technology available are insufficient to identify phony and tampered goods. Frequently, the precise number of foreign suppliers of the products is unknown. Only a tiny percentage of facilities are actually inspected on the ground (**Dogarawa, 2013**), says Dogarawa. Adulteration of food products makes it less likely to be accepted in the market because consumers doubt its authenticity. Dairy products from the Wolaita and Kucha area command high prices because they are valued for their high quality **Asrat and Yilma (2014)**. Such behaviour as to be avoided because it may harm the reputation of the region's butter.

Conclusion

Without our knowledge, food adulteration may have a serious negative influence on health. If our culture adopts a few safety precautions, this can be avoided. Customers should be able to differentiate between good and terrible products. The quality of the food sold by both large and small stores should be inspected by government organizations.

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**HIGHER EDUCATION SYSTEM IN INDIA – AN OVERVIEW OF THE
CURRICULUM AND PEDAGOGY IN THE NATIONAL EDUCATION POLICY 2020**

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ABSTRACT:

For the last few years, India's education system has emerged as one of the largest education systems in the world. Out of the system, India's higher education sector also becomes one of the largest in the world, with 40 million students enrolled in more than 55,000 institutions. However, it continues to suffer from three fundamental challenges: access, equity, and quality. The National Education Policy-2020 articulates well on how the entire system of education can be organized and implemented at various levels such that quality standard is enhanced, the quality of student learning experiences increases and the employability and quality of the graduates is strengthened. The policy specifically focuses on the teaching – Learning Assessment and curriculum pedagogy. In this short report, we have taken a snapshot of Indian higher education's growth progress and analyzed its present status. We also analyzed the challenges that Curriculum, Teaching – Learning & Assessment, Curriculum Pedagogy Indian higher education system.

KEYWORDS: Education, Higher education system in India; The University Grants Commission (UGC); Curriculum, Teaching-Learning & Assessment, Curriculum & pedagogy.

INTRODUCTION

India, the 7th largest country by geographical area and the 2nd most populous country with over 1393.4 million or 1.39 billion or 139 crores people in July 1,2021.

India is a country in South Asia. It is the 7th largest country in the world, with a total land area of 3,287,263 square kilometers¹. The mainland comprises of four regions, namely the great mountain zone, plains of the Ganga and the Indus, the desert region, and the Southern peninsula. Moreover, India is a federal nation composed of 28 states and 8 union territories.

India's population, as on 1 July 2021, stood at 1.39 billion(139 crores) (723.97 million males and 669.44 million females). Because of its very populous situation, India has difficulty in universalizing its education According to the provisional results of the 2021 census, the literacy rate in India stands at 74.04 per cent (82.14% for males and 65.46% for females), an increase of 9.2% from the last decade

The first Commission on education set up in the post-Independent India was on higher education (Radhakrishna Commission, 1948) which advocated for the expansion of higher education and recommended for the establishment of national regulatory bodies such as the University Grant Commission(UGC) with a very low and slow start, after passing through over 70 years of planned education development and implementation of two national education policies(1968 and 1986), the higher education in India has reached the massified stage to be the second largest higher education system in the world after China, with 37.4 million students, and 1.4 million teachers spread over more than forty thousand higher education institutions (MHRD,2019). The third National Education Policy-2020 aims at carrying out major structural reforms in higher education by transforming higher education institutions into large multidisciplinary universities, colleges and knowledge hubs. It is also expected that affiliated colleges will gradually phase out giving ways to multidisciplinary universities and colleges by 2035. By 2040, all higher education institutions shall aim to become multidisciplinary institutions. The policy also recommends to build a world class multidisciplinary HEIs called Multidisciplinary Educational Research University (MERU)

The evaluation and assessment model suggested under the new policy is also going to change from End semester examination system to continuous assessment system. All the HEIs will give due emphasis on knowledge, skills and values. The NEP-2020 aim at increasing the GER in higher Education to 50% by 2035

The new policy has proposed transforming the governance system in higher education by setting up a single regulator as Higher Education Commission of India (HECI) with four verticals: National Higher Education Regulatory Council (NHERC) for regulation, National Accreditation Council (NAC) for accreditation, Higher Education Grants Council (HEGC) for funding and General Education Council (GEC) for academic standard.

The National Education Policy-2020 articulates well on how the entire system of education can be organized and implemented at various levels such that the quality standard is enhanced, the quality of student learning experiences increases, and the employability and quality of the graduates is strengthened. The policy specifically focuses on the following, in so far as teaching-learning is concerned:

- Grounding curriculum design, learning resources, and teaching – learning strategies in the Indian culture and values and Bhartiya Gyan Parampara
- Offer of learning resources and teaching-learning in regional/local languages, mother tongue and local dialects, besides English and Hindi.
- Multidisciplinary and holistic education, encompassing courses from multiple disciplines and by judiciously addressing the physical, mental, social, emotional, moral and spiritual development of the students.
- Emphasis on Outcome –based learning in which the student learning outcomes, engagement of learning activities, and the rubric/strategies of assessment are integrated to each other.
- Multiple entry and exit within an academic programme of study, and also horizontal and vertical mobility between general education and vocational education.
- Integrating skilling and employability with curriculum and teaching-learning across disciplinary, inter-disciplinary, and multi-disciplinary studies.
- Blended teaching and learning by combining self-study, face to face, hands-on and practicum, and online collaborative learning.

Objectives:

1. To know the workable formulation of blended learning design
2. To know the frame work of holistic curriculum design, and linkage between the learning outcomes
3. To know various sources of digital learning
4. To reflect upon various pedagogy strategies, and linking learning activities with various levels of learning outcomes

Blended Learning:

National Education Policy-2020 advocates for all higher education institutions to go for blended learning –blended self-learning, face-to-face learning, and online collaborative learning in a judicious way.

There are many ways blended can take place for curriculum design, learning resources design, strategies and methods of teaching-learning, assessment and evaluation , among others. An educational Programme of study can be judiciously distributed across three strategies.

1. **Self- faced learning:** Some credit hours may be allocated to self-learning by the students with the help of self-learning materials (Print, Audio, Video, resources at social networks and sites, as also open educational resources). This self-learning needs to be guided/mentored by

the teachers through various means available to them. Moreover, the self learning component of credit hours also forms part of both formative and summative assessment.

2. **Face to face learning:** some portions of the credit hours may be devoted to face to face interaction, which may be organized largely for interaction, discussion, counseling, student activities, conduct of practicum, and internship (including virtual internships available for college and university students).
3. **Online collaborative learning:** The third portion of the credit hours may be devoted to collaborative assignment and projects including project-based learning, case-based learning, and portfolio-based learning) which can be organized through various online platforms or networks(like , for instance, Module LMS).

Curriculum Design:

National Education Policy-2020, development and delivery of multidisciplinary, holistic and integrated curriculum- meaning thereby that:

- **Multidisciplinary:** Students shall be provided the freedom to choose courses from other disciplines which will enhance their mental horizon and world view, as also increase the aspect of skills and employability.
- **Holistic:** Besides the disciplinary and multidisciplinary courses, the curriculum design will focus on social and life skills including health, environment, engagement, and community, values, happiness/well being among others as compulsory components of any academic programme.
- **Integrated curriculum:** Various individual, social, environment, cultural, and local dimensions and concerns should be integrated within the curriculum, so also integration of general education and vocational education , and integration and continuity between school education and higher and further education.

The national Education Policy also incorporation of the twenty-first century skills into curriculum and teaching-learning activities in any programme of the study

Skills:

- Communication skills
- Independent learning skills
- Thinking skills(critical thinking, Problem solving, creativity)
- Responsibility and ethics skills
- Leadership skills
- Knowledge management skills
- Self-directed learning/self regulated learning/happiness skills

Generic learning outcomes: problem solving, critical thinking, creativity, communication, Analytical reasoning, Research skills, coordination and collaboration, leadership, learning to learn, digital literacy, multicultural competence, value inculcation, autonomy and accountability, environmental awareness , community engagement.

Learning Resources:

Beside the above noted types of learning, resources, teachers may like to locate and suggest to students some of the MOOC-based resources that are available in our country.

- SWAYAM (swayam.gov.in) national platform houses above 3000 credit-based courses from various disciplines, and this online platform has four components or quadrants (digital text, video, additional web resources, and tests, besides, interaction through discussion forum). Institution can approve in their statutory bodies the courses that the teachers prescribe and that the students would like to go through/take up from SWAYAM so that those course

credits and course completion grades are transferred to the programme of study to obtain the diploma or degree.

- NPTEL (npel.nic.in) online platform (created by seven IITs and IISc) contains curriculum-based instructional videos in engineering and related subjects.
- IITBX(www.iitbombayx.in) platform by IIT-Bombay provides four types of MOOCs - edu MOOCs, tech MOOCs, and life MOOCs-which the teachers and students can access and use in their teaching – learning.
- IIMBX (www.iimb.ac.in/iimbx) platform offers MOOCs in various management areas (offered by IIM-Bangalore).
- mookIT (mookit.in) platform through which IIT-Kanpur provides Arch4cloud certification in six languages (in collaboration with IIT- Ropar)
- agMOOCs (agmoocs.in) is a consortium of four institutions/agencies which offers MOOCs in agriculture education to teachers , students and agriculture practitioners.

Besides the above , students of banking and finance can also access Vskills MOOCs; the Epg-Pathshala online courses of UGC; the online courses base of INFLIBNET of UGC and the online courses offered through E-Vidya Bharati. Teachers and students can also access curriculum-based print, audio and video resources of E-Gyankosh of IGNOU free of cost, and the curriculum-based telecasts of Gyandarshan and Swayam Prabha TV channels.

Recently, the UGC has initiated the scheme of 5 lakh common service centres in 2.5 lakh villages panchayats where students can take up courses online (about 23,000 PG courses and 137 SWAYAM courses) and deposit the courses completed and credits earned in their Academic Bank of credits to encash toward obtaining a degree.

Pedagogy:

The quotation from a recent analysis and articulation on reformations in teaching-learning by Amelia Peterson from the Harvard University should be handy to explain pedagogy: “Pedagogies provide frameworks for the multitude of decisions teachers have to make about how they teach” (Peterson et al, 2018,p.8). As teachers, we have to make a variety of decisions on how to teach our discipline or multidiscipline course- about selection of learning resources, content delivery strategies, student collaboration and engagement, learning activities, selection and integrated use of media including social technologies and social networks, design of appropriate assessment strategies, among others. Grounding in pedagogy shall not only facilitate this but also enhance the quality of teaching – learning and the quality of student learning experiences (and therefore the quality of the graduates).

For a general understanding, the relationship between curriculum, pedagogy, and learning theories is depicted in below table:1

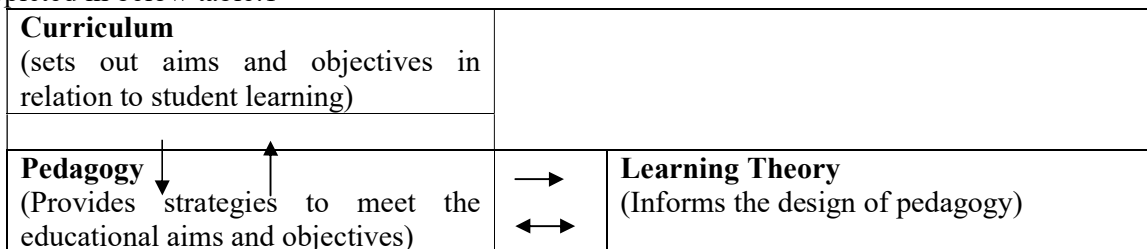
Curriculum (sets out aims and objectives in relation to student learning)		
Pedagogy (Provides strategies to meet the educational aims and objectives)		Learning Theory (Informs the design of pedagogy)

Table1: Relation between curriculum, Pedagogy and learning theory

While the curriculum expresses the goals of educating programme of study and its contents, pedagogy on the other hand provides strategies to achieve the curricular goals; and grounding in various pedagogic or andragogic learning theories facilitates effective design and application of pedagogies. To explain a little more, it may be noted that there are three components of pedagogy which we need to know and develop appropriate skills;

1. **Teaching –Learning strategies:** Various theories of learning like constructivism or situated learning, etc. which provide the required conceptual frameworks to teaching learning
2. **Instructional Design:** Various instructional strategies and instructional/learning design models which facilitate organization of content and learning activities.
3. **Pedagogic Method:** Various teacher-centred , content-centred, and learner-centred methods including presentation, tutorial, demonstration, discussion, collaboration, field trip, apprenticeship, case study, project-based learning.

Based on the levels of learning outcomes, starting from the level ‘Knowledge ‘to ‘creativity’ and ‘constructivist’ learning the students activities corresponding to the levels of learning are given in table:2

Learning Outcomes	Activities/Engagement in -Practice
Knowledge	Multiple choice test Memory, Knowledge of subject, ordering of material. Potential to access analysis, problem solving, evaluation and decision making
Understanding	Oral examination Communication skills, knowledge and understanding, ability to think quickly under pressure Poster Presentation or Ability to interpret and present findings attractively exhibition- individual or group.
Application	Case study or Open Application of Knowledge, analysis, problem-solving problem and evaluative skills
Analysis	Course essay or Gathering, selecting , synthesizing and presenting dissertation information, developing an argument, understanding, synthesis, analysis and evaluation, writing skills. Internship Applying theory, interpersonal/communication/time management/Problem solving/ technical skills, reflection.
Creativity	Project work(BPL)- Planning, project management, research methods, individual/group problem solving, relating concepts to situations, application of knowledge, decision making.
Constructivist	Individual reflective tasks. Portfolio: Recording progress over time, skills development, self-reflection, analysis, applying theory, organizing and presenting material.

Table:2 Level of learning outcomes and corresponding learning activities

Irrespective of the discipline or subject of teaching three pedagogic methods, i.e. case-based learning, Project – based learning (PBL), and portfolio-based learning should be considered by the teachers for enhancing the quality of student learning. Besides, technology provides for greater flexibility and more possibilities to enhance student’s reflective experience. For instance, blog can be built in to student learning activities to enhance individual reflection, and wiki can be used for collaborative learning and group reflection. Reflective learning is a higher order learning , and facilitates development of meta-cognitive skills and self-regulated learning of the students.

Portfolios are considered to be the best pedagogic and assessment strategy at all levels of education, and especially for higher education. Two types of portfolios may be formulated:

Formative Portfolio: Assessment for Learning (maintained through class to provide feedback to improve learning).

Summative Portfolio: Assessment of Learning (structured around outcomes/standards, especially based on rubric and quantitative data to determine outcomes of instruction).

Conclusion

National Education Policy 2020, the entire higher education is moving toward 'blended' teaching-learning (by combining self-learning, face-to-face interaction, and online collaborative learning, as also by combining traditional classroom education, distance learning, and online learning). The recent UGC guidelines also stipulated that campus-based, distance, and online learning is all equivalent in educational delivery, quality of learning and academic degrees. As you know, any student from any HEI can take up a maximum of 40% courses/course credits from the national SWAYAM platform online and transfer the earned credits toward one's own programme of study and degree.

In the future, there will be more of 'course-based' registration, allowing students to take up courses from other disciplines and interdisciplinary areas – e.g. a student of social science can take up any science course or a course in music or even artificial intelligence- not only from one's own institution but also from other institutions and deposit in his/her account in the ABC, and transfer to a diploma or degree. The institution which offered the highest amount of course credits will award the degree.

While the entire higher education is going to practice blended learning, the educational resources need not confine to textbooks- students can access open educational resources (OERs), social networks, YouTube resources, and the digital resources available through various national and regional networks in the country including SWAYAM, other MOOC platforms, etc. to enhance employability, multidisciplinary courses and skill-based courses need to be offered. Courses on values, environment, community engagement, social and like skills etc will not only enhance employability skills but more so will contribute to holistic, integrated and balanced life and happy life.

The National Education Policy proposes almost a 50-50 formulation –i.e. on the one hand there can be 50% discipline core and rest 50% from other disciplines, on the other hand there can be 50% conceptual/theoretical teaching and the rest 50% time/credit hours can be devoted to application of the concepts into practice/student engagement in activities/apprenticeship and internship. Our pedagogy methods should focus more on student-centred and problem-centred based and project-based learning and activities. Portfolios should be an integral part of student activities as also student assessment across all disciplines, and student assessment should be viewed from the perspective of assessment as learning

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ABSTRACT

Education is the most important invention of mankind. Man without education would still be living just like an animal. It is education, which transformed man from a mere “two legged animal” in to human. Education is a lifelong process which continuous from womb to tomb. Education is a tool for total development of human, if any aspect of human personality is ignored, it can result very adversely. Education enables one to lead a better physical, mental intellectual and spiritual life. Ethics deals with the morality. The ethics and moral values adept in Universities heavily affect the future leaders. Ethics education is the prospect for a new value alignment. Such education guarantees the training of both the student and the teacher, develops new technologies and a new vision and a new resources and a new system.

Key words: Higher Education, Human values, Professional Ethics.

Introduction:

Human values and Professional ethics refer to the quality of a person or an Organization or society at large. Basic inherent human values are the one which includes truth, honesty, loyalty, love, peace etc. because they bring out the goodness of human beings and large community. Hundreds of thousands of new students will begin college this fall, and most college and universities have designed elaborate orientation activities to induct beginning students into the academic and social cultural of their campuses. These orientation activities are usually crammed with advising and registration information, academic and social rituals, campus tours and welcoming activities designed to help new students get off to a good start in their academic study and navigate their ways around their new surroundings. Most colleges and universities also make an effort to transmit some important core ethical values that are central to the mission and social culture of the institution and help to define the institutions expectations for being an ethically responsible student and citizen on campus. Ethical values such as respect for others, honesty, self-discipline, hard work, love of learning and appreciation of diversity are some of the core values many colleges and universities prize. But how do institutions go about promoting these core values with new students and what are some effective educational approaches? We focus here on out of class activities since most students spend the majority of their time in this domain of college life and these activities are especially important for new students. Colleges and universities often seek to transmit ethical values to new students through orientation speeches, publications, convocations and other public statements.

Review of Literature:

Alexander, (2009); Curtis, (2010) Covers in their study that another important reason for urging that pre-service teachers engage with ethics education in teacher training programs is that teachers are now required to guide their students with the help of human rights, conflict resolution and social justice, matters included under the auspices of values education.

The study of **Chhonkar in (2014)** indicates that the code of professional ethics for the educators makes provision of framework for the standards and principles to guide them appropriately in involving their obligations towards students, parents, colleagues and communities states. The increased awareness of the ethical principles governing the teaching profession is regarded as indispensable in achieving the desired objectives and enhancing the overall system of education.

Himanshu Kumar Sharma (2015) States the importance of human values in modern era. It can be understood from the study that in the technological era, value crisis is one of the burning problems. To overcome these issues educators have an essential role to play. The study reveals that the teachers

should have an integrated perspective to nurture the hearts and minds of learners in a balanced way so as to retain human values within oneself.

Pallavi Gupta (2016) examines in her study that how and why the human values are consistently degraded in education system in India. It shows that higher education institutions lack to provide learning positive atmosphere, academic syllabus related to human values and extracurricular activities based on human values which lead to many societal issues in recent days. Hence, it states that it's the responsibility of the parents, teachers and society to inculcate human values among the students in educational institutions.

According to **Yadav, & Sunil, (2016)**, the recognition of moral values and professional ethics in the system of education in India are indispensable aspects. In order to promote enrichment of the system of education and enable the individuals to acquire an efficient understanding of academic concepts and achieve academic goals, it is necessary to generate awareness in terms of human values and professional ethics. With the help of moral values, one can acquire an efficient understanding in terms of what is appropriate and what is not appropriate for the person.

Venkataiah, (2000); Laxmi and Paul, (2018) Value education helps every one in improving the value system that any individual can adopt in their lives and puts it to use. The students should be motivated for independent decision making. They should be made responsible for their own actions and should learn to analyze if they go wrong which will help to develop decision making abilities and confidence in them. Teachers are the role model for adolescent learners says.

Higher Education in India:

Higher education is a leadership education Indian higher education system is the third largest system in the world, next to the China and United States of America. In India the higher education system has grown in an extraordinary way, particularly after Independence period, to become one of the largest system of its kind in the world. However, the system has many issues of concern at present, like financing and management including access, equity and relevance, re orientation of programmes by laying emphases on health consciousness, values and ethics and quality of higher education together with the assessment of institutions and their accreditation. These issues are important for the country, as it is now engaged in the use of higher education as a powerful tool to build a knowledge based information society of the 21st century.

Concept of Moral Values, Ethics and Education:

- ❖ **Moral values:** These are the set of some precious principles which helps a person in becoming a good human being these values involve a lot of factors like morality, respecting others, helping others, loving others etc. According to Jerry Springer: we are all born as empty vessels which can be shaped by moral values.
- ❖ **Ethics:** It is the branch of philosophy that deals with the morality. The word ethics has been derived from the Greek word 'ethos' which means character. Ethics covers the following dilemmas
 - a. How to live a good life?
 - b. What are our rights and responsibilities
 - c. The language of right and wrong etc.
- ❖ **Education:** The root of word education is derived from Latin words 'Educare' Educare' and 'Educatum'. The word 'Educare' means to bring up and to nourish. The word 'Educatum' means to train. So we can say that education is to bring up, to developing and shaping up the individual talent and his inner potentialities. According to Aristotle; 'Education' is an ornament in prosperity and a refuge in adversity.

Objective of the study

- To study the awareness about human values among teachers in higher educational institutions.

- To study the awareness about Leadership qualities among students in higher educational institutions.
- To identify the factors required to develop the professional ethics among the teachers in higher educational institutions.

Research Methodology

A secondary study has been done to understand the impact of moral values among the teachers in the educational institutions and how it helps to develop the professional ethics among them.

Data Collection: Secondary data collected through Journals, reviews, Chapter books and websites etc.

Discussions and Suggestions

1. **Role of teachers in Education:** A teacher's role in today's world is not only limited to classroom teaching and lecturing but it is far more than that. A teacher must understand that teaching involves wearing multiple hats to ensure that the educational institution runs smoothly and all students gets a quality education.
2. **Human values and Human Rights:** We know that our work is founded on values and principles set down in universal human rights. These rights must be promoted and defended in every phase of education and the teachers should adopt it.
3. **Professional Community:** It initiates ethical reflection and dialogue with the employees at work place. It works in a culture of openness and enables transparency and respects the competence of other professions and acknowledges the limits of one's own disciplinary supports. It takes responsibility when colleagues meet special challenges in their work takes responsibility to find good solutions.
4. **Leadership Education:** The popularity of leadership programs among college students and the intrinsic connections of ethical considerations to leadership roles and responsibilities make leadership education a powerful forum for character development.
5. **Student Activities Programming:** While student activities are often regarded as student entertainment, there is much about these campus activities that encourage moral and civic learning. Speaker programs bring to campus important leaders in the arts, politics and entertainment. Student galleries display the artistic creations of students, faculty, alumni and professional artists. Craft programs provide opportunities for students to develop talents and to explore the creative process. Coffee house, open mike programs and discussion roundtables give students opportunities to debate and discuss current topics and issues. A thoughtfully designed student activities program can contribute to the creation of a rich campus environment of intellectual and ethical reflection.
6. **Participation in student Governance Organizations and Activities:** Students often learn best by doing and there are few areas of campus life where students are given as much responsibility for independence and self-governance as in activities such as student government, residence halls government, student clubs and organizations, and student activities. In these leadership roles students have many opportunities to share in institutional governance by creating programs, policies and procedures, debating conflicting values, rendering fair and just decisions and bearing the consequences for the actions they take.

Conclusion

According to study of Rokeach, "Value is an enduring belief a specific mode of conduct or an end state of existence, along a continuum of relative importance". Every person need value in their lives to guide them in the right path, to learn the importance of certainty, goodness and beauty, give positive direction to life and bring joy, preserve our culture and heritage, bring changes in behavior towards positive thoughts and much more. To improve the professional institutions, human values play an important role which helps to develop human values in future generations. Every teacher

must adopt the professional ethics between them because it ultimately affects the student's behavior. As a result we can lead a happy, peaceful and satisfied life throughout.

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IMPORTANCE OF LIFE SKILLS IN HIGHER EDUCATION

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ABSTRACT

The paper would discuss the importance of Life skills in Higher Education to empower the youth with abilities to surpass not only employment crisis but also the crisis they go through in their lives. The current higher education system prepares youth for financial stability and standard of living but still facing challenges in preparing them for psycho social stability. Life skills are “the abilities for adaptive and positive behavior that enable individuals to deal effectively with the demands and challenges of everyday life “. It is imperative today seeing the rising number of cases of Depression, drug addiction and suicide that the youth is not fully equipped in dealing with failures and emotional setbacks. The global platforms like WHO and UNICEF have understood the significance of Life Skills in Education and keep discussing around the challenges it faces and suggest measures to overcome it.

Life skills are important for everyone, especially students with different life experiences, financial situation and skill levels. You may not have the basic skills needed for difficult aspects of work or adult life Higher education is clear that the global competitiveness and job creation potential of Indian industries depend on the skills and skilled work force required. Higher education should be accessible and accessible to everyone it should be emphasized that the adaptability of higher education system must be strengthened to continue to provide skills and skilled workers. Improving the skills of those involved in higher education can make a significant contribution to placing higher education at the center of our society. In many ways, scholars have serious doubts about the direction of our society. Life skills help students get to know themselves better, live more consciously achieve personal satisfaction and achieve personal and scientific goals.

Key words: Life skills, Personal skills, Higher Education, skill Development.

Introduction

In the new millennium, education is undergoing a revolutionized change regarding science & technology, globalization, privatization, urbanization, industrialization, etc. Today’s youth are facing many emerging issues such as global warming, famines, poverty, suicide, population explosion as well as social, emotional, physical and psychological issues. Cut-throat competition, unemployment, lack of job security, etc. are some of the major concerns for the educated and as a result, they are caught in the mad race. No one has time for his/her ‘self’, to develop empathy with surrounding and to have harmony in society. Young mind is being considered, as the most productive members of the society, due to their physical and intellectual capability. But in real scenario, most of them are unable to utilize their potential in an appropriate way due to lack of guidance and motivation. Social problems like alcoholism, drug abuse, sexual abuse, smoking, juvenile delinquency, anti-social acts, etc. have an adverse effect on them and others too, to a large extent. This new challenge requires immediate and an effective response from a socially responsible system of education. Education, now a days is hence, very important, but the kind of education, to support and live life better is more important. Thus, the cardinal focus of Education, therefore, needs an extraordinary emphasis on developing such skills in students, as they are the important building blocks for a dynamic citizen, who can cope up with future challenges, and survive. Central Board of Secondary Education (CBSE) India has recognized this fact that it is necessary to develop scholastic as well as co-scholastic areas, and hence, has made life skill education as a compulsory element in its curriculum. It has been felt, that life skills education bridges the gap between basic functioning and capabilities. It strengthens the ability of an individual to meet the needs and demands of the present society. Thus, a relevant life skill education helps in dealing with the above issues in a manner to get desired behavior practical.

Review of Literature

The topic has been a significant area of interest to the researchers, theorists, and practitioners, and there have been numerous researches carried out to emphasize the importance & effectiveness of life skills education in the development of students’ social, emotional and cognitive development &

dealing with their psychosocial problems and issues. According to Albertyn et al. (2004) life skills training enhance critical thinking abilities, which further impacts were living life actively, being responsible in the job and in future planning too. Ramesh and Farshad C. (2004) in his study proved the effectiveness of like skills training in increasing mental and physical health, pro-social behavior and decreasing in behavioral, social problems & self-destructive behaviors. Smith & et al., (2004) noted significant improvement in interpersonal relationship and reduction in aggression and behavioral problems. Tuttle et al., (2006), during their investigation, add the life skills to students' curriculum. The results of this study suggested the extraordinary capability of teens to positive promotion and flexibility. Vranda and Rao (2011) proved that life skills training enhanced their psychosocial Competencies. Puspakumarag (2013) in his study showed that life skills training was effective in preventing a wide range of problems such as substance abuse, teenage pregnancies, violence Bullying & to promote self-confidence and selfesteem among the adolescents. Roodbari, Sahdipoor, and Ghale (2013) in their research showed that life skills training has a positive effect and improves social development, emotional and social adjustment, suggesting an increase in compatibility of children and public health. The present paper focuses on how enhancing social, emotional and thinking skills through life skills education, helps the 21st- century youngsters to achieve their goals strengthens the abilities to meet the needs and demands of the present society and be successful in life

Importance of life skills in Higher education

If we want to live life successfully, then we need to understand the importance of life skills. And it is also very important to implement it in our life. If this happens then our life can move in a simple and right direction. Life skills make us competent to know how to make our life easy and simple, how to create a positive life, how life can be spent in the right way. Therefore, life skills are very important in our life.

It polishes the ability to adapt to all kinds of circumstances and succeed in every aspect of the society. Lack of life skills in the lives of new generations needs to be taken care of as it is important in life. Due to absence of life skills, not only personal lives but professional lives and careers get affected.

By educating life skills, students can develop self confidence in them. It makes them cooperative and communicative. It prepares them to take quick action in any unfavorable circumstances.

Types of life skills

There are two types of life skills which need to be taught to students. The first one is General Life Skills and the other is High Level skills. And under these skills comes a variety of skills which are the following.

General skills

- ❖ Confidence skills.
- ❖ Decision-making skills.
- ❖ Stress alleviation skills.
- ❖ Adjustment skills in adversity.
- ❖ Self-awareness skills.
- ❖ Skill of negative tendency towards wrongdoing.
- ❖ Positive behavior.
- ❖ Critical Thinking.
- ❖ Society's skills towards each other.
- ❖ High level skills
- ❖ **The following skills are covered under high level skills.**
- ❖ Excellent warmth and high mental level.
- ❖ Way of thinking.
- ❖ Mental and physical relaxation.
- ❖ Goal Setting and Problem Solving.
- ❖ Communication.
- ❖ Social support.
- ❖ Standard of living with health.

Aims of Development of Life Skills

Following are the objectives of development of life skills.

- ❖ The purpose of social development.
- ❖ Development of experimental knowledge.
- ❖ The purpose of the development of adjustment power.
- ❖ Objective of development of life values.
- ❖ Objective of mental development.
- ❖ Of all-round development

Essential Life Skills Everyone Should Learn

Developing life skill is important and every life skill has its importance to apply in life. Following are life skills:

1. **Self-Awareness Skills:** By developing the Self-awareness skill, one can be aware of his/her doings. They will be aware of their own performance and their behaviours which will make them competent to handle any situation. A person will get to know his feelings for things or towards other people. It also helps them to make sound decisions.
2. **Empathy and Sympathy Skills:** With Empathy, a person will be able to understand other people's perceptions, their feelings, and circumstances any person is in. It simply put them in someone's place to understand their actual emotions. It helps them to react accordingly. With sympathy, a person will be able show appreciation and compassion towards other people and their emotional reaction.
3. **Problem-Solving Skills:** The life skill of problem-solving makes an individual to trace a problem, suggesting options to solutions, evaluate the solutions to pick the best solution, and then apply the solution to the problem within the time limit. It is one of the most important life skills to practice in life on an everyday basis.
4. **Decision-Making Skills:** Every now and then, an individual has to face times when they have to make a decision which can affect their life. With decision-making skills, a person develops a skill to make the right and appropriate decision and pass it on. Decision making enables them to take decisions in any hard and fast situation.
5. **Thinking Skills:** Developing thinking skill is very important as it is the mental activity by which an individual can process information, use experiences, make relationships, finalize solutions to problems, pass on decisions, ask questions, and suggest new ideas.

Thinking skills are of four types:

- a. **Analytical Thinking Skills:** It is a visual thinking skill which makes an individual competent to break complex problems into manageable components to solve it effectively.
- b. **Divergent Thinking Skills:** With Divergent thinking skill, one can generate creative ideas after working on or exploring many possible solutions. It is a spontaneous and free flow thinking.
- c. **Creative Thinking Skills:** Creative thinking skill helps a person to create something new. It also allows their brain to explore things and look at things in creative ways to suggest creative solutions. Creative thinking is infused with imagination and it does not involve logical reasoning.
- d. **Critical Thinking Skills:** Critical thinking skill is opposite to creative thinking skill. It is the ability to make a difference between fake truth and real truth, judgement and opinion. It prepares a person to think rationally and prepare to build trust on right and to avoid wrong.
6. **Communication skills:** Without proper communication, you cannot express and make people understand your thinking and it can be made possible by developing communication skills. It helps them to convey people in a very convincing and clear way. It develops confidence in people as well and good communication skills helps them in the professional environment too.
7. **Interpersonal Skills:** Interpersonal skills are basically the interaction skills and social skills. This skill prepares an individual to communicate socially in person or in group. These skills have traits such as self-confidence, critical thinking, communication skills, active listening, leadership etc. To develop interpersonal skills, one needs to start their day with an optimistic approach towards the day.

8. **Accepting Criticism Skill:** Accepting criticism is not easy but by developing this particular skill, one will be able to open to constructive criticisms and improve themselves according to that criticism. An individual should keep their emotional side and accept the truth to work on it. Students have to understand that not only studies will give them success, they will also have to develop their skills.

Conclusion

Life skills are very important and integral part of educational system worldwide. Higher education has the potential to deliver skills and research for productivity and innovation. It is important to remember that Education with life skills is not another subject but it humanizes education. It helps to organize thinking and effort to achieve a goal. Once an Action Plan has been developed, especially in the curriculum, it can be developed spirally, in depth and width. A lot of thought requires to be given on how to bring in life skills education into the mainstream curriculum. Our educational policies and the subsequent curriculum frameworks all along have emphasized the need for Life skill Education. It is also true that in order to be effective; there must be clearly defined and definite focus, direction and commitment for fostering life skills. These can be acquired every moment and every day of our lives. Life skills are essentially those abilities that help promote overall wellbeing and competence in young people as they face the realities of life. They are the beginning of wisdom which focuses on behavior change or developmental approach designed to address a balance of three areas-knowledge, attitude and skills. These skills enable individuals to translate knowledge, attitude and values into actual abilities-i.e. what to do and how to do it, given the scope and opportunity to do so. Promoting efficient life skills training programme in higher education would thereby be an ode to the youth in the country. It would be a way of empowering youth to build their lives and their dreams. It would be a means of handholding them through the critical stages in their life and helping them tap their potential to the fullest. Thereby, it is hoped that the current education system with its oppressive rigidity would open up and make life skills education a part of its mainstream curriculum. This would enable the country to build individuals who believe in themselves, who are efficient leaders and administrators, who are able to understand their potentials and achieve them.

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**PROBLEMS AND PERSPECTIVES OF MICRO, SMALL AND MEDIUM ENTERPRISES
(MSMES) SECTOR IN INDIA- AN ANALYTICAL STUDY**

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ABSTRACT:

The Micro Small and Medium Enterprises (MSMEs) sector have been accepted as the engine of economic growth and for promoting equitable development all over the world, especially in India in view of second highly populated country in the world. MSMEs, post – independence, have emerged as dynamic and vibrant sector of Indian economy. MSMEs play a significant role in elimination of economic backwardness of rural and underdeveloped regions of the country, assist big industries in their growth, and help in making the best use of various resources of the country. MSMEs major source of the area thus leading to reduction of disparities in income, wealth and consumption. MSMEs sector has a major role in Indian economy as it has around 45% share in national industrial output, around 70% in industrial employment and approximately 40% in exports. But small-scale and cottage industries face a number of problems. As a result, many small-scale units turn sick and a large number have to close down.

Key words: Micro, Small and Medium Enterprises, employment, schemes, Small Scale and cottage industries, problems.

Introduction

Marginal Small and Medium Enterprises (MSMEs) in India have emerged as a vibrant and dynamic sector of the economy. MSMEs form an important line for the Indian Industrial sector. They play an important role in the economy in terms of manufacturing output, employment generation and exports. The entrepreneurs in this sector with their intelligence and hard work try to make the best possible use of opportunities that are available. MSMEs focus on smaller markets; have lower investments and lead to effective mobilization of resources and equitable distribution of national income.

MSMEs are important support for the economy as they lead to the growth of economy with a vast network of over 30 million units, creating employment of about 70 million, and manufacturing more than 6000 products, as the country moves towards the growth agenda. MSMEs sector effectively contributes in achieving the target of raising the GDP. Today MSMEs are present across sectors, forming the formidable component of the country's outstanding economic growth.

Review of Literature

Large number of studies has been conducted in India on various aspects related to MSMEs. Some important studies are as follows:

Sen, Salim (2016) conducted a study to deal with high regional disparity in the growth of MSMEs sector. Realizing the importance of this sector, Government of West Bengal along with Government of India introduced certain schemes to solve the issues of high cost credit, staffing, planning, and inadequate infrastructure facilities.

N.Aruna (2015) conducted a study to identify the problems faced by enterprises due to which the growth of enterprises is affected, in turn affecting growth of the country. Further, the data collected revealed that overall globalised business environment of India has been favorable for the growth of micro and small- scale industries. Simple and clear policies and acts are to be made so that these enterprises can understand them and utilize as well as implement them in business for compliance and secure benefits. There are many government schemes but from the study it was observed that most of these enterprises are not aware and do not understand how they can benefit out of them.

Ali and Husain (2014) conducted a study to present the status of MSMEs in India. There are situations where there is need of credit from banks, rural sector facing competition from the multinational companies, lack of knowledge in technology due to non-availability of effective

training and skill development programs etc. foreign banks are not taking so much interest in sanctioning loan to the MSME sector.

Gupta and Agarwal (2013) conducted a study on various schemes for MSMEs with special reference to SIDBI. It focused on various financial and Non- financial assistance provided by SIDBI to MSMEs.

Rao and Apparao (2013) Studied MSMEs contribution to GDP, employment and the role of MSMEs in the supply chain for large businesses. They found that most of the MSMEs in rural areas face the problem of shortage of finance to advance business growth. MSMEs require lot of setup capital, liquid capital, and investment capital to survive and grow in this competitive business world.

Lahiri (2012) studied the reasons for lack of sufficient funds for meeting the credit needs of MSMEs. Lahiri critically analysed the impact of Micro, Small and Medium Enterprises Development (MSMED) Act, 2006 by analyzing the opportunities and threats of MSMEs in India during the pre- and post-liberalization period.

Mapdar (2011) showcased the major challenges faced by the handloom owners and designers. The research has brought out various aspects that have strategic and policy/managerial implications. The study is related to production related issues, financial aspects, and management practices. Getting irregular credit facilities, lack of knowledge of raw material, price fluctuations of cotton, infrastructure problems etc.

Objectives of the study

- To understand the definition of MSMEs on the basis of investment limits in India
- To understand the current status of MSMEs in India
- To find out various problems and challenges being faced by MSMEs in India

Research Methodology

Only secondary data is taken into consideration for purpose of the study. The relevant secondary data is collected from the publication of Ministry of Micro, Small and Medium Enterprises, Journals, Government of India published by Reserve Bank of India and Handbook of statistics on Indian Economy.

MSMEs sector is a combined name given to three different types of organizations i.e. Micro, Small and Medium Enterprises. As on date following are criteria for defining these organizations:

Classification of Micro, Small and Medium Enterprises in India

Types of Firm	Manufacturing Sector (Investment in Plant and Machinery)	Service Sector (Investment in Equipment)
Micro Enterprises	Does not exceed Rs. 25 lakh	Does not exceed Rs. 10 lakh
Small Enterprises	More than Rs. 25 lakh but does not exceed Rs. 5 crore	More than Rs. 10 lakh but does not exceed Rs. 2 crore
Medium Enterprises	More than Rs. 5 crore but does not exceed Rs. 10 crore	More than Rs. 2 crore but does not exceed Rs. 5 crore

Revised classification of MSMEs in India

Types of Firm	Investment	Annual turnover
Micro Enterprises	Does not exceed Rs. 1 crore	Does not exceed Rs. 5 crore
Small Enterprises	More than Rs. 1 crore but does not exceed Rs. 10 crore	More than Rs. 5 crore but does not exceed Rs. 50 crore
Medium Enterprises	More than Rs. 10 crore but does not exceed Rs. 50 crore	More than Rs. 50 crore but does not exceed Rs. 250 crore

Source: Government of India, Ministry of Micro, Small and Medium Enterprises

Table 1: Estimated Number of MSMEs (Activity Wise)

Activity Category	Estimated Number of Enterprises (in lakh)			Share (%)
	Rural	Urban	Total	
Manufacturing	114.14	82.50	196.65	31
Electricity*	0.03	0.01	0.03	0
Trade	108.71	121.64	230.35	36
Other Services	102.00	104.85	206.85	33
All	324.88	309.00	633.88	100

Source: MSME Annual Report 2020-21

Table 2: Estimated Employment in the MSME Sector (Activity Wise)

Activity Category	Estimated Number of Enterprises (in lakh)			Share (%)
	Rural	Urban	Total	
Manufacturing	186.56	173.86	360.41	32
Electricity*	0.06	0.02	0.007	0
Trade	160.64	226.54	387.18	35
Other Services	150.53	211.69	362.22	33
All	497.78	612.10	1109.89	100

Source: MSME Annual Report 2020-21

Table 3: Distribution of Enterprises (Rural and Urban area wise)

Sector	Micro	Small	Medium	Total	Share(%)
Rural	324.09	0.78	0.01	324.88	51
Urban	306.43	2.53	0.04	309.00	49
All	630.52	3.31	0.05	633.88	100

Source: MSME Annual Report 2020-21

The Ministry of MSME initiated special schemes to provide credit and financial assistance due to COVID-19, such as;

- 3lakh Crore was released as **Emergency Credit line Guarantee Scheme(ECLGS)** for MSME from banks and Non-Banking Financial Companies which was fully guaranteed and collateral free and it will be extended till March 2023, as it has been badly hit in the first & the second wave of COVID-19. Thus policy makers understood additional capital to cover operational liabilities to resurrect their business.
- The government of India understood the plight of the MSME sector, so extended Rs.20,000 crores as **Subordinate Debt for Stressed MSMEs**.
 - Two lakh MSMEs were likely to benefit from the government announcement
 - The central government guaranteed zero loans through banks and gave authority to banks to be more comfortable in assisting MSME borrowers. (**Asma, 2020**)
 - Rs. 17.66 crores were distributed to 178 borrowers who received guarantees from 12 banks.
 - On 13th May 2020, Finance Minister announced –The **fund of Fund** for MSMEs to infuse Rs. 50,000 crore as Equity to help MSMEs in capacity augmentation.

- Rs 50,000 crore Equity infusion for MSMEs through Fund of Funds (Sources-Annual Report MSME 2020-21)

- The government of India supports Rs. 4000 Crores to Credit Guarantee Trust for MSMEs.
- Rs.50,000 crore equity infusion for MSMEs through the 'Fund of Funds' Scheme which would be hand holding for entrepreneurs to rejuvenate their business due to pandemics.
- Other interventions for MSME
- E-market linkage was promoted to replace trade fairs and exhibitions for MSMEs
- Data provided by the e-marketplace, fintech be used to improve transaction-based financing

MSME Loan Schemes initiated by the Govt. of India

MSME schemes offered by financial institutions and initiated by the Indian Government are mentioned below:

- CGTMSE: Credit Guarantee Fund Trust for Micro and Small Enterprises
- CLCSS: Credit Linked Capital Subsidy Scheme
- Credit Guarantee Scheme
- MUDRA Yojana under PMMY
- National Small Industries Corporation (NSIC) Subsidy
- PMEGP: The Prime Minister Employment Generation Programme
- PMRY: Prime Minister's Rozgar Yojana
- PSB Loans in 59 minutes
- Standup India
- Startup India

Opportunities in MSMEs

The opportunities in the MSME industry are massive due to the succeeding factors:

- Export Promotion and potential for Indian products
- Funding – Finance & Subsidies
- Government's Promotion and Support
- Growth in demand in the domestic market
- Less Capital required
- Manpower Training
- Project Profiles
- Raw Material and Machinery Procurement
- Tooling & Testing support and much more

Problems of Small Scale and cottage Industries

The small scale and cottage industries face a number of problems. As a result many small scale units turn sick and a large number have to close down. The following are the main problems that the small scale units have to face

1. **Finance and Credit:** The scarcity of finance and credit is the main obstacle in the development of MSMEs. The position of cottage and village industries in this regard is even worse. The capital base of the small industrial units is usually very weak since they generally have partnership or single ownership. The artisans or craftsmen running cottage industries either run their business with whatever little capital they possess or take credit from the mahajans or the traders who supply raw material to them. In many cases, such credit is obtained on a very high rate of interest and is thus exploitative in character.
2. **Infrastructural constraints:** In their survey of 1063 firms, Keshav Das and Sebastian Morris found that as many as 716 firms said that they faced significant infrastructural problems. This is very large and confirms the well recognized and popular conceptualization that many productive activities are being constrained by inadequate physical infrastructure. The severe constraint is power. Captive generation at reasonable cost is out of question for small firms. Therefore they have to depend on state electricity boards for meeting their requirement which do not supply regular and adequate power. Moreover, because of rampant corruption, many

small-scale industrialists are faced to make private deals with the electricity officials; otherwise they face a danger of tampering with their meters by the electricians. Transportation and communication infrastructures are also universal constraints. In many SSI units (particularly those relating to beverage, tobacco and related products. Printing and publishing, basic chemicals, paints and varnishes, and drugs and medicines), water supply is fast emerging as an important infrastructural constraint.

3. **Inverted tariff structure and raw material availability:** As noted earlier, small-scale industries contribute significantly to the export earnings of the country. Many of these industries use imported raw material and intermediate goods. According to Sebastain Morris, despite import liberalization during 1990s, the tariffs on materials like steel, copper, and many non-ferrous metals, many chemicals, paper etc. Remain high in comparison to tariffs structure, which specifically hurts small firms since they are more labour using and have high material-to output ratio. Small-scale industries that use local raw material also face a number of problems. For instance, the handloom industry depends for its requirement of cotton on local traders. These traders often supply cotton on the condition that the weavers sell the cloth only to them when it is ready. Thus, the weavers are subjected to double exploitation at the hands of the traders. The traders sell cotton to them at high prices and purchase the ready cloth at low prices.
4. **Machines and other equipment:** Machinery and other equipment in many small industries have grown obsolescent. On account of this reason while their costs of production are high, the quality is inferior as compared to the large –scale units. Moreover the small scale units often do not care about the changing tastes and fashions of the people. Accordingly, modernizations are urgently required in small-scale industries.
5. **Problems of marketing:** One of the main problems faced by the small-scale units is in the field of marketing. These units often do not possess any marketing organization and consequently their products compare unfavourably with the quality of the products of the large scale units. Because of the shortage of capital and financial resources, these units do not have adequate staying capacity and are often forced to sell their products at unremunerative prices.
6. **Poor Technology Base:** There exists considerable heterogeneity among the MSMEs in India. A small percentage of firms operate with sophisticated technology base whereas majority of firms use outdated technology. They suffer from low productivity and poor product quality. Due to their small size they cannot enjoy large scale production economies.
7. **Lack of skilled workers:** Though India has no shortage of human resource, most of them are unskilled worker. Large firms pay higher remuneration and employ skilled workers. The MSMEs have to operate with unskilled or semi-skilled workers. Thus, the MSMEs suffer from low managerial capabilities.
8. **Adverse effects of economic reforms and globalization:** The decade of 1990s was marked by considerable deregulation of industrial economy through delicensing and dereservations, opening up the industrial sector to both internal and external competition, lowering of tariffs, removal of quantitative restrictions etc. These reforms have had an adverse effect on the small –scale sector. Cheaper and better quality imported goods are posing a serious threat to small scale units operating in various industries like chemicals, silk auto components, toys, sports goods, footwear etc. The most serious threat is being posed by cheap Chinese imports as the so called china price (which is a rock bottom price) is forcing many small-scale units to close down.

Major findings of study

MSMEs account for about 45% of India's manufacturing output and account for about 40% of India's total exports. The sector is projected to employ about 73mn people in more than 31mn units spread across the country. MSMEs manufacture more than 6000 products ranging from traditional to high tech items. The number of MSMEs units has increased from 105.21 lakh units in 2001-02 to 633.88 lakh units in 2020-21. The investment and production increased from Rs.

Conclusion:

The overall performance and contribution of small scale industries to Indian Economy is described in terms of its absolute growth in units employment, production and exports. The MSMEs Development Act of 2006 perhaps is the most crucial of these recent policy changes. The formulation and implementation of policies and programmes/projects/schemes for MSME sector is undertaken by the Ministry with the assistance of its attached and autonomous organizations. The growth of small scale industries can be evaluated on the growth rates of units, employment, output and exports of small scale industries in 2021 with that of 2001s. At the same time MSMEs sector faced key challenges like as lack of availability of adequate and timely credit, High cost of credit, Collateral requirements, limited access to equity capital, procurement of raw material at a competitive cost, problems of storage,, designing, packaging and product display, lack of access to global markets, inadequate infrastructure facilities, including power, water, roads low technology levels, lack of skilled manpower for manufacturing services, marketing etc. despite the various challenges it has been facing the MSME sector has shown admirable innovation, adaptability and Resilience to survive the recent economic downturn and recession. The small scale sector has grown rapidly over the years. The period of liberalization and the development the MSMEs sector constituted an important segment of our economy. MEMEs are a very important segment in the Indian industrial sector and would continue to play a crucial role in the Indian Economy in the future. A rewarding feature of economic development in India is due to impressive growth of modern MSMEs.

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కర్పూర వసంత రాయలు - సినారె సాహితీ వైభవం

- కొయ్యశ్రీనికెసులు, తెలుగు విభాగాధిపతి & లెక్చరర్, యస్.టి.యస్.యస్ ప్రభుత్వ కళాశాల, కదిరి.

బహుముఖ ప్రజ్ఞాశాలి సింగిరెడ్డి నారాయణ రెడ్డి, సి.నారాయణ రెడ్డిగా, 'సినారె'గా సుప్రసిద్ధులు. పద్యం, గేయం, వచనకావ్యాలు, నాటికలు, గజళ్ళు, ముక్తకాలు, అనువాదాలు, విమర్శ, పరిశోధన, బుర్రకథ, యాత్రా సాహిత్యం, ఇలా అనేక ప్రక్రియల్లో ఎనభైకి పైగా రచనలు చేసిన సాహితీ సార్వభౌముడు సినారె. సి.నారాయణ రెడ్డి సినిమా పాటల రచయితగా కూడా లబ్ధి ప్రతిష్ఠుడు. సినారె తెలుగు సినిమాకు 3500లకు పైగా పాటలు రచించి సినిమా పాటల సాహిత్యాన్ని సుసంపన్నం చేసి సినీ అన్నమయ్యగా పేరు గడించాడు.

సి. నారాయణ రెడ్డి, కరీంనగర్ జిల్లా సిరిసిల్లా తాలూకా హనుమాజీపేట గ్రామంలో 29-07-1931న జన్మించారు. తండ్రి మల్లారెడ్డి రైతు, తల్లి బుచ్చమ్మ గృహిణి. ఉన్నత చదువులు చదివిన సినారె గారు ఎన్నో ఉన్నత పదవులు, బహుమతులు పొందాడు. భారతదేశంలో సాహిత్యంలో ఉన్నత పురస్కారమైన జ్ఞానపీఠ పురస్కారం (1988) కూడా పొందిన సాహితీ కృషివలుడు సినారె. 1992లో భారత ప్రభుత్వ 'పద్మభూషణ్'తో సత్కరించబడింది.

సి.నారాయణ రెడ్డి గారు చిన్ననాట నుండే కవితా రచన మొదలు పెట్టారు. సినారె గారు 1953లో 'నవ్వని పువ్వు' సంగీత నృత్య నాటిక ప్రచురించారు. అది మొదలు చనిపోయే దాకా నిరంతరం రచనలు చేశారు.

“ఊపిరాడడం లేదు -ఉక్క పోస్తోంది ఏసిగదిలో”

కారణం తెలిసిపోయింది - కవిత రాయలేదు ఇవాళ”
కవిత్యం రాయనిదే ఉండలేని సింగిరెడ్డి నారాయణ రెడ్డి 2017 జూన్ 12న మరణించేంత వరకు కవితా వ్యాసంగం లోనే గడిపాడు.

సి.నారాయణ రెడ్డి రచనలన్నీ అత్యుత్తమ శ్రేణికి చెందినవే. కానీ ఆయన రచనల్లో అత్యంత ఆకర్షణీయ

మైన రచన 'కర్పూర వసంతరాయలు' ఈ కథా గేయ కావ్యాన్ని సినారె గారు 1957లో ప్రచురించారు. ఈ గేయ కావ్యాన్ని ప్రసిద్ధ చరిత్రకారుడు మల్లంపల్లి సోమశేఖర శర్మకు అంకిత మిచ్చాడు నారాయణ రెడ్డి గారు. ఈ గేయకావ్యాన్ని సినారె గారు తన సొంత గొతుకతో ఎంతో ఇష్టంగా ఆలపించేవారు.

కర్పూర వసంతరాయలు రెడ్డిరాజుల చరిత్రకి సంబంధించిన శృంగార రసప్రధానమైన అయిదాశ్వాసాల కథాగేయ కావ్యం. ఇది ఆధునిక యుగమున వెలువడిన గేయ ప్రబంధముగ కీర్తిని సంపాదించుకొంది. హృద్యమైన వర్ణనలు, సరసమైన సన్నివేశాలు, రమ్యమైన శబ్ద ప్రయోగాలు ఈ గేయ ప్రబంధాన్ని విశిష్ట కృతిగా తెలుగు సాహిత్యంలో నిలబెట్టాయి. మాత్రా ఛందస్సులో రచింపబడ్డ ఈ కృతిలో సినారె మాత్రా ఛందస్సుతో 'సరిగమలు' అడుకున్నారు. సాహితీ ప్రయులను చక్కని ఊహలోకంలో విహరింపజేసే రసార్థ కావ్యము కర్పూర వసంతరాయలు.

కర్పూర వసంతరాయలులో ఒక చారిత్రక ఇతివృత్త శకలాన్ని ఆధారంగా తీసుకొని దాని చుట్టూ అల్లిన అందమైన కథ వుంటుంది. చారిత్రక ఆధారాలు ఉన్న ఈ కావ్యంలో కుమార గిరి రెడ్డి, లకుమ, రాణి ప్రధాన పాత్రలు. కుమారగిరి రెడ్డి, లకుమలు చారిత్రక వ్యక్తులైనా రాణి పాత్ర మాత్రం చరిత్రలో కనిపించనిది. అనురాగానికి, ధర్మానికి మధ్య లకుమ అనుభవించిన సంఘర్షణ కావ్యంలో ఆర్ధ్రపూరితం. ప్రజాశ్రేయస్సు కోసం ఆమె కథ విషాదాంతంగా ముగుస్తుంది. కావ్యనాయిక లకుమ ఒక నాట్యకత్తై, ఈమె నాట్యం కారణంగానే రెడ్డి రాజైన కుమారగిరి రెడ్డి గారు 'వసంత రాజీయం' అనే నాట్య శాస్త్రాన్ని రాయగలిగాడు. “నేటికినీ లకుమ అందెల

हिन्दी कथा-साहित्य में स्त्रियों का शोषण और नारी मुक्ति-संघर्ष

डॉ. कौंडा चन्द्रा

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सारांश

आधुनिक शिक्षा नारी के लिए वरप्रदाता बनकर आई। भारतीय नारी की स्थिति में अनेक परिवर्तन हुए जो उसके विकास और प्रगति की दृष्टि से संतोषप्रद हैं। स्त्री को घर की चारदीवारी से बाहर कदम रखने का अवसर दिया। भारतीय स्त्री की सोचने-समझने के दृष्टिकोण में परिवर्तन आया, अनेक कथा साहित्य में प्रकट होता है। खासकर स्त्री लेखिकाओं में।

मूल शब्द: आंदोलन, परिवर्तन, दृष्टि कोण, संघर्ष

आज हिंदी कथासाहित्य में स्त्रीविमर्श सशक्त विषयवस्तु बना हुआ है। पितृसत्तात्मक समाज ने उसे स्त्री बनाकर परंपराओं के आड में उसका शोषण करते रहे। हिंदी कथा-साहित्य में कथाकारों ने नारी की इस मूक पीड़ा को अपनी पीड़ा समझकर उद्घाटन किया। हिंदी कथा-साहित्य में नारी के शोषित स्वरूप एवं दास्थरूप नारी की छवि को तोड़ने की अकुलाहट को प्रकट किया है। समाज के सभी क्षेत्रों में पुरुष की सहयोगी रही नारी को भारतीय समाज ने उचित स्थान नहीं दिया। अतः नारी की उपेक्षा, शोषण एवं नारीमुक्त आंदोलन पर हिंदी कथा-साहित्य में साहित्यकारों ने अपनी विश्लेषणात्मक दृष्टि प्रकट की है। भारतीय समाज में स्त्री को प्राचीनकाल से ही गृहिणी पद से सुशोभित किया गया, अतः उसके बाहर आने की समस्या ही नहीं थी। बचपन में वह पिता के संरक्षण में रहती थी, विवाहित होने पर पति का कठोर नियंत्रण रहता था और वृद्धावस्था में बच्चों की इच्छानुसार चलना पड़ता था। इस तरह माना जाता है कि पुरुष को केन्द्र बनाकर नारी का जीवन चक्र चलता रहता है। स्त्री के जीवन-चक्र की धुरी पुरुष ही है। समाज और परिवार की मान्यताओं के अनुसार ही स्त्री का जीवन चलता है और हम जानते हैं कि ये दोनों ही पुरुष-प्रधान संस्थाएँ हैं। स्वभाव से संवेदनशील होनेके कारण स्त्री पारिवारिक और सामाजिक मान्यताओं और को संपूर्ण रूप ग्रहण करती है। उनका निर्वहण भी करती है। स्त्री अपने इस निष्ठापूर्ण निर्वहण के कारण पुरुष की धूर्तता, धोखा-धड़ियों एवं रोब-दाब को झेलना पड़ता है। वह जैसा चाहती है, उस तरह से कुछ होता नहीं है। उसे अपने को पुरुष-प्रधान व्यवस्था के अनुरूप ढालना पड़ता है। उच्च आदर्शों के बावजूद वह समाज में गौरवपूर्ण स्थान बना नहीं पायी।

शिक्षा के व्यापक प्रचार-प्रसार के फलस्वरूप आज स्त्री अपने अधिकारों के प्रति सचेष्ट है। उसमें एक नवीन चेतना का सफुरण हुआ। वर्तमान काल में आर्थिक व्यवस्था ने उसे और भी प्रोत्साहन दिया कि वह घर की सीमाओं को पार करे। परिणामस्वरूप स्त्री को नौकरी करना आवश्यक हो गया और उसने अपने अधिकारों की मांग की। स्त्री किसी की कृपा पर आश्रित न रहकर स्वावलंबी बनने लगी। पारिवारिक और सामाजिक फैसले केवल पुरुष का ही था। लेकिन जब से स्त्री शिक्षित हुई, चेतना आई और स्वावलंबन हुई, तब से पुरुष की जड़ें हिलने लगीं हैं। आज स्त्री अपनी पहचान के लिए सारे बंधन तोड़ रही है। वह अपनी स्व-अस्तित्व की लड़ाई लड़ने में रत है। युगों से पीड़ित स्त्री, पुरुष की दासी न बनकर अपने अधिकारों की मांग की। स्त्री को पुरुष के बराबर का पद मिलना चाहिए। समाचार-पत्रों, अधिवेशनो और पुस्तकों में तो यह पद मिलता रहता है। परन्तु

कानून और देश की आर्थिक योजनाओं में स्थिति नहीं के बराबर है। स्त्रियाँ आज समाज में स्त्रियों के उद्धार का आंदोलन कर रही हैं और अपनी स्थिति को दृढ़ बनाने में तुली हुई हैं। आज की नारी का आंदोलन कहता है कि— नारी को पद चाहिए जग में पुरुष समान, वह ले कर ही रहेगी, कृ बोल रहे बलिदान।

स्त्रियों की उपेक्षा एवं शोषण

हर तरह की निष्ठा और सेवा भाव के बावजूद भारतीय स्त्री समाज में महत्वपूर्ण व्यक्ति नहीं मानी जाती है। हर तरह की गैर जिम्मेदारी और अदूरदर्शीता के बावजूद पुरुष विशेष महत्व का बना हुआ है। निर्णय का बिन्दु पुरुष के यहां ही बनता है। यह स्त्री की सबसे बड़ी विडंबना है। स्त्री पहचान एवं प्रतिष्ठा के लिए छटपटाती रही। मगर समाज और परिवार दोनों स्तरों पर स्त्री की उपेक्षा रही और शोषण होते आया है। हिन्दी कथा-साहित्य में स्त्री की इस उपेक्षित, शोषित स्थितियों का विश्लेषण कर, स्त्री के प्रति पुरुष समाज के वस्तुवादी एवं भोगवादी दृष्टिकोण के प्रतिपादनो का उद्घाटन किया है। मन्मूढपंडारी की 'अकेली' की सोमू बुआ बड़ी सहृदयता के साथ परिवार को समहालती है और पति के तीर्थयात्रा पर जाने पर अडोस-पडोस की महिलाओं के काम-काज में हाथ बटाती है। किसी के घर में मुंडन हो, जनेऊ हो, शादी हो या गमी बुआ पहुंच जाती है, मानो दूसरों के घर में नहीं, अपने ही घर में काम कर रही हो। लेकिन उसको न परिवार से सहानुभूति मिलती है, न समाज की ओर से। रिश्तेदारों की ओर से शादी का निमंत्रण तक उसे मिलता नहीं। इस उपेक्षा के कारण बुआ समाज के प्रति ही नहीं, जीवन के प्रति भी उदास है, और जीवन में नितांत अकेली रह जाती है। बुआ के इस अकेलेपन का उपचार केवल थोड़ी दृ सी हमदर्दी है। संवेदनाओं की उपेक्षा से स्त्री टूट जाती है। वह संवेदनाशून्य समाज में जी नहीं पाती है।

मार्कण्डेय से लिखित "वासवी की मां" की मृणालिनी पुरुष की भोगवादी प्रवृत्तिका शिकार होती है। पति रतनलाल शराबी और वासनालोलुप है। फिर भी मृणालिनी उसके प्रतिनिष्ठा रखती है। व्यापार के दौरान पति घर से बाहर रहता है। उसकी बेटी वासवी पर रतनलाल के मित्र की नजर पड़ती है। इसको जानते हुए भी अपने फायदेकारे दृष्टि में रखकर रतनलाल चुप रहता है। रतनलाल के मित्र की लपटता का शिकार खुद मृणालिनी होती है। इस तरह रतनलाल और उसका मित्र दोनों मृणालिनी का उपभोग करते चलते हैं। यह एक प्रकार से पुरुष द्वारा स्त्री की उपेक्षा के साथ-साथ उसका शोषण भी प्रकट होता है। स्त्री के

प्रति पुरुष इस उपेक्षा एवं शोषण प्रवृत्ति को हिंदी कथा-साहित्य में व्यक्त किया गया है। शैलेश मटियानी की “लाटी” कहानी की लाटी को लूटने का हर प्रकार का जाल समाज में बिछाया जाता है। जवान ही नहीं, बूढ़ों तक की नजरें उसके देह पर लगी हुई हैं। बुक-सेलर सोचता है “उत्तम लाटी डिगरेवाकाने के साथ नहीं, बल्कि उसके साथ ज्यादा अच्छी लग सकती है।” डॉ शीला रजवार जी का कहना है कि इन सबके अंदर वह पुरुष छिपा हुआ है जो नारी को केवल भोग की वस्तु समझता है और उसका शोषण करता है। पुरुष में छिपी इस शोषण प्रवृत्ति के कारण स्त्री को जीवन में संकट पूरा स्थितियों से जूझना पड़ता है। इस तरह हम देखते हैं कि हिन्दी कहानी साहित्यकारों ने समाज की बुरी परिणतियों का प्रतिपादन कर, यह बोध जगाया है कि स्त्री के प्रति सहानुभूतिपूर्ण रवैया अपनाया जाए। और उसके स्वतंत्र व्यक्तित्व के विकास की संभावनाएं समाज में खुल पड़नी चाहिए।

नारी मुक्ति संघर्ष

नारी मुक्ति संघर्ष आज के युग में तीव्र रूप में है। हिन्दी साहित्यकारों ने भी अपने कथासाहित्य के द्वारा इस संघर्ष का विश्लेषण करते हुए स्त्री संघर्ष का प्रोत्साहन भी किया है। घर-परिवार तक सीमित रहती आयी नारी, आजकल अपनी शक्ति प्रतिभाओं का सदुपयोग, नौकरी के दौरान करने लगी है। शिक्षा और नौकरी के द्वारा सशक्त होने के प्रयास में है। आज नारी परिवार को अतिरिक्त आर्थिक सहारा प्रदान करने लगी है। परिवार में उसका अलग महत्व बनने लगा है। आज स्त्री शिक्षित होकर जागरूक है। आर्थिक रूप से स्वावलंबन है। उसने परंपराओं का कठोर विरोध किया और अपने अस्तित्व के लिए संघर्ष करने लगी। आज नारी समाज के बंधनों से ऊपर उठकर सोचने लगी है। इस प्रकार वह अपने यथार्थ को ढूँढने का प्रयास कर रही है। आज की आधुनिक नारी श्रमजीवी होकर घर और बाहर (नौकरी से) दोनों कार्य सफलतापूर्वक कर रही है। इस कारण आधुनिक नारी झुकना नहीं चाहती वह अपने आत्म सम्मान की रक्षा चाहती है। परंपरागत मान्यताएं एवं नैतिक आदर्श अब उसके लिए उतने महत्वपूर्ण नहीं रह गए हैं। आज ग्रामीण नारी भी किसी न किसी रूप में इस नवीन मानसिकता से अवश्य प्रभावित है। ग्रामीण नारी भी आज अपने अधिकारों के प्रति जागरूक दिखाई देने लगी है। वह आज परंपरागत पुरुष दृष्टि आधिपत्य को नकार रही है। स्पष्ट है कि ग्रामीण नारी भी आज मात्र तस्वी रनहीं रह गई है, जिसे जहां चाहे ‘फिट’ करके रख दिया जाये।

नारी आज नौकरी के माध्यम से आर्थिक स्वावलंबन प्राप्त कर और अपनी शक्ति प्रतिभाओं के सदुपयोग की सुविधा के बावजूद समाज में कुरीतियों, रूढ़ धारणाओं एवं संकीर्णताओं के कारण असंतुष्ट है। इसी तनाव संघर्ष को उषाप्रियंवदा के “छुट्टी का दिन” कहानी में दर्शाया गया है। “छुट्टीकेदिन” की मिससहगल नौकरी और स्वावलंबन के बावजूद व्यस्तता के कारण, घड़ी भर के लिए भी फुर्सत नहीं पाती है। वह टूटन तथा थकान का अनुभव करती है कृ“अपने जिदगी के पैटर्न पर, उसके खोखलेपन और सारहीनता पर”। इसी तरह चित्रामुदगल की “अपनी वापसी”, मृदुला गरग “राख”, मन्नू भण्डारी की “बंदराजोंकासाथ” और “नई नौकरी” आदि जैसी कई कहानियों में नारी सामाजिक परिवेश की जटिलताओं के कारण, नौकरी के रूप में प्राप्त आर्थिक स्वावलंबन के बावजूद जीवन में व्यर्थता का तीखा बोध व्यक्त करती है। घर और दफ्तर या काम के अन्य जगहों पर उसे अनेक प्रकार के मानसिक तनाव सहने पड़ते हैं। नौकरी के लिए आते-जाते समय नारी को तरह-तरह की यातनाओं का सहन करना पड़ता है। अपनी नौकरी के पदोन्नति की संभावनाओं को बनाए रखने के लिए नारी को सामाजिक संबंधों को भी निभाना होता है। मालिक,

अधीनस्थ और सहकर्मी सभी उसका शोषण करने का प्रयत्न करते हैं। आज भी उसे नारी ही समझा जा रहा है, एक व्यक्ति नहीं।

निष्कर्ष

आज नारी अपमानित जीवन व्यतीत न कर, अपने पैरों पर खड़ी होकर अपने स्वाभिमान की रक्षा करने की शक्ति रखती है। महादेवी वर्माजी मानती हैं कि यदि नारी को बढ़ना है तो उसे अपना अस्तित्व पहचानना होगा, स्वीकारना होगा। हिन्दी कथासाहित्य में स्त्री सशक्तिकरण पर विशेष बल दिया गया है। हिन्दी कथासाहित्य में कथाकारों ने यह उद्घाटन सफलतापूर्वक करने का प्रयत्न किया है कि नारी जीवन के सहज विकास के लिए आर्थिक औन्नत्य, जीवन की सुविधाओं की उपलब्धि, सुरक्षा की व्यवस्था प्रदान करना आवश्यक है। भविष्य के निर्माण के लिए वर्तमान के तमाम प्रतिरोधों के बावजूद वह निरंतर गतिशील है। निष्कर्ष में यह आशा है कि स्त्री और पुरुष दोनों की सहनता और आपस की समझ (एक दूसरे के प्रति) एवं वैचारिक परिवर्तन से स्त्री का पूर्ण रूप से विकास हो सकता है। फिर भी स्त्री को सतर्कता से जीवन में अपने कदम बढ़ाते चले जाना है।

संदर्भ सूची

1. उषा प्रियंवदा – वापसी
2. मृदुला गर्ग – राख
3. मन्नू भण्डारी – नई नौकरी
4. मन्नू भण्डारी – अकेली



नवचेतन और नवजागरण के कवि 'रामधारी सिंह दिनकर'

डॉ. श्रीमती. के. चन्द्रा

सहायक आचार्य, एस टी एस एन सरकारी स्नातक महाविद्यालय, कदिरि, श्री सत्य साई जिला, आंध्र प्रदेश, भारत

सारांश

प्रगतिवादी कवियों में दिनकर विशेष महत्व रखते हैं। प्राचीनतम एवं नवीनतम का भव्य और क्रांतिकारी समन्वय आप की रचनाओं में हुआ। कल्पनाशीलता और सौंदर्यप्रेम से अधिक महत्व आप यथार्थ और संगर्ष को देते हैं। छायावाद से प्रगतिवाद की ओर एवं प्रगतिवाद से राष्ट्रवाद की ओर आप अग्रसर रहे। आप की भाषा ओजपूर्ण एवं शक्तिमय है। दिनकर जी व्यक्ति की चेतना के व्यापकत्व की विविध प्रतीकों में करते हैं।

मूल शब्द: कल्पनाशीलता, ओजपूर्ण, राष्ट्रवाद, क्रांतिकारी

प्रस्तावना

रामधारी सिंह दिनकर जी राष्ट्रीय भावनाओं के कवि हैं। दिनकर जी का नाम प्रगतिवादी विचारक कवियों में लिया जाता है। उन्होंने देश की राजनैतिक व सामाजिक परिस्थितियों पर लेखनी चलाई। इनका विद्रोही स्वर ललकार व चुनौती के रूप में प्रस्फुटित होकर देश पर बलिदान होने की प्रेरणा देते हैं। इन्होंने समाज की अर्थव्यवस्था तथा आर्थिक असमानता के प्रति रोष प्रकट किया जिस कारण वे प्रगतिवादी रचनाएँ कहलायीं। इन्होंने शोषण, उत्पीड़न, वर्ग विषमता की निर्भीकता से निंदा की। दिनकरजी ने श्रमसाध्य जीवन जिया और उनका साहित्य साधन भी अपूर्व था। वे प्रेम के पुजारी एवं सौन्दर्य के उपासक थे। दिनकरजी की राष्ट्रीयता चेतना व व्यापकता उनकी सांस्कृतिक दृष्टि, उनका ओजपूर्ण वाणी एवं काव्यागत तत्वों पर बल, उनका सात्विक जीवन मूल्य उन्हें पारंपरिक रीति से जोड़े रखा है। अतः यह कहा जा सकता है कि दिनकरजी ने हमारे क्रांतिकारी-युग कविता का सम्पूर्ण प्रतिनिधित्व किया। क्रांतिवादीवादियों की सच्ची तस्वीर है दिनकर का काव्य दिनकर जी बीसवीं सदी के ओजस्वी व तेजस्वी कवि थे। अपनी बहुमुखी प्रतिभा के कारण 'रामधारी सिंह दिनकर जी' अत्यन्त लोकप्रिय हुए। उन्हें भारतीय संस्कृति एवं इतिहास से अधिक लगाव था। राष्ट्रीय धरातल पर स्वतन्त्रता की भावना का स्फुरण करने वाले कवियों में 'रामधारी सिंह दिनकर जी' का अपना विशिष्ट स्थान है।

रामधारी सिंह दिनकर की रचनाएँ

काव्य-रेणुका, हुँकार, रसवन्ती, कलिंग विजय, बापू, नीम के पत्ते, कुरुक्षेत्र, नील कुसुम, उर्वशी। गद्य-मिट्टी की ओर, अर्द्ध-नारीश्वर, संस्कृति के चार अध्याय।

दिनकर जी के काव्य स्वभाव में प्रकृति के प्रति एक अबोध आकर्षण है। वे समस्त प्राकृतिक व्यापारों में एक आत्मीयता का अनुभव करते हैं। इसलिए जहाँ भी उन्होंने प्रकृति वर्णन किया है वह मार्मिक और सजीव है। उसके यथार्थ वर्णन के कारण उसमें गीतात्मकता की अपेक्षा कथात्मकता अधिक है। दिनकर जी की काव्य भाषा विशुद्ध खड़ीबोली हैं। तत्सम शब्दों का प्रयोग बड़ी सफलता के साथ हुआ है। शब्द योजना पुष्ट और भावानुकूल है। भावों की शिथिलता भाषा में ही मिलती। उनकी भाषा शैली पूर्णरूप से विचारों और भावों की अभिव्यक्ति करने में समर्थ है। प्रत्येक शब्द विचार और भावों का वाहक बन गया है। दिनकर जी के काव्य में कहीं भी क्लिष्ट शब्द योजना नहीं मिलेगी। शब्दों का तोड़ मरोड़ और व्याकरण की अशुद्धियाँ नहीं मिलतीं। शाब्दिक चमत्कार तथा साहित्य प्रदर्शन के चक्कर में दिनकर जी कहीं नहीं पड़े। लाक्षणिकता तथा व्यंजक शब्दों का प्रयोग भी उन्होंने बहुत कम किया है। इसलिए इनकी शैली अत्यन्त परिमार्जित और प्रौढ़ है। सरलता और सुबोधता ही भाषा की अपनी सौन्दर्य विशेषता है। दिनकर जी की छन्द-योजना में नवीनता है तथा अलंकारों के प्रयोग में भी स्वाभाविकता है। उनकी समस्त रचनाओं में भाव और भाषा का सामंजस्य मिलता है। रामधारी सिंह दिनकर का नाम प्रगतिवादी विचारक कवियों में लिया जाता है। इन्होंने अपने काव्यों में राष्ट्रियता, भारतीय संस्कृति, युद्ध व शांति किसानों की दयनीय दशा उच्च वर्ग का शोषण एवं जीवन के अनेकों क्षेत्रों जैसे सभी विषयों का सजीव चित्रण किया है। कवि ने 'परशुराम का उपदेश' कविता द्वारा देशवासियों में ओज और वीरता का भाव भरा है। अन्याय और अत्याचार के प्रति आवाज उठाना मानव का धर्म है और उसको सहना कायरों का काम है। मानव को प्रकृति से अनेक शक्तियाँ प्राप्त होती हैं। प्रत्येक भारतवासी अपनी शक्ति को पहचाने और एक जुट होकर शत्रु से लड़े। इसलिए कवि देशवासियों से कहता है- 'बाहों की विभा सँभालो।' इस कविता में प्रतिकों, अलंकारों, और लाक्षणिक प्रयोगों से दिनकर ने काव्य सौंदर्य बखूबी उभारा है।

"लाखों क्रौंच कराह रहे हैं,

जाग, आदि कवि की कल्याणी?

फूट-फूट तू कवि-कंठों से,

बन व्यापक निज युग की वाणी।"

कविता अपने युग की वाणी बनती है। वह अपने समय के हर वर्ग एवं शोषितों की आवाज बनती है। समाज में व्याप्त अंधविश्वास, आडंबर, पाखंड को खत्म कर एक स्वस्थ व जागृत समाज निर्माण में योगदान दें। और राष्ट्रकवि रामधारी सिंह दिनकर अपनी कविता के जरिये जीवन भर यही करते रहे। दिनकर के रचनाओं में उनके विचार और सोचों को दर्शाती है। दरअसल, आधुनिक युग में हिन्दी काव्य में पौरुष का प्रतीक और राष्ट्र की आत्मा का गौरव गायक जिस कवि को माना जाता है, उसी का नाम रामधारी सिंह 'दिनकर' है। दिनकर यशस्वी भारतीय परम्परा के अनमोल धरोहर हैं, जिन्होंने अपनी कालजयी रचनाओं के जरिए देश निर्माण और स्वतंत्रता संघर्ष में स्वयं को पूरी तरह समर्पित कर दिया था। 'कलम आज उनकी जय बोल' जैसी प्रेरणादायक कविता और उर्वशी जैसे काव्य के प्रणेता रामधारी सिंह दिनकर ने साहित्य की विभिन्न विधाओं में अनवरत लेखन किया, लेकिन उनकी विशिष्ट पहचान कविता के क्षेत्र में ही बनी। उन्होंने कविता में पदार्पण भले ही छायावाद और श्रृंगार रस से प्रभावित होकर किया हो, लेकिन समय के साथ-साथ उनकी कविता निरंतर राष्ट्रीयता और स्वातंत्र्य प्रेम का पर्याय बनती चली गई।

दिनकर ने अपनी इस राष्ट्रीयता और राष्ट्रीय प्रेम को स्वीकार्य करते हुए भारतीय ज्ञानपीठ पुरस्कार समारोह के अवसर पर कहा था कि "जिस तरह जवानी भर मैं रवीन्द्र और इकबाल के बीच झटके खाते रहा, उसी तरह जीवन भर मैं गांधी और मार्क्स बीच भी झटके खाता रहा हूँ। इसीलिए उजले को लाल से गुणा करने पर जो रंग बनता है वही रंग मेरी कविता का है और मेरा विश्वास है कि भारतवर्ष के भी भावी व्यक्तित्व का रंग यही होगा।" उनकी रचनाओं में स्वदेश को युवा पीढ़ी भी अपनी कुर्बानी से मुक्त करवा सकती है। कुछ ऐसी ही भावना इन पंक्तियों में दिखाई देती है-

"नए सुरों थिंजनी बजा रही जवानियाँ
लहू में तैर-तैर के नहा रही जवानियाँ"

दिनकर स्वच्छंदतावाद के कवि कहे जाते हैं और बंधनों, रूढ़ियों को तोड़ना उनकी कविताओं की विशेषता है। लेकिन, व्यक्ति स्वातंत्र्य उनके चिंतन में नहीं दिखाई देता। कवि की स्वच्छंदता की भावना और चेतना अद्भुत कल्पना प्रवण, अव्यावहारिक तथा मिथकीय बिम्बों, प्रतीकों, ऐतिहासिक व्यक्तित्वों के माध्यम से व्यक्त होती हैं। दिनकर की काव्य चेतना में विविधता और विषय वस्तु की दृष्टि से बहुलता दिखाई देती है। उसमें देशभक्ति से परिपूर्ण राष्ट्रीय चेतना है और विषमता को मिटाकर सामाजिक समानता स्थापित करने की भावना है। ईश्वर को चुनौती देने वाले वाला कवि जब भीष्म जैसे महारथी को केंद्र में रखकर रचे काव्य "कुरुक्षेत्र" में पूछता है-

"धर्म का दीपक, दया का दीप
कब जलेगा, कब जलेगा

विश्व में भगवान" तो कवि की अशक्तता और अधीरता का बोध होता है।

दिनकर की पंक्तियों में धरती के प्रति आकर्षण दिखता है, स्वर्ग के प्रति नहीं। दिनकर जी वस्तुओं पर कम, अपने मन पर पड़े प्रभाव को कविता के रूप में अदम्य भाषा शैली में बहुत प्रभावकारी ढंग से प्रस्तुत करते हैं-

"व्योम कुंजों की परी अभिकल्प ने
भूमि को निज स्वर्ग पर ललचा नहीं
पा न सकती मृत्ति उड़कर स्वप्न को
युक्ति हो तो आ बसा अलका यहीं" ('रेणुका')

छात्र जीवन से ही संघर्षों और चुनौतियों से जूझते हुए दिनकर ने बचपन से जवानी तक के सफ़र में अनेक उतार-चढ़ाव देखे। इस संघर्षों ने दिनकर के विचारों और सोच को एक व्यापक दृष्टिकोण प्रदान किया। इस परिवेश का परिणाम ही था कि जुझारूपन उनके व्यक्तित्व की एक प्रमुख प्रवृत्ति बन गया। हालांकि, तमाम उतार-चढ़ाव के बावजूद दिनकर की पैनी नजर अपने युग की हर छोटी-बड़ी घटनाओं पर केंद्रित रही। अपने युग की हर सांस को वे पहचानते थे और इसका विस्फोट उनकी कविताओं और रचनाओं में खूब देखने को मिलता है। तभी तो दिनकर यह ललकारते हुए दिखते हैं कि

"सुनूँ क्या सिंधु मैं गर्जन तुम्हारा, स्वयं युग-धर्म का हुंकार हूँ मैं
कठिन निर्घोष हूँ भीषण अशनि का, प्रलय गांडीव का टंकार हूँ मैं।"

हिंदी काव्य जगत में क्रांति, ओज और प्रेम के सृजक के रूप में उनका योगदान अविस्मरणीय है और उनकी काव्यगत विशेषताएँ अद्वितीय हैं। दिनकर अपने युग के प्रतिनिधि कवि और भारतीय जनजीवन के निर्भीक रचनाकार के रूप में हमेशा हिंदी साहित्य के जगत में मूर्धन्य रहेंगे।

संदर्भ सूची

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नारीवाद: स्त्री शक्ति

डॉ. कौंडा चन्द्रा

सहायक आचार्य, एस.टी.एस.एन. सरकारी स्नातक कालेज, कदिरि, श्री सत्य साई जिला, आंध्र प्रदेश, भारत

सारांश

नारीवाद एक ऐसा सिद्धांत या विचारधारा है जो समाज में महिला एवं पुरुष को समान अधिकार दिलाने की वकालत करता है। इस सिद्धांत के अनुसार महिला व पुरुष के बीच समाज द्वारा किसी भी प्रकार का भेदभाव नहीं किया जाना चाहिए। प्राकृतिक व लैंगिक अंतर के अलावा कोई भी ऐसा अंतर जो पुरुष और महिला में किया जाता है उसका नारीवाद डटकर विरोध करता है। नारीवाद के कारण आज नारी शिक्षित होकर जागरूक है और आर्थिक रूप से भी स्वावलंबन है। परंपरागत मान्यताएँ एवं नैतिक आदर्श अब नारी के लिए उतने महत्वपूर्ण नहीं रह गए हैं।

मूल शब्द: स्वावलंबन, समानता, उत्पीड़न, सिद्धान्त, वाद

प्रस्तावना

नारीवाद नारी के सशक्तीकरण का शस्त्र है। नारीवाद, सामाजिक और राजनीतिक आंदोलनों तथा विचारधाराओं की एक श्रेणी है, जो राजनीतिक, आर्थिक, व्यक्तिगत एवं सामाजिक रूप से लैंगिक समानता को परिभाषित करने और प्राप्त करने के लक्ष्य में प्रकट किया है। नारीवाद की यह धारणा है कि समाज पुरुष-दृष्टिकोण को ही महत्व देता आया है। इस पितृसत्तात्मक समाज में महिलाओं के साथ भेदभाव और अन्याय होता आया है। अतः नारीवाद का लक्ष्य पुरुषों के समान शैक्षिक, वृत्तिक और पारस्परिक अवसर एवं परिणाम स्थापित करना है जो पुरुषों के समान हो। नारीवादी सिद्धांत का लक्ष्य लैंगिक असमानता को समझना है। अतः, नारीवादी सिद्धांतों का उद्देश्य लैंगिक असमानता की प्रकृति एवं कारणों समझना है और इनके फलस्वरूप होने वाले लैंगिक भेदभाव के परिणामों की व्याख्या करना है। नारीवादी संबंधी आदर्शों का मूल कथ्य यही होता है कि कानूनी अधिकारों का आधार लिंग न बने।

आधुनिक नारीवादी चिन्तन का प्रारम्भ 18वीं शताब्दी के अन्तिम वर्षों से माना जाता है। 19वीं शताब्दी से लेकर अब तक के वर्षों में नारीवादी गतिविधियों के अनेक रूप प्रकट हुए हैं। इसको विद्वानों ने 'नारीवाद की लहरों' के नाम से सम्बोधित किया है। नारीवाद की पहली लहर का समय 19वीं शताब्दी के मध्य से लेकर 20वीं शताब्दी के प्रारम्भिक वर्षों तक माना जाता है जबकि दूसरी लहर जिसे उग्र महिलावाद के नाम से जाना जाता है का समय 60 के दशक के अन्तिम वर्षों में माना जाता है। साठ के दशक में उपजे नारीवाद का मुख्य उद्देश्य यह प्रदर्शित करता था कि सभी महिलाएँ एक ही प्रकार के शोषण का शिकार होती हैं परन्तु वर्तमान नारीवाद पुरुष प्रधान समाज में नारी की भिन्न-भिन्न स्थिति की चर्चा तो करता ही है, साथ ही महिला के आपसी सम्बन्धी की भी विवेचना करता है।

समकालीन समाज में जेंडर पर आधारित विभेद किस तरह पूरे जीवन की संरचना करते हैं। नारीवाद की यह धारणा है कि समाज, पुरुष-दृष्टिकोण को महत्व देता है और इस पितृसत्तात्मक समाज में महिलाओं के साथ भेदभाव और अन्याय होता रहा है। इसका लक्ष्य महिलाओं के लिए पुरुषों के समान शैक्षिक, वृत्तिक और पारस्परिक अवसर और परिणाम स्थापित करना है जो पुरुषों के समान हो। यह पितृसत्ता द्वारा स्त्रियों के ऊपर प्रभुत्व की प्रणाली के प्रति अपने विरोध के मसले पर एकजुट है। नारीवादी सिद्धांत, सैद्धांतिक या दार्शनिक क्षेत्रों में नारीवाद का विस्तार है। यह समाज की संरचना को बिना बदले राजनीतिक और कानूनी सुधार के माध्यम से पुरुषों और महिलाओं की व्यक्तिवादी समानता की तलाश करता है।

नारीवाद का तर्क है कि महिलाओं के उत्पीड़न का मूल कारण पूंजीवाद है, और घरेलू जीवन और रोजगार में महिलाओं के खिलाफ भेदभाव पूंजीवादी विचारधाराओं का ही परिणाम है। अपने अधिकांश इतिहास के दौरान, पश्चिमी यूरोप और उत्तरी अमेरिका की मध्यम वर्ग की श्वेत महिलाओं द्वारा नारीवादी आंदोलनों और सैद्धांतिक विकास का नेतृत्व किया गया था। हालाँकि अन्य जातियों की महिलाओं ने वैकल्पिक नारीवाद का प्रस्ताव रखा है। 1960 के दशक में संयुक्त राज्य अमेरिका में नागरिक अधिकारों के आंदोलन और अफ्रीका, कैरिबियन, लैटिन अमेरिका के कुछ हिस्सों और दक्षिण पूर्व एशिया में यूरोपीय उपनिवेशवाद के पतन के साथ इस प्रवृत्ति में तेजी आई। उस समय से, विकासशील देशों और पूर्व उपनिवेशों में रहने वाली महिलाएँ, जो रंग या विभिन्न जातीयता की हैं या गरीबी में रह रही हैं, ने अतिरिक्त नारीवाद का प्रस्ताव दिया है।

नारीवाद को लेकर विभिन्न समूहों के लोगों की अपनी-अपनी प्रतिक्रिया है, और इसके समर्थकों और आलोचकों में दोनों पुरुष और महिलाएँ शामिल हैं। नारी-समर्थक पुरुष समूहों की गतिविधियों में स्कूलों में लड़कों और युवा पुरुषों के साथ हिंसा रोकने जैसे कार्य, कार्यस्थलों में यौन उत्पीड़न कार्यशालाओं की पेशकश करना, सामुदायिक शिक्षा अभियान चलाना और हिंसा में लिप्त पुरुष अपराधियों को काउंसलिंग देना भी शामिल है। प्रो-फेमिनिस्ट पुरुष, पुरुषों के स्वास्थ्य सम्बंधित कार्यक्रम जैसे: पोर्नोग्राफी के खिलाफ सक्रियता, जिसमें पोर्नोग्राफी विरोधी कानून, पुरुषों का अध्ययन और स्कूलों में लिंग इक्विटी पाठ्यक्रम का विकास आदि में भी शामिल होते हैं। कभी-कभी नारीवादी और महिला संगठन साथ आकर, घरेलू हिंसा और बलात्कार संकट केंद्रों में सहयोग करते हैं।

नारीवाद सामान्यतया वह विचारधारा और आन्दोलन है जिसका उद्देश्य है जीवन के प्रत्येक क्षेत्र में महिलाओं को पुरुषों के बराबर स्थान प्राप्त हो। परम्परागत रूप से और समकालीन जीवन में भी महिलाओं को अधीनस्थ और अवपीडित स्थिति ही प्राप्त है। नारीवाद का लक्ष्य है इस अधीनस्थ और अवपीडित स्थिति को समाप्त कर उन्हें परिवार, समाज, राज्य और समूचे विश्व के स्तर पर पुरुष के समकक्ष स्थान दिलाना। इस प्रकार एक पंक्ति में नारीवाद, नारी समानता (पुरुष से समानता), नारी एकता और नारी सशक्तिकरण का आन्दोलन है। नारीवाद की मांग है कि नारी को अपना हक (समानता का हक), अपने अधिकार और अपना स्वतन्त्र व्यक्तित्व चाहिए। नारीवाद एक विश्वव्यापी आन्दोलन है, कुछ देशों में यह अपने विकास के उच्च स्तर पर है, कुछ देशों में अपेक्षाकृत कम विकसित स्तर पर। सिमोन दिबोवा की प्रसिद्ध पुस्तक *The Second Sex* में विस्तार में बतलाया गया है कि स्त्री-पुरुष का भेद समाजीकरण का परिणाम है। समाजीकरण (समाज से जुड़े समस्त वातावरण) से उत्पन्न इस स्थिति को दूर कर समान व्यक्तियों के लिए समान अधिकारों की अधिकार के रूप में मांग नारीवाद है।

भारत में नारीवाद, भारतीय महिलाओं के लिए समान राजनीतिक, आर्थिक और सामाजिक अधिकारों को परिभाषित करने, स्थापित करने, समान अवसर प्रदान करने और उनका बचाव करने के उद्देश्य से आंदोलनों का एक समूह है। संसार भर में अपने नारीवादी समकक्षों की तरह, भारत में भी नारीवादी लैंगिक समानता, समान मजदूरी के लिए काम करने का अधिकार, स्वास्थ्य और शिक्षा के लिए समान अधिकार और समान राजनीतिक अधिकार चाहते हैं। भारतीय नारीवादियों ने भारत के पितृसत्तात्मक समाज के भीतर संस्कृति-विशिष्ट मुद्दे जैसे कि वंशानुगत कानून और सती जैसी प्रथा के खिलाफ भी लड़ाईयाँ लड़ी हैं।

भारत में नारीवाद के इतिहास को तीन चरणों में देखा जा सकता है: पहला चरण, 19वीं शताब्दी के मध्य में शुरू हुआ, जब यूरोपीय उपनिवेशवादी, सती की सामाजिक बुराइयों के खिलाफ बोलने लगे। दूसरा 1915 से, जब भारतीय स्वतंत्रता के लिये गांधी के नेतृत्व भारत छोड़ो आंदोलनों में महिलाओं ने बढ़ चढ़ कर हिस्सा लिया और कई स्वतंत्र महिला संगठन उभरकर आने लगे। अंत में, तीसरा चरण, स्वतंत्रता के बाद, जहाँ शादी के बाद ससुराल में, कार्यस्थल में और राजनीतिक समानता के अधिकार में महिलाओं के प्रति निष्पक्ष व्यवहार पर ध्यान केंद्रित किया गया है।

भारतीय नारीवादी आंदोलनों द्वारा की गई प्रगति के बावजूद, आधुनिक भारत में रहने वाली महिलाओं को अभी भी भेदभाव के कई मुद्दों का सामना करना पड़ रहा है। भारतीय पितृसत्तात्मक संस्कृति ने भूमि-स्वामित्व के अधिकार प्राप्त करने और शिक्षा तक पहुँच को चुनौतीपूर्ण बना दिया। पिछले दो दशकों में, लिंग-चयनात्मक गर्भपात की प्रवृत्ति को भी ऊभरकर सामने आई। भारतीय नारीवादियों ने इस अन्याय के खिलाफ संघर्ष का रूप देखा जाता है। नारी की स्वतंत्रता, अस्मिता और समता का पक्ष लेने वाला वाद या सिद्धान्त जो पितृसत्तात्मक समाज व्यवस्था का और राजनीति के विरोधी को ही नारीवाद की संज्ञा दी है। भारत में नारीवादी आंदोलनों की कुछ आलोचना हुई है। विशेष रूप से पहले से ही विशेषाधिकार प्राप्त महिलाओं पर ध्यान केंद्रित करने और गरीब या निम्न जाती की महिलाओं की जरूरतों और प्रतिनिधित्व की उपेक्षा करने के लिए उनकी आलोचना की गई। जिसका परिणाम यह हुआ की कई जाति-विशेष के नारीवादी संगठनों और आंदोलनों का उदय हुआ।

नारीवाद की विशेषताएँ या लक्षण :

1. नारीवाद मैरिज सिस्टम या विवाह संस्कार (एक स्त्री और एक पुरुष के बीच काम सम्बन्धों को मर्यादित करने की व्यवस्था) और परिवार संस्था का विरोधी नहीं है। नारीवाद पुरुष को धिक्कारना नहीं है, पुरुष को अस्वीकार करना नहीं है पुरुष को केवल समानता, पूर्ण समानता के आधार पर स्वीकार करना है। नारीवाद विवाह विरोधी या परिवार विरोधी तो नहीं है, लेकिन इस बात पर अवश्य ही बल देता है कि विवाह और परिवार नारी के लिए केवल उतनी ही सीमा तक आवश्यक है, जितना सीमा तक यह पुरुष के लिए आवश्यक है।
2. नारीवाद इस बात पर बल देता है कि योग्यता और क्षमता की दृष्टि से, नारी किसी भी पुरुष से कम नहीं है तथा उसे आवश्यक शिक्षा, ज्ञान और प्रशिक्षण प्राप्त कर प्रतियोगी जीवन के सभी क्षेत्रों में पुरुषों के समान स्तर पर कार्य करने का अधिकार होना चाहिए। वह पुरुष से प्रतियोगिता करने की क्षमता रखती है तथा उसे यह अधिकार प्राप्त होना ही है।
3. नारीवाद इस बात पर बल देता है कि राजनीति में नारी को लगभग बराबरी की भागीदारी (कम से कम एक-तिहाई भागीदारी अवश्य ही) प्राप्त होनी चाहिए। महिलाएँ न केवल राजनीति में भाग लेने की योग्यता और क्षमता रखती हैं वरन् वे इस कार्य के लिए पुरुषों की तुलना में अधिक योग्य और सक्षम हैं। राजनीतिक क्षेत्र में श्रीमति गांधी, श्रीमती भण्डारनायक, माग्रेट थैचर और गोल्डा मायर आदि महिलाओं ने जिस सुयोग्य नेतृत्व का परिचय दिया, उससे यह बात प्रमाणित हो जाती है।
4. नारीवाद इस बात पर बल देता है कि यदि नारी को उत्थान और विकास की दिशा में आगे बढ़ना है तो यह कार्य नारी एकता और संगठन तथा स्थानीय प्रादेशिक, राष्ट्रीय और अन्तर्राष्ट्रीय स्तर पर नारी-नारी सहयोग के आधार पर ही सम्भव है। विभिन्न देशों के अधिकार पत्रों में नारी-पुरुषों के लिये समान अधिकार की बात कही गयी है। संयुक्त राष्ट्र शंघ द्वारा मानवीय अधिकारों का सार्वलौकिक घोषणापत्र स्वीकार किये हुए इतना अधिक समय व्यतीत हो चुका है लेकिन आज तक भी महिला वर्ग के हित और अधिकार सुरक्षित नहीं है। महिला वर्ग की इस गिरी हुई स्थिति के मूल कारण महिलाओं में शिक्षा का अभाव तथा आर्थिक आत्मनिर्भरता का अभाव है। इसके अतिरिक्त महिलाओं की स्थिति में सुधार के मार्ग में एक प्रमुख बाधक तत्व है दृष्टासामाजिक कट्टरता, धार्मिक कट्टरता, और अन्धविश्वास।

भारत में महिला संगठन (Women's Organization in India)

विगत कुछ वर्षों में स्त्री द्वारा पुरुष के साथ समानता की खोज एक सार्वभौमिक तथ्य बन चुकी है। इस मांग के कारण कुछ नारी संगठनों ने नारियों में चेतना जाग्रत करने और उनकी स्थिति में सुधार लाने की दृष्टि से प्रयत्न किये हैं। मध्यम वर्गीय महिलाओं ने कीमतों में निरन्तर वृद्धि के मुद्दे को उठाया है और घरेलू स्त्रियों ने पुरुषों के साथ समानता की माँग की है। सर्वप्रथम चेन्नई में भारतीय महिला संघ का गठन किया गया। इसके बाद विभिन्न महिला संगठनों के प्रयत्नों से

देश में अखिल भारतीय महिला सम्मेलन की स्थापना की गई है। इस संगठन के अलावा विश्वविद्यालय महिला संघ, भारतीय ईसाई महिला मण्डल, अखिल भारतीय स्त्री शिक्षा संस्था एवं कस्तूरबा गाँधी स्मारक ट्रस्ट आदि स्त्री संगठनों ने स्त्रियों की नियोग्यताओं को दूर करने, सामाजिक कुरीतियों को समाप्त करने और स्त्री शिक्षा का प्रसार करने की दृष्टि से कार्य किया है। विश्वव्यापी स्तर पर भी नारियों की स्थिति में सुधार के लिये कुछ प्रयत्न किये गये हैं। नारी संगठनों के प्रयत्नों के परिणामस्वरूप नारियों की स्थिति में सुधार के लिये भारत में कुछ अधिनियम पारित हुए हैं जैसे—हिन्दू विवाह अधिनियम, हिन्दू उत्तराधिकार अधिनियम, दहेज प्रतिषेध अधिनियम आदि। यही नहीं कुछ अन्य संवैधानिक प्रयत्न भी किये गये हैं जिसमें पंचायत संस्थाओं और नगर पालिकाओं के चुनाव में एक तिहाई पद महिलाओं के लिये आरक्षित किये गये हैं तथा संसद में महिला आरक्षण विधेयक पर बहस निरन्तर जारी है। जिसमें विधानसभा और लोकसभा में एक तिहाई पद महिलाओं के लिये आरक्षित होने की बात कही गई है ताकि महिलायें निर्णय लेने की प्रक्रिया में शामिल हों और नीति निर्माण के स्तर पर उनकी सहभागिता रहे। इस प्रकार अधिकारों की दृष्टि से नारी और पुरुष में भेद करना उतना ही अनुचित है जितना लिंग के आधार पर भेदभाव करना। किसी भी सभ्य समाज में स्वतन्त्रता और अधिकार की दृष्टि से महिला और पुरुष में कोई भेद नहीं किया जाता है उन्हें समान अधिकार मिलना चाहिए जो एक सुसंस्कृत सुसभ्य समाज की कसौटी है।

संदर्भ ग्रंथ

1. पंचशील शोध — समीक्षा — पृष्ठ 87
2. आजकल : मार्च 2013 — पृष्ठ 24
3. आजकल : मार्च 2011 — पृष्ठ 25
4. पंचशील शोध — समीक्षा — पृष्ठ 61

प्रबंधकाव्य: एक दृष्टि

डॉ. श्रीमती. के. चन्द्रा

सहायक आचार्य, एस टी एस एन सरकारी स्नातक महाविद्यालय, कदिरि, श्री सत्य साई जिला, आंध्र प्रदेश, भारत

सारांश

प्रबंधकाव्य एक समाख्यान काव्य है। इसमें कथा अपरिहार्य रूप से होती है। प्रबंधकाव्य में कथा के साथ-साथ भावों एवं विचारों की शृंखलाबद्ध होना भी आवश्यक है। इसमें सम्पूर्ण समाज एक इकाई के रूप में चित्रित होता है। आचार्य शुक्ल प्रबंधकाव्य के लिए रसात्मकता को अनिवार्य मानते हैं। किसी विषय या कथा का गद्य या पद्य में प्रस्तुतीकरण प्रबंध कहलाता था।

मूल शब्द: रसात्मकता, शृंखलाबद्ध

प्रस्तावना

भारतीय आचार्यों ने काव्य के श्रव्यकाव्य और दृश्यकाव्य नामक दो भेद बतलाए हैं। उनके अनुसार श्रव्यकाव्य के तीन भेद हैं – गद्य, गद्य और चंपू। छंदरहित रचना गद्य, छंदोबद्ध रचना पद्य और गद्य-पद्य मिश्रित चंपू कहलाती है। पद्य के भी दो प्रकार हैं – प्रबंधकाव्य और मुक्तक काव्य। प्रबंधकाव्य में छंद परस्पर सापेक्ष होते हैं और मुक्तक काव्य में पूर्वापर संबंध नहीं होता। आचार्य विश्वनाथ ने इन दोनों का लक्षण निर्धारित करते हुए लिखा है –

“छंदोवद्धपदम पद्यम तेन मुक्तेन मुक्तकम्।”

यहाँ प्रबंधकाव्य ही वर्ण्य है। अतः उस पर ही विचार किया जाएगा। भारतीय आचार्यों में कुंतक ने प्रबंधकाव्य को महाकवियों का कृतिकन्द बताया है – “प्रबंधेषू कवीन्द्राणाम कीर्ति केन्द्रेषु कि पुनः।” यह मुक्तक से श्रेष्ठ माना गया है। प्रबंधकाव्य की चर्चा करते हुए डॉ. गायत्री जोशी ने लिखा है – “संस्कृत में ‘प्रबंध’ शब्द का मूल अर्थ (प्र+बन्ध) (बांधना +अय) संदर्भ या ग्रंथ रचना है। आधार (कथा-विषय) पर कल्पना से ग्रंथ रचना करना भी प्रबंध कहा जाता था। दूसरे शब्दों में परंपरानुमोदन के साथ किसी विषय या कथा का गद्य या पद्य में प्रस्तुतीकरण प्रबंध कहलाता था। धीरे धीरे यह शब्द आख्यान या कथा के सम्यक तारतम्य पर आधारित केवल काव्य के लिए प्रयुक्त होने लगा और प्रबंधकाव्य के लिए रुद हो गया।”² डॉ. भगीरथ मिश्र ने प्रबंधकाव्य के लिए काव्यात्मकता कथा और छंदों की क्रमबद्धता को अपरिहार्य माना है – “यह पद्य रचना है जिसके अंतर्गत छंद किसी कथा सूत्रता कि व्यवस्था से पिरोये रहते हैं उनके छंदों के क्रम को बदला नहीं जा सकता।” डॉ. नगेन्द्र लिखते हैं – “प्रबंध में जीवन का सवांग विस्तार तथा संपूर्ण अभिव्यक्ति रहती है, इसीलिए आनंद के अतिरिक्त काव्य के महत्वपूर्ण उद्देश्य पुरुषार्थ चतुष्टय की प्राप्ति का साधन प्रबंधकाव्य ही अधिक है।”⁴

इन कथनों के विवेचन से यह स्पष्ट होता है कि प्रबंधकाव्यमें निम्नलिखित चार तत्वों का होना आवश्यक है— कथात्मकता, काव्यात्मकता, वस्तुवर्णन और चरित्र-चित्रण।

क) कथात्मकता: प्रबंधकाव्य एक समाख्यान काव्य है। इसमें कथा अपरिहार्य रूप से होती है। आचार्य भामह ने इसे निबद्ध काव्य कहा है। प्रबंधकाव्य में कथा के साथ-साथ भावों एवं विचारों की शृंखलाबद्ध होना भी आवश्यक है। इसमें संपूर्ण समाज एक इकाई के रूप में चित्रित होता है। यही कारण है कि कभी-कभी किसी

प्रबंधकाव्य में जीवन-वृत्त के स्थान पर संपूर्ण जाति या समाज का ही चित्रण होता है।

ख) काव्यात्मकता: प्रबंधकाव्य एक काव्य है इसे पद्यात्मक कथाकाव्य भी कहा जाता है। पद्य इसकी पहली शर्त है। आचार्य रामचन्द्र शुक्ल ने लिखा है — “प्रबंधकाव्य में मानव जीवन का पूर्ण दृश्य होता है। इसमें घटनाओं कि संबंध-श्रृंखला और स्वाभाविक क्रम के ठीक-ठीक निर्वाह के साथ हृदय को स्पर्श करनेवाले, नानाभावों का रसात्मक अनुभव करने वाले प्रसंगों का समावेश होना चाहिए। इतिवृत्त मात्र के निर्वाह से रसानुभव नहीं किया जा सकता।”⁵ इस प्रकार आचार्य शुक्ल प्रबंधकाव्य के लिए रसात्मकता को अनिवार्य मानते हैं। यह रसानुभूति कविता के माध्यम से ही कराई जाती है।

ग) वस्तुवर्णन: यह बाह्यार्थ निरूपक है। इसमें इतिवृत्त का वर्णन होता है एल प्रबन्धकाव्य की विकासयात्रा में अब यह अंतर आया है कि भाव एवम विचार प्रधान प्रबंध काव्यों की रचना होने लगी है।

घ) चरित्र-चित्रण: इतिवृत्त का विकास चरित्रों को आधार बनाकर ही होता है अतः प्रबंध काव्य में चरित्रों का पूर्ण विकास होना चाहिए। पंडित रामदहिं मिश्र ने इन सबको समेकित करते हुए लिखा है — “प्रबंध प्रकृष्टतः विस्तार का द्योतक है। प्रबन्धकाव्य जीए पद्य, प्रबंधगत कथा वर्णन के अधीन तथा परस्पर संबद्ध रहते हैं। वे सम्बद्ध रूप से अपने विषय का ज्ञान करते, भावमग्न करते एवम रस में सरोबार करते हैं।”⁶ प्रबंधकाव्य का विभाजन करते हुए आचार्यों ने इसे दो प्रधान भेद बताए हैं — ‘महाकाव्य और खंडकाव्य।’ इनकी विशेषताओं पर आगे विचार किया जाएगा।

महाकाव्य

किसी विदा की परिभाषा देकर इसका यथावत लक्षण निर्धारित करना कठिन कार्य है फिर भी पहचान के लिए उसका स्वरूप-निर्धारण आवश्यक हो जाता है। महाकाव्य साहित्यिक विधा रही है अतः इसका सर्वकालिक लक्षण निर्धारित करना संभव नहीं है। यह युगीन चेतना को आत्मसात कर चलनेवाली एक प्रगतिशील विधा है। महाकाव्य एक सांस्कृतिक प्रयास है। संस्कृति जिस प्रकार अखंड रहकर भी युगीन विशेषताओं को आत्मसात करती चलती रहती है, उसी प्रकार महाकाव्य भी अपने मूल उद्देश्य को संरक्षित रखते हुए युगीन प्रवृत्तियों को प्रश्रय देते हुए

गतिशील रहता है। यह जातीय जीवन की अभिव्यक्ति का माध्यम है। दिनकर ने लिखा है —“विश्व के महाकाव्य मनुष्यता के प्रगति के मार्ग में मील — पत्थरों के समान होते हैं। वे व्यंजित करते हैं कि मनुष्य किस युग में कहां तक प्रगति कर सका है।” महाकाव्य की इन विशेषताओं को देखते हुए इसके लिए कोई रुढ़ परिभाषा निर्धारित करना संभव नहीं है। इन सीमाओं के होते हुए भी भारतीय एवम पाश्चात्य विद्वानों ने महाकाव्य की परिभाषा निर्धारित करने का प्रयास किया है। यहां भारतीय और पाश्चात्य दोनों परंपराओं में विद्वानों द्वारा प्रस्तुत परिभाषाओं का विश्लेषण किया जाएगा। भारतीय साहित्य में संस्कृत के आचार्यों ने इस पर गंभीरता से सूक्ष्म विचार किया है। यहां भारतीय आचार्यों से तात्पर्य संस्कृत आचार्यों से है। अतः यहां विश्लेषण के क्रम में संस्कृत आचार्यों की परिभाषाओं पर विचार किया जाएगा।

संस्कृत आचार्यों की परिभाषाएं

संस्कृत आचार्यों में भामह प्रतिष्ठित आचार्य माने जाते हैं। उनके अनुसार “सर्गविभाजन से महाकाव्य में व्यवस्था आती है। नाटकीय संधियों एवम कार्यवस्थाओं के प्रयोग के द्वारा कथानक के विकास में क्रामबद्धता एवम काव्यात्मकता आती है। वर्णनात्मकता काव्य के लिए अनिवार्य है। धर्म, अर्थ, काम, मोक्ष आदि चतुर्वर्ग फल प्राप्ति का विधान होना चाहिए। उससे नायक का अभ्युदय होता है, किंतु अन्य पात्रों का उत्सर्ग दिखाने के लिए नायक का वध नहीं किया जाता है।”⁸ इस प्रकार ‘भामह’ ने अपनी परिभाषा में महाकाव्य को उसकी संपूर्णता में समेटने का प्रयत्न किया है। आचार्य दंडी ने महाकाव्य के लक्षणों का निरूपण करते समय भामह की बातों को परिभाषा में आत्मसात किया ही है उसके बाह्य स्वरूप का विवेचन किया है।⁹ परवर्ती आचार्यों के लिए दंडी की परिभाषा अनुकरणीय रही है। रुद्रट¹⁰ एवम हेमचंद्र¹¹ जैसे आचार्यों ने भी अपने लक्षणों का पूर्ववर्ती आचार्यों के परिभाषाओं का आधार बनाया है। रुद्रट ने महाकाव्य के लिए महत् उद्देश्य, महत् चरित, महती घटना और समग्र जीवन के रसात्मक चित्रण को अनिवार्य माना है। कविराज विश्वनाथ¹² ने अपेक्षाकृत व्यापक और स्पष्ट परिभाषा दी है। उनकी परिभाषा में पूर्ववर्ती सभी आचार्यों के लक्षणों का समाहार है।

विश्वनाथ की परिभाषा सर्वमान्य और सर्वांगपूर्ण है। इस परिभाषा में महाकाव्य के लिए निम्नलिखित तत्व आवश्यक बताए गए हैं —

1. कथानक की ऐतिहासिकता
2. कथावस्तु का सर्गों में विभाजन
3. नाटकीय संधियों का निर्वाह
4. धीरोदात्त उच्च कुलीन नायक
5. श्रृंगार, वीर और शांत रसों में एक की परिपक्वता और अन्य रसों का सहायक होना ।
6. धर्म, अर्थ, काम, मोक्ष, चतुर्वर्ग की प्राप्ति
7. आठ से अधिकसर्गों की संख्या
8. सर्ग के अंत में छंद परिवर्तन
9. महाकाव्य के आरंभ में नमस्कार, मंगलाचरण, आशीर्वचन आदि का विधान
10. सज्जन की स्तुति एवम दुर्जन की निंदा
11. सूर्य, प्रातः, मध्याह्न, संध्या, रजनी, प्रदोष, पर्वत, सागर, स्वर्ग, पुर, ऋतु, संयोग श्रृंगार, विप्रलंब श्रृंगार, पुत्रोत्पत्ति, यात्रा, मंत्रणा, यज्ञ आदि का सांगोपांग चित्रण।
12. कवि, कथा अथवा नायक पर आधारित महाकाव्य का नामकरण।
13. कथा के आधार पर सर्गों का नामकरण।

इस प्रकार विश्वनाथ ने महाकाव्य की एक व्यापक परिभाषा दी है, किंतु यह परिभाषा मौलिक नहीं है इन्होंने पूर्ववर्ती आचार्यों का दोहन किया है, किंतु व्यापकता के कारण इनकी परिभाषा समादृत

रही है। अनेक कवियों ने उनकी परिभाषा को आधार बनाकर काव्य रचना की और प्रतिष्ठा अर्जित की। इससे यह परिभाषा यशस्वी हुई।

संदर्भ सूची

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WHY EVERY ATHLETE SHOULD NEED YOGA

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ABSTRACT

Athlete irrespective of sport or discipline has the potential to enhance their ability by adopting a consistent yoga practice. Today's top athletes have a unique ability to constantly perform at their highest potential in comparison to their competition. For High School, College, University players and professional sports, most athletes are very similar in Physical abilities, so how are some athletes able to consistently dominate their competitions. The most important benefit of yoga is physical and mental health therapy. The ageing process which is largely an artificial condition, caused mainly by autointoxication i.e. self poisoning can be slowed down by practicing yoga. By keeping the body cleans, flexible and well lubricated. Through the practice of yoga we become aware of inter connectedness between our emotional mental and physical levels.

Keywords: Yoga, Potential, Artificial.

Introduction

Yoga exercises helps in mental (emotional) health

When yoga is used as part of a regular exercise regime, there can be many benefits beyond flexibility or strength training. A lot of athletes use yoga exercises as a form of meditation to clear your mind before a game, but the benefits of yoga extend beyond cleansing the mind. If you are thinking about starting an exercise routine, you might consider using yoga, because there are many emotional benefits of using yoga regularly.

Yoga Reduces Stress

One of the best emotional health benefits of yoga is the fact that yoga exercises can reduce stress, which is very important for an athlete. Often times, an athlete will become overwhelmed with an upcoming game or meet, and this can really cause a lot of stress for them which will hinder athletic performance. Yoga exercises require a lot of concentration and this means an athlete will be concentrating on the aim at hand instead of thinking about a sport or game. When an athlete has the ability to concentrate only on the yoga exercises, it can help him reduce overall stress levels, which might increase athletic ability during the competition.

Yoga Relieves Depression

Yoga can also help relieve depression symptoms in an athlete, which can hinder athletic ability or cause them to feel like a failure. When an athlete performs yoga exercises, it can help get rid of the negative energy within the body, which is release through the various poses. If an athlete performs yoga exercises regularly, he will come to know that the depression starts going away and he will feel overall more positive about life. Since yoga helps the mind and body connection while also balancing hormones in the body it is logical that it can relieve depression symptoms.

Yoga Increases Concentration

Another important emotional health benefit of yoga is that it can increase overall concentration, which is very important for an athlete. The ability to concentrate is especially vital during conditioning, a game or an athletic meet, and it can really help them to succeed in sports. Yoga helps to increase concentration levels in an athlete because due to the concentration is needed during the yoga poses. When an athlete performs a yoga pose he has to focus only on the pose and breathing techniques needed for that exercise, which requires a lot of concentration.

Yoga helps on Mental Focus

A dominant athlete is able to maintain a higher level of mental focus, awareness and concentration over his competition, some term this as performing in the Zone.

Yoga exercises helps to improving strength

Routine and constant practice of the various yoga asana helped to build strength and improve lean muscle mass. Most notably with respect to several muscle groups under-utilized in the athletic disciplines of swimming, cycling and running. These gains have



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enhanced core body stability and significantly impeded overuse injury by strengthening the supportive but otherwise under developed muscles surrounding the more utilized muscles creating a more balanced and optimally functional overall strength.

It helps Great Balance

Swimmer must have always been rather flexible. But the balance is historically horrible, through a consistent yoga practice, athletes coordination and balance have improved immensely. It is important that better balance and coordination means enhanced control over how athletes move their body which in turns leads to better technique and form the brass ring every athlete spends a career refining whether your focus is a swim stroke, mallakamba twist, drafts and catches, shuttle and jump shots in Basket ball, wrestling moves foot ball heading and Pele shot.

To prevent serious injury

A dominant athlete is able to avoid serious injury during each and every performance.

Yoga improves Flexibility

Yoga invariably improves joint and muscular flexibility, which is crucial to the body's overall structural soundness. Enhanced joint and muscle pliancy translates to greater range of motion, or an increase in the performance latitude for a particular movement or series of movements for example, a swimmer with supple shoulder and hip joints is able to capture and pull more water than a swimmer with a more limited range of motion. The result is more forward movement per stroke as well as enhanced muscular economy. In turn, this increased range of motion provides a greater ability to strength condition a particular muscle group due to the amelioration in overall force that can be exerted with each movement.

It helps Great recovery

A dominant athlete is able to recover more quickly, both mentally and physically over their competition. They are able to continually compete again, and even at higher mental and physical level than previously, as their competition get tougher and they move towards successful way.

Yoga increase Overall Happiness

Yoga is known to increase your overall happiness, which can significantly help an athlete. If an athlete is in a bad mood or is not happy this can hinder his or her athletic ability during a game. Yoga exercises help balance the hormones within the body which are responsible of many things, such as mood and quality of life. When an athlete practices yoga his nervous system will become balance over time, leading to an increased outlook on life in general. Yoga also help to increase the awareness of the body, create a healthier feeling body and can increase the mind and body connection, which will also help increase the overall mood of an athlete.

Mental Benefits of Yoga

- Control the Stress and Anxiety
- Internal discipline and mind concentration
- Relaxation for healing & Recovery
- Presence of mind
- Controlled Breathing & Hear Rate
- Body and Mind Awareness

Physical Benefits of Yoga

- Improves Balance
- Increases Range of Motion
- Improves Recovery Time
- Strengthen Ankles & Knees, Tendons & Ligaments
- Decreases Injuries
- Increases body Awareness



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