

# ADSORPTION OF LEAD (Pb) FROM WASTE WATER BY USING JATROPHA LEAVES POWDER AS ADSORBENT

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## **Abstract**

*In this research jatropha leaves powder (JLP) existing in great quantity in south region of Andhra Pradesh, were used as natural low-cost adsorbent for the removal of lead ions (Pb) in wastewater by means of the process of adsorption. The jatropha leaves powder is characterized by using Fourier transform infrared and scanning electron microscope to predict the functional groups and surface morphology. The experiment were carried out in a batch adsorption studies and covered the different process parameters such as the effect of initial lead ion concentration, contact time, adsorbent dosage, solution pH and temperature. The maximum percentage removal of jatropha leaves powder was found to remove 90% of lead at the end of 140 mins by using jatropha leaves powder in aqueous solution.*

*The maximum removal of lead is found to be 87% achieved at the higher adsorbent dosage of 10 g/100ml. It is observed that the lead removal efficiency from the aqueous solution decreased from 82 to 56% on the increment of initial lead concentration from 50 to 500 mg/L. The maximum percentage removal of lead was found to be 84% at the temperature of 52°C. Initially as the temperature increases from 32°C to 62°C, then the % removal of lead decreases from 75% to 84%. Furthermore, to design the equilibrium data of adsorption of process, two isotherm models such as Langmuir and Freundlich were used. It is found that Freundlich equation has the highest value of  $R^2$  (0.9911) than Langmuir equation (0.9744). It was found that the equilibrium data was fitted very well with Freundlich isotherm model than Langmuir isotherm model.*

**Keywords:** Jatropha Leaves Powder, Lead (Pb II), Adsorption Isotherms, Wastewater

## INTRODUCTION

The heavy metals are among the most harmful of the elemental pollutants and are of particular concern as their increasing level in the environment represents a serious threat to human health, living resources and ecological systems. Therefore, the discharge of effluents containing metals into the environment is a chief concern as they are considered persistent, bioaccumulative and toxic[1]. Lead is known as a very ancient environment pollutant and it can be discovered in wastewater generated by different industries such as tanneries, oil refining, and mining, acid battery, ceramic and glass manufacturing, metal plating and finishing, printing, tanning, and production of lead additives for gasoline.

The lead concentration in the runoff wastewaters are inspired by the toxic effects of lead on the water world and the threat of pollution of water resources nominated for human consumption. According to USEPA, the drinking water standard for lead is 0.015 mg/l [2]. Severe lead contaminating in human systems which causes harsh spoil to the red blood cells, nervous system and kidneys whereas contact can influence abortion neonatal death and sterility [3-6]. The separation of such a detrimental ingredient from the waste water systems became inescapable. The waste water treatment which containing heavy metal is a major challenging problem in the research [7]. The most common various techniques such as coagulation–flocculation, chemical precipitation, flotation, ion exchange, membrane filtration and Adsorption [8]. Adsorption is now recognized as an effective and economic method for heavy metal wastewater treatment [9]. Additionally, it can be found in the environment naturally in a abundant or produced as a by-product or a waste from an agriculture [10].

Many natural low-cost adsorbents using leaf powder of various trees such as bael tree [11], cypress, cinchona and pine [12], neem [13], rubber [14], Cinnamomum camphora [15], castor [16], Solanum melongena [17], and others were used for removing Pb(II) ions from aqueous solution. To make additional use of leaf powder of trees, the current investigation is an attempt to use jatropha leaves powder (JLP), as non-conventional low-cost adsorbent for the removal of heavy metal ions such as Pb(II) from aqueous solution [18-22]. In the Present study, Adsorption equilibrium is usually explained the equilibrium state between the amount of adsorbed metal ion onto the adsorbent surface ( $q_e$ ) and the concentration of metal ions in solution ( $C_e$ ). The general equations used to describe adsorption isotherm are Langmuir and Freundlich. The variable of those equations can describe both the adsorbent affinity and surface properties like JLP to the adsorbate such as metal ions. In this work, the linear forms of the above mentioned equations were used to describe the equilibrium data hence their applicability was evaluated by finding the correlation coefficients.

## **Removal of Arsenic from wastewater by using coal fly ash as adsorbent**

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### **Abstract**

To examine the utilization of coal 'fly ash' as adsorbent, batch studies were conducted to assess the removal of arsenic (As) from wastewater. The parameters such as Effect of the Contact time, Concentration, Adsorbent's dosage, pH on Percentage removal was studied. The 'Langmuir' isotherm was well fitted to the experimental data and Adsorption kinetic studies concludes that 'pseudo second order' is best fitted for the data. The coal fly ash concentration required to accomplish the most extreme heavy metal removal was observed to be 6 g/L with the removal effectiveness of 96% of arsenic (As). The results of the study exhibited that the fly ash could be utilized as one of the successful low-cost adsorbent material for removal of Arsenic (As) from the wastewater.

**Keywords:** Wastewater, Arsenic, Fly ash, Adsorption, Batch experiments.

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## **I. INTRODUCTION**

Developing nations like India, urban bodies have been helped ill-advised wastewater transfer system; because of the reason of substantial industrialization and ill-advised sewer water system. Though, a few chemicals based ventures released wastewater having dangerous components or substantial metals like Arsenic (As), Cadmium (Cd), Lead (Pb), Chromium (Cr), and so on which makes extreme harm to environment and human being [3]. Despite concentration of substantial metals in wastewater has turned into the significant issue to the living and non-living things in environment. In these respects, removal of heavy metals assumes the crucial part in definite transfer of wastewater into water bodies. Heavy metal particles are non-biodegradable; they can gather their entireties along the normal way of life. In this manner, it is basic important to expel or limit the heavy metal particles in wastewater efficiently. The treatment strategies for heavy metal removal from wastewater are chemical precipitation, chemical coagulation, ion exchange, electro chemical techniques, adsorption, zeolite, and membrane process. [4]. Present study is focussed on the adsorption to remove Arsenic (As) from the wastewater using coal fly ash as adsorbent.

## **II. MATERIALS & METHODS**

### **2.1 Coal Fly ash**

Coal fly ash remains (FA) is one which is produced in coal power stations (CPS) which is extremely stubborn to get wiped out from the biological system, causing natural risks, water and soil contamination and ruination of environmental cycles [9]. In India, out of 176.74 MT of FA produced by 151 TPSs, 107.77 MT is used for different purposes. From 1996-97 to 2015-16, there was an expansion of 6 overlap in the usage percentage of FA, i.e., from 10% to 60.97% ('Central Authority of Electricity', 2016). In this manner, keeping in mind the end goal to reduce hazards and hindrances caused by this harmful issue, a few kinds of research have been made to remove something great out of it. Around the world, just 25% of the aggregate FA produced is put into use. Reusing CFA rather than transfer is the best arrangement that deters natural worries, as well as makes new financial chances. Just less than 25% of the world's CFA is placed in different applications. For example: soil enhancement, Portland concrete and ceramic production, zeolites, filaments, fillers in polymers, adsorbents for air, and water and wastewater treatment. [10] Fig. 1 indicates distinctive usages of coal 'fly ash' in India.

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# KINETICS OF REACTIVE EXTRACTION OF LEVULINIC ACID USING TRI-N-OCTYLAMINE IN 1-HEXANOL

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**Abstract:** In the present study, kinetic data on reactive extraction of levulinic acid using tri-n-octylamine (TOA) in 1-hexanol was investigated at room temperature. From the kinetic studies, the specific rate of extraction is almost constant with an increase in the speed of agitation. Therefore, the speed of agitation does not affect the specific rate of extraction. The specific rate of extraction is relatively constant over the phase volume ratio indicating that the extraction of levulinic acid is occurring very near to the interface. Therefore, the reactive extraction of levulinic acid with TOA in 1-hexanol falls in Regime 3. The order of the reaction with respect to TOA concentration is found to be 1 by regression analysis and the rate constant is found to be  $7.262 \times 10^{-7} \text{ s}^{-1}$ . The order of the reaction with respect to initial levulinic acid is found to be 1 by regression analysis and the rate constant is found to be  $1.666 \times 10^{-6} \text{ s}^{-1}$ .

**Keywords:** Reactive extraction, Levulinic acid, 1-Hexanol, Tri-n-octylamine, Kinetics.

## 1. INTRODUCTION

Levulinic acid has received considerable attention due to its potential use as an important basic chemical. It has been identified by the US Department of Energy as one of the 12 top value-added biochemical's [1]. With the ever-increased demand for levulinic acid globally. Worldwide consumption of levulinic acid was estimated to be 3414 tons in 2019 and is expected to reach 4018 tons in 2021. Levulinic acid demand in growth rate is predicted to increase by 33.5% annually by 2021. However, its vital role demands an increase in the production volume in the industry and encroached the researchers to explore novel separation techniques to reduce the production cost of levulinic acid.

The production cost of levulinic acid mainly depends on the feedstock cost and the downstream processing cost. The downstream processing cost is usually around 40-50% of the production cost To minimize the downstream processing cost of carboxylic acids, recent research has been targeted on reactive extraction. It is a promising alternative for recovering carboxylic acids from the fermentation broth.

Reactive extraction is a separation technique used to enhance the extraction of solute from the aqueous phase to the organic phase [3]. The extractant molecule in the organic phase reacts with the solute molecule in the aqueous phase to form reaction complex, which will stabilize in organic phase due to hydrogen bonding and hydrophobic nature of complex [4]–[7]. Reactive extraction is a combination of the physical phenomena (diffusion and solubilization of the system components) and chemical phenomena (the reaction between the extractant and the solute) [2], [5], [7]–[9].

In the kinetic study for levulinic acid the following parameters are considered (i) volume ration of organic to aqueous phase, (ii) Speed of stirrer, (iii) aqueous phase composition and (iv) organic phase composition.

## Removal of Lead ( $Pb^{+2}$ ) From Waste Water by Using Coal Fly Ash as Adsorbent

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### ABSTRACT

Coal Fly Ash is produced by coal-fired electric and steam generating plants is the finely divided residue that results from the combustion of pulverized coal. It mainly comprised of oxides having high adsorption capacity. Coal fly ash is used as a low-cost adsorbent to remove heavy metals such as Lead, Chromium, Arsenic, Cadmium etc. from industrial wastewater. Wastewater containing Lead has adverse effects on environment like changing the microbiological balance of soil, soil fertility disorders, contamination of groundwater etc.

The main objective of the present work is to remove Lead from wastewater by using coal fly as adsorbent. The effect of contact time, pH, concentration and dosage of fly ash was studied. The kinetic studies and isotherms were also developed.

**KEYWORDS:** Coal fly ash, Lead, XRD analysis, Wastewater, Adsorption technique

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### I. INTRODUCTION

Wastewater is a mixture of several heavy metal ions. Among this lead is very dangerous metal in water which are obtained from industries like pharmaceutical, preparation of batteries, ceramics, amplifiers e.t.c. If people continuously exposed it causes a various effect like nervous system, kidneys, and reproductive system damages [1]. Lead content in water cannot be reduced easily to minor amount [2]. The maximum permissible level of lead in drinking water is about 15ppb. The applications of lead are in building construction materials, cable sheathing and ammunition. It is also obtained through agricultural discharges. It stunted the growth of the plant, decreases photosynthesis rate, chlorosis, blackening of the root system and it leads to disturbed mineral nutrition, water imbalance, and inhibition of enzyme activities [3]. Different methods such as sedimentation, coagulation, precipitation, filtration, adsorption, absorption, chlorination, ion exchange, chemical oxidation, osmosis, reverse osmosis and electrostatic precipitators are utilized to treat the contaminated water. Among all this adsorption technique is used because it is economically low and it is more efficient. Coal fly ash used as cheaper adsorbent to treat wastewater which is collected from thermal power plant. It mainly comprises of some oxides silicon oxide, ferrous oxide. Silicon oxide has a nature of high adsorption capacity of toxic metals from wastewater than other metals. The various parameters have been conducted to control the effectiveness of lead in wastewater by batch and kinetic, isotherms studies.

### II. MATERIAL AND METHODS:

#### 2.1 Preparation of the Adsorbent:

Coal fly ash is inexpensive adsorbent which is collected from Rayalaseema thermal power plant. It is used to remove the lead from wastewater. Coal fly ash is further classified into two classes they are Class C fly ash & Class F fly ash. These classifications are based on percentage of silica content. Class C has more amount of silica than Class F fly ash. The coal fly ash used in this project is Class C fly ash it has more silica content.

#### 2.2 Preparation of stock solution:

Lead nitrate is used to prepare synthetic solution. For this purpose, primary solution of lead was prepared about 100mg/l. By diluting the solution different concentration of solutions are prepared (2, 4, 6, 8 and 10) ppm. The concentration of the solutions is determined by using UV adsorption spectroscopy.

#### 2.3 Characterization of coal fly ash:

The figure shows, the XRD pattern obtained on fly ash material (collected from Rayalaseema thermal power plant, India). It mainly consists of SiO<sub>2</sub>, Fe<sub>2</sub>O<sub>3</sub>, Al<sub>2</sub>O<sub>3</sub>, CaO, MgO. XRD studies on our sample and



## Adsorptive Removal of Cobalt and Cadmium by Using Bagasse Pith

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**ABSTRACT-** The wastewater of industries flows which contain heavy metal ions are manufactured from different industries. The heavy metals ions are amongst the mainly dangerous of the elemental pollutants and are of particular concern as their increasing level in the environment represents a serious threat to human health, living resources and ecological systems. Adsorption is one of the most promising techniques for the removal of cobalt and cadmium from water and wastewaters. The sugarcane bagasse pith is developed from locally sugarcane industries to measure the suitability remediates cobalt and cadmium contaminated water. Bagasse pith was pre-treated with 0.1 N NaOH followed by 0.1 N H<sub>2</sub>SO<sub>4</sub> for the present work before its use. Batch adsorption experiments were carried out to study the adsorption of cobalt and cadmium on sugarcane bagasse pith sorbent taking into account the effect of initial concentration, contact time, adsorbent dosage, pH and temperature. The experimental maximum adsorption removal of bagasse pith was found to be 99.8% and 93% for cobalt and cadmium at the higher adsorbent dosage of 10 g/100ml.

The removal of cobalt ions decreased with increasing in pH, thus pH of 2, which gives maximum removal of cobalt, was shown as 97.4 %. The maximum removal of cadmium (81.5%) was observed at optimum pH 6 for bagasse pith. The adsorbent material which shows a good adsorption capacity for both the metal ions. The processes of adsorption on bagasse pith were evaluated by using Langmuir and Freundlich isotherm models. The values of correlation coefficient of Langmuir and Freundlich models for cobalt and cadmium were found to be 0.999 and 0.9977 respectively. The Langmuir adsorption model exhibited excellent indication of adsorption data than the Freundlich isotherm model.

**Keywords: Adsorption Isotherms, Bagasse Pith, Cobalt and Cadmium, Langmuir, Freundlich, Wastewater.**

### I. INTRODUCTION

The primary thing required in all the living organisms is the contact to clean water. Due to increase of population, not only the stress on the reserves raise but contaminations of these natural resources is increasing day by day. The different pollutants discharge from different industries is making the scenario poorer. A few water that has been unnatural by the use of public is called wastewater. Cobalt is a very contaminated element which affects the environment. It can be react with different particles or adsorb on particles of soil or water sediments. Soils which contain very less amounts of cobalt can grow plants that contain a deficiency of cobalt. While the regular level of cobalt in soils is 8 ppm, there are soils with as little as 0.1 ppm and others with as much as 70 ppm [4]. This metal ion which causes sterility, loss of hair, vomiting, bleeding, diarrhoea, coma and even death. Cadmium has been classified as a carcinogen of human and teratogen which affects the kidneys, lungs, liver and reproductive systems.

The heavy metal ions separated from inorganic waste matter can be achieved by using conventional treatment methods. Separations of heavy metal ions from industrial wastewaters can be consummate through different treatment methods which includes like unit operations as chemical precipitation, complexation, coagulation, activated carbon adsorption, ion exchange, solvent extraction, foam flotation, electro-deposition, membrane operation and adsorption methods [5].The majority of them engage high capital costs with returning operating cost, which are not appropriate for small-scale industries.

Adsorption process to be the most efficient process for the reason that it is very much efficient, low-priced, and simple and eco-friendly technique among all physicochemical processes. Adsorption on bagasse pith is widely used for elimination of cobalt and cadmium metal ions at trace levels. Bagasse is one of the fibrous waste gone after the sugarcane juice has been extracted for crystallize into sugar. The analysis which shows that bagasse production is equivalent to 20-30 percentage of full cane volume

# Thermodynamic Parameters of Adsorption of Nickel and Lead onto Cinnamomum Camphora Seeds Powder

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**Abstract:** Adsorption is one of the best technologies for the removal of nickel and lead water decontamination because it is an efficient, cheap and eco friendly treatment method. It is a good technique strong adequate to recognize water reuse requirement and high overflow standards in the industries. In the present work Cinnamomum Camphora seeds powder was studied as adsorbent for the removal of nickel and lead ions from aqueous solutions. The batch adsorption studies were carried out to examine the adsorption of nickel and lead on Cinnamomum Camphora seeds powder for the effect of initial concentration, contact time, adsorbent dosage, pH, temperature and also studied thermodynamic parameters. The maximum adsorption removal of Cinnamomum Camphora seeds powder was found to be 90 % and 91% for lead and nickel at the initial concentration of 50 mg/L. For the effect of temperature, the percentage removal of lead and nickel was noticed as 92% and 96% at the temperature of 62°C. The removal of nickel ions decreased with increasing in pH, thus pH of 10, which gives maximum percentage removal of nickel, is 90% and for lead is 89% at the optimum pH of 6. The adsorbent dosage of Cinnamomum camphora seeds powder increases with increasing the percentage removal of lead and nickel and it is found to be 88 % and 85 %. The correlation coefficient of Langmuir model for lead and nickel were found to be 0.986 and 0.9936 and the correlation coefficient of Freundlich model for lead and nickel were found to be 0.9905 and 0.9647 respectively. The Langmuir adsorption model which exhibited outstanding indication of adsorption data than the Freundlich adsorption model for Cinnamomum Camphora seeds powder in the nickel. The plot of  $\log q_e/c_e$  versus  $1/T$  was obtained with R-squared value 0.988 and 0.985 for nickel and lead. The slope & the intercept which gives the value  $\Delta S^\circ$  of  $\Delta H^\circ$  and  $\Delta S^\circ$ , respectively. The decrease in  $\Delta G^\circ$  with the increase in temperature which shows good adsorption at high temperatures. The positive value for change in enthalpy is due to endothermic nature of adsorption of cadmium

**Keywords:** Thermodynamic Parameters, Cinnamomum Camphora Seeds Powder, Lead and Nickel, Langmuir and Freundlich Isotherm Models, Wastewater

## 1. Introduction

The most important thing required in all the existing organisms is the contact to clean water. Due to increase of population, not only the stress on the reserves raise but contaminations of these natural resources is increasing day by day. Nickel is an element which occurs in the environment only at extremely low down levels [1]. The nickel metal ion content in soil the can be as small as 0.2 ppm or as elevated as 450 ppm in few clay and loamy soils. This nickel metal ion which causes serious health troubles such as damage to lungs, kidneys, gastrointestinal distress, e.g., nausea, vomiting, diarrhea, pulmonary fibrosis and skin dermatitis [1]. Lead is a growing toxicant which can affects the multiple body systems and is mostly injurious to young children.

This metal ion also used in several other products such as paints, pigments, stained glass, lead crystal glassware, ceramic glazes, jewellery, toys and in few cosmetics and traditional medicines [2]. At elevated levels of introduction, lead will attacks the brain and central nervous system which can causes coma, convulsions, death, Lung and liver damage; loss of appetite. The permissible level of lead is 0.15 mg/L. The heavy metal ions separated from inorganic waste matter can be achieved by using conventional treatment methods [3]. Separations of heavy metal ions from industrial wastewaters can be consummate through different treatment methods which includes like unit operations as

chemical precipitation, complexation, coagulation, activated carbon adsorption, ion exchange, solvent extraction, foam flotation, electro-deposition and membrane operation methods [4].

Among these methods, adsorption has been accepted as a successful and cost-effective mode to treat the wastewaters which containing poisonous metals. It gives flexibility in the design and operation, as the process of adsorption can be operated in batch operations (5). The adsorption is more cost-effectively favourable; when the adsorbent is reused and the adsorbate can be recovered, as it makes the process of adsorption is more suitable [6]. Cinnamomum Camphora seeds powder used as a low cost and eco-friendly adsorbent for the removal of lead and nickel from industrial wastewater [7].

## 2. Materials

Lead Nitrate, Nickel Nitrate Hexahydrate, Dimethyl glyoxime, Sodium Hydroxide, Sulphuric acid, distilled water and Cinnamomum Camphora seeds powder are purchased online from Nursery live in Kerala. All chemicals were used of analytical reagent grade only for the conduction of experiments

## Earnings and Profitability Analysis of Life Insurance Companies- Comparative Study of ICICI Prudential and SBI Life Insurance companies

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**[Abstract]** Insurance has been playing a vital role in advanced and emerging nations and has been recognized as a reliable tool for the mobilization of public savings. In India, the insurance sector has gone through various phases, such as deregulation, regulation, nationalization, privatization and globalization. Liberalization has paved the way for the entry of many private players that have the support of foreign partners. Since 2000, the Indian life insurance sector has been characterized by intense competition between the private and public sector players and within the private sector players. Against this backdrop, this study aims to examine the earnings and profitability performance of ICICI Life and SBI Life during the period 2010-11 to 2017-18 by employing indicators from the CAMEL framework. For further analysis of the data, a t-test is applied, and the results of the t-test reveal that there is a significant difference in the performance of selected insurers.

**[Keywords]** ICICI Life, SBI Life, CAMEL framework, t-test

Life Insurance is a contract under which, in consideration of sums of money (called premiums), the insurer agrees to pay a certain amount of money on the death of the insured or upon the expiration of a certain fixed period, whichever is earlier. Here, an insurer is the one who indemnifies the loss suffered by the insured and the insured/assured is the one who gets protection against the loss by paying the premium.

### **Brief History and Present Condition of Life Insurance in India**

Life insurance in its modern form came to India from England in the year 1818. The first life insurance company on Indian soil was the Oriental Life Insurance Company started by Europeans in Calcutta. Later, in 1870, the Bombay Mutual Life Assurance Society, the first Indian life insurance company, was started. Subsequently, a number of insurance companies came into existence. Prior to 1912, there was no legislation in India to regulate the insurance business and in 1912 the first Insurance Companies Act was passed with a view to regulating the insurance business. In 1938, the Insurance Act was passed to govern the life insurance and the non-life insurance business. The life insurance business in India was nationalized in 1956, and by the act of parliament, the Life Insurance Corporation of India (LIC) came into existence on September 1, 1956. From 1956 to 1999, the Life Insurance Corporation of India reigned over the Indian life insurance industry. The monopoly of LIC in the Indian life insurance sector came to an end with the opening up of doors to private participation. As a result, many private insurance companies jumped into the fray in the form of joint ventures with globally recognized foreign players as their partners.

The Indian life insurance industry expanded tremendously from the year 2000 onwards in terms of premium income, number of offices, number of agents, new business products, and so on; as of now, the Indian life insurance business is shared by twenty-three private life insurers besides the sole public insurer, LIC of India. For the purpose of the present study, two private life insurance companies, which are largest gross premium earners as on March 3, 2018, were selected. ICICI Prudential Life with Rs.27068.77 crore and SBI life with Rs.25354.19 crore of gross premiums stood in first and second places, respectively;

# A Backhaul and Access Game based Adaptive Power Allocation for MIMO-Radar

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**Abstract**—Multiple Input Multiple Output (MIMO) radar is enormously used in communication systems due to its target detection capacity, high resolution, and better target detection estimation. However, the restricted power of radar affects the throughput of the MIMO radar. Therefore, an optimal power allocation is required to obtain reliable data communication between the MIMO radars. In this article, the backhaul and access game based power allocation is proposed to assign the appropriate power between the clusters of MIMO radar. Here, the MIMO radar is classified into primary and secondary clusters by using the Naïve Bayes classifier. The angle of arrival is considered to enable the respective radar of the cluster instead of enabling all radars in the cluster. The performances of the backhaul and access game based power allocation are analyzed in terms of power density factor and throughput (i.e., capacity) and it is evaluated by using the existing method called generalized Nash game theory. The power consumption of the proposed method for cluster 1 is 0.0456, it is less when compared to the generalized nash game theory.

**Keywords**—Access Game, Angle of Arrival, Backhaul Game, Multiple Input Multiple Output Radar, Power Allocation, Target Detection.

## I. INTRODUCTION

MIMO radar is widely used due to its waveform diversity and its target detection capacity under Radar Cross Section (RCS) fluctuations. The MIMO radar broadcasts multiple independent waveforms from multiple antennas than the conventional phased-array radar. Here, the high dimensional data structure is used to describe the MIMO radar because of its numerous transmit and receive signals [1] [2]. The radar system is used to provide different features, e.g. a collision warning system that provides an alert message to the driver while parking the vehicle on the road [3]. MIMO radar is generally divided into 2 types such as a collocated and distributed antenna. The MIMO radar with collocated antenna improves parameter identifiability, estimation of target parameter and flexibility in the design of transmit beam pattern by using the huge degree of freedom and waveform diversity [4]. Next, the MIMO radar with broadly separated (i.e., distributed) antennas supports the velocity evaluation and precise target location as well as uses the spatial diversity by obtaining the data from different views of RCS of radar [5] [6]. Moreover, the diversity gain is exploited and higher resolution is obtained based on the precession of various targets in the MIMO radar systems [7].

Due to the resilient tracking ability and high probability of detection, the MIMO radar system is used in military and civilian applications [8]. The conventional MIMO radar generally produces the orthogonal waveforms from different antennas for generating the omnidirectional pattern [9]. However, the MIMO radar is required to concentrate the

transmitted waveform' energy in one or numerous predefined angle sections. The ability of the radar system is improved by using the cooperation of optimal illumination from the MIMO radar waveform [10]. In radar resource optimization, the power allocation is considered as a key constraint due to the restricted transmits power. Hence the power allocation is used to allocate enough power to the antenna and to minimize the harmful effects on the MIMO radar. Besides, the radar system performance and efficiency are affected due to the intraradar, intruder and clutter interference [11]. Therefore, an effective power allocation method is required to be developed to improve the efficiency of MIMO radar system. The major contributions of this research paper are specified as follows:

- The Backhaul and Access Game theory-based Power Allocation (BAG-PA) is proposed to provide an essential transmission power to the desired radar of the clusters. Here, clustering over the MIMO radar is achieved by using the Naïve Bayes classifier.
- In this MIMO radar, the angle of arrival is used to enable the respective radar of the cluster during the power allocation.
- This MIMO radar system is analyzed for a different number of transmitter and receiver variations such as  $1 \times 1, 2 \times 2, 3 \times 2, 2 \times 3$  and  $4 \times 4$ .

The overall organization of the paper is given as follows: The literature survey about the resource allocation in MIMO radar is given in the Section 2. The problem statement and solution for this research paper are specified in Section 3. Section 4 describes the backhaul and access game theory-based power allocation in the MIMO radar network. The results and discussion of the BAG-PA method are shown in Section 5. Finally, the conclusion is given in section 6.

## II. LITERATURE SURVEY

Lu et al. [9] presented the Joint Scheduling and Power Allocation (JSPA) scheme to accomplish the multiple targets tracking in collocated MIMO (C-MIMO) radar network. The efficiency of the JSPA scheme was enhanced by considering the deviation variables. Moreover, the JSPA has automatically adjusted the resources based on the performance remand as well as defines the number of targets required to be identified during the lack of resources. The target with less priority was not considered when there is a lack of resources in the MIMO radar network.

Yi et al. [10] developed the Joint Beam and Power Scheduling (JBPS) for Multi-Target Tracking (MTT) in the netted C-MIMO. An unwanted information correlation between the radar nodes was addressed by using the covariance intersection fusion. The performance of global



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# Novel deep learning convolution technique for recognition of Alzheimer's disease

Pemmu. Raghavaiah<sup>a</sup> ✉, S. Varadarajan<sup>b</sup>

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## Highlights

- Novel Deep Learning Convolution technique for detection of Alzheimer's Disease.
- AD detection using DNN with MRI and Fmri.
- The accomplished exactness rates for both MRI and fMRI modalities as per cutting edge design.

## Abstract

To separate examples from neuroimaging information, different measurable strategies and AI calculations have been investigated for the analysis of Alzheimer's sickness among more established grown-ups in both clinical and examination applications; in any case, recognizing Alzheimer's and solid cerebrum information has been trying in more seasoned grown-ups (age greater than 70) because of exceptionally comparable examples of mind decay and picture forces. As of late, bleeding edge profound learning innovations have quickly ventured into various fields, including clinical picture investigation. This paper diagrams cutting edge DL-formed pipelines utilized to recognize Alzheimer's Magnetic resonance imagin

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FEEDBACK

# A Dual-Band Minkowski-Shaped MIMO Antenna to Reduce the Mutual Coupling

K. Vasu Babu and B. Anuradha



**Abstract** This paper describes the performance of minkowski patch antenna wherein the size of antenna is maintained at  $60 \text{ mm} \times 40 \text{ mm}$  with an overall area occupied by the antenna including substrate, ground and patch at  $2400 \text{ mm}^2$ . A neutralization line is inserted between the two small microstrip patches by maintaining a separation value of  $0.12 \lambda_0$  at the two edges of antenna. By using this type of technique, the electromagnetic interference between the antennas (mutual coupling) is strongly reduced at the resonant frequency of the proposed antenna with a value of  $63.08 \text{ dB}$  at  $3.376 \text{ GHz}$  and  $49.23 \text{ dB}$  at  $7.216 \text{ GHz}$ . The resonating frequency of the proposed design greatly improves the impedance bandwidth from  $2.77$  to  $4.0 \text{ GHz}$  is around  $1.23 \text{ GHz}$  and the resonate frequency from  $6.94$  to  $7.55 \text{ GHz}$  is around  $610 \text{ MHz}$ .

**Keywords** Minkowski patch antenna • Neutralization line • Mutual coupling • Impedance bandwidth

## 1 Introduction

In the present communication technology antenna plays an important role in application areas like WiMAX, WLAN, satellite, and radar applications. By using the technique of electric and magnetic fields to reduce the isolation with an overall size of  $70 \text{ mm} \times 60 \text{ mm}$  and separation between the two edges  $0.45 \lambda_0$  as proposed in [1]. A loop antenna is used in order to reduce the isolation with an overall size is  $2500 \text{ mm}^2$  operating at  $2.4$ ,  $5.2$ , and  $5.8 \text{ GHz}$  which reduces the mutual coupling around  $35.7 \text{ dB}$  [2]. A coradiator dual-polarization MIMO system in [3] produced  $S_{12}$  of  $28 \text{ dB}$ . The frequency operated from  $3.1$  to  $10.6 \text{ GHz}$  is used in the applications area of handheld devices, robots and PDA's with spacing between the elements is  $0.35 \lambda_0$  with overall

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# Comparative Study on SVD, DCT and Fuzzy Logic of NOAA Satellite Data to Detect Convective Clouds

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**Abstract.** Information available in the Infrared and visible NOAA (National Oceanic Atmosphere Administration) satellite imagery is in the form of brightness temperature and albedo. Three Techniques are constructed to retrieve the convective cloud portion using Singular Value Decomposition (SVD), 2D-DCT (Discrete Cosine Transform) and fuzzy logic methods provided within MATLAB<sup>®</sup>, and compared the accuracy of these methods. The results delineates that there is tradeoff between accuracy of effective cloud amount and execution time. Though the fuzzy logic method takes the time to train the data but gives the accurate detection and classification of clouds

**Keywords:** SVD · 2D-DCT · Fuzzy logic · NOAA data

## 1 Introduction

Now a day's analysis of weather condition is quite simple due to the fact that the huge data of satellite imageries are generated at receiving stations. Reliable Interpretation of cloud detection and classification has been needed with advanced modeling. Therefore, processing of satellite imagery for cloud classification is to inference the cloud physical properties for climatological applications like rain estimation and cyclone prediction.

Cloud types can be segregated from earth surface based on height they exist or develop their vertical profile. The cumuliform clouds are vertically strong enough, whereas stratus cloud appears horizontally. Cirrostratus, cirrocumulus comes under high altitude clouds, altostratus and altocumulus are found in the middle altitude and one can find cumulus in the low-altitude. Cumulonimbus is spread from low to high altitude.

Generally clouds are determined by a lower temperature values and higher reflectance values than remaining earth surface. So simplest way of detection of clouds in visible and infrared window are threshold approach [1, 10].

Although NOAA infrared and visible images are more acquainted with cloud data, but cloud properties varied with different atmosphere conditions and geographical locations. Earlier, there are many basic approaches to detect the clouds from satellite data which are threshold method, spectral ratio, brightness temperature difference (BTD). BTD is a best method for identifying optical thick clouds from optically thin cirrus clouds. Optically thick cumulus clouds have smaller BTD than thin cirrus clouds [2, 11].

# Wearable Electronic Gloves in Two-Way Communication to Convert Signs into Speech



S. Swarnalatha, Anusha Manubrolu, and Pooja Dande

**Abstract** Usual tasks such as, communicating messages and expressing feelings/thoughts, are easy for an average person with all functional organs. However, for differently abled persons day-to-day conversations are challenging. So they prefer writing down messages or making signs to communicate. The major drawback of signs is that, they can only be understood by those who are aware of the sign language. In this project, a two way communication system is introduced to convert signs to audio output using electronic gloves and speech to text using a speech-to-text converting application. Flex sensors are used to capture signs by the moments of fingers and their output is given as input to microcontroller and microcontroller's output to speaker. Output from software which converts speech into text is given as input to microcontroller with the help of Bluetooth and LCD is used to display text from speech-to-text converter.

**Keywords** Signs · Flex sensors · Speech-to-text converter · Bluetooth

## 1 Introduction

In world's population 5% of people has hearing disability and for the others who engage with them communication is not easy. Listening and speech disability in people causes a decrease in ratio of literate and employment. Signs can be used to communicate which uses gestures and postures to convey a message.

There are different sign languages in different countries and regions. Like spoken languages, sign languages also differ from each other based on regions. Hand gestures

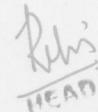
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# Real Time Recognition of Rashdriving and Alcohol Detection to Avoid Accidents and Drunken Driving



S. Swarnalatha, T. Srilakshmi, and K. Thilak Kumar

**Abstract** In Today's life most number of accidents are occurring because of rash driving and driving the vehicle by consuming vehicle. These are the two important reasons for occurring accidents today and may also be in future generations. So we have to take some important decisions to prevent the accidents happening with this two reasons. Now a days as technology got improved more and more we have different systems available to detect the alcohol content in drivers breath and detection of the vehicle speed which exceeds normal speed limit that pose danger to driver. More number of accidents is occurring and is increasing day by day and among these accidents more than 50% are occurring due to alcohol consumption and 50% is occurring due to rash driving. So we have to take immediate action to prevent accidents due to alcohol consumption and rash driving. To overcome all these, this paper provides a smart system that detects the drunk and driving as well as over speeding on roads using vehicular networks tech. The main objective is to stop the drunken person by traffic personnel as early as possible and save lives before the accident even happens.

**Keywords** Embedded · Drunk and drive · Rash driving · MEMS sensor · MQ3Sensor · LCD

## 1 Introduction

At present vehicle transport system takes a major role for going from one place to another place. But accidents are occurring more and more in today's life. So to

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# Design and performance of four port MIMO antenna for IOT applications

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## Abstract

In this paper, a four port MIMO antenna of compact split ring resonator (SRR) type with high degree of isolation among four ports on the antenna has been proposed for MIMO multiband applications. It is Tribands which operate at frequencies 1.44 GHz (−11 dB), 2.3GHz(−10 dB) and 4.2 GHz (−245 dB) respectively. This proposed MIMO antenna is designed with meander line for better gain and Split Ring Resonator (SRR) in the form of ring for high isolation between the antenna elements. A loaded stub is used to achieve the resonant frequency. The proposed MIMO antenna was simulated with IE3D EM software by Mentor graphics and the features such as impedance view, lower return loss, gain, radiation pattern and VSWR, etc are measured. The proposed antenna has better gain and provides higher isolation between multiple antenna elements.

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**Keywords:** Meander line; MIMO; SRR

## 1. Introduction (10p)

Multiple Input Multiple Output (MIMO) antennas are widely preferred for current radio applications because of their large channel capacities and higher data rates [1]. Meander line antenna is used to achieve resonance at lower bands. It also improves the return loss characteristics and provides high isolation between ports in the MIMO system. Meander line is loaded with two L shaped stubs fed by microstrip [2,3]. Split ring resonator (SRR) which is used on the antenna produces high isolation.

The recent research on MIMO antennas assures the substantial contribution in the field of Internet of Things (IOT) and medical applications [1]. As these patch antennas are compact and Low profile, they can be easily implantable and can operate in the range of L-band (1–2 GHz), ISM band (2.45 GHz) and C-Band [2]. These are just few examples of electromagnetic field and radio frequency applications. Also, these patch antennas play an important role in the field of Telecommunication applications [3–5]. These MIMO antennas ease and improve the communication performance between source and destination even when they are in remote area even

in the absence of user. The feeding method used is coaxial feeding, and this has led to high frequency response [6–8]. Here, the proposed model shows high accuracy with low back radiation. The proposed model was analyzed with the use of Vector Network Analyzer and chamber measurement.

The proposed model is constructed by using Multi Input Multi Output feed, as a result, better frequency response is obtained and antenna's back radiation is also condensed. The entire volume of the proposed antenna is extremely small, that is,  $10 \times 10$  mm with the thickness of 1 mm. Subsequently, the bow-tie antenna of hexagon shape has been modeled and examined with IE3D and VNA with the corresponding electrical conductivity, mass density, relative dielectric permittivity, and the other antenna parameters are measured [9,10].

In this work, a novel four port MIMO antenna is designed for medical devices as a medium for IOT applications which work attribute frequencies. Meander line technique is used to decrease the radiation loss and to make the fabrication simpler. Unlike traditional antennas, MIMO antennas are tiny antennas and are used widely in general wireless applications like mobile phones [11].

## 2. MIMO antenna geometry

The proposed antenna is printed on top of FR4 substrate. This antenna is having  $\epsilon_r$  of 4.4 and  $\tan \delta$  is of 0.02. Another substrate with  $44 \times 44$  mm<sup>2</sup> is used at the back side of antenna

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## Chapter 21

# Significance of Internet of Things (IoT) in Health Care with Trending Smart Application



V. V. Satyanarayana Tallapragada , I. Kullayamma, G. V. Pradeep Kumar, and M. Venkatanaresh

**Abstract** Advancement in the healthcare industry is growing quickly and is quite difficult to identify the breakout that may be the next game changer. The innovations and technological advancements in the Internet of things (IoT) will shape the future of the healthcare industry. This also enables a centralized network of interconnected devices to be created that can produce and share information within a single system. The main features and highlights of IoT-enabled healthcare industry are reduced errors, decreased costs, better patient experience, improved disease management, and home care. This paper presents the current trends in IoT-enabled smart healthcare applications such as remote patient monitoring systems, smart hospitals, robotics and healthcare automation, tracking of healthcare assets, and smart implantable devices, challenges in IoT-enabled health care such as interoperability, big data analysis, connectivity security, and privacy. Moreover, recommendations are made toward future directions to overcome the challenges in establishing full-fledged smart devices in the healthcare industry.

### 21.1 Introduction

Many facets of our everyday lives have been impacted by the Internet of things (IoT). Twenty-five billion items are going to be connected to the Internet in the upcoming days. The healthcare system today has also recognized the advantages of using IoT to enhance healthcare quality, turning conventional into smart health care [1]. Diagnosis and health monitoring play a significant role in the healthcare field. Owing to time constraints, people do not visit hospitals which may lead to

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## Design and Optimization of Double Balanced Gilbert Cell Mixer in 130 nm CMOS Process



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### ABSTRACT

An improved design procedure for double balanced Gilbert cell mixer is proposed for specific gain and power requirements at various license exempted frequency ranges for a variety of wireless equipment in India. The down conversion mixer design is aimed to carry out in 130 nm CMOS process. At 2.5 mW d.c power, a conversion gain of over 10 dB and a noise figure under 10 dB is intended at minimum overdrives for transconductance and switching stages of the mixer. Several optimization techniques for enhancement of gain, linearity and noise performances of the designed mixer are presented. An improvement in linearity about 10 dBm is targeted for 1-dB gain compression as well as third order intercept points introducing a unique criterion to integrate and exhaustively explore the enhancement techniques while preserving the gain as well as noise performance of the mixer.

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### 1. Introduction

Wireless communication paved ever increasing demand for ubiquitous radio communication aids especially at the consumer level. It's existence is universal, for instance businesses, industries, education, healthcare, defence sectors, etc. In order to fulfil power requirements, production cost and volume, a best yield process is sought after. VLSI at nanometer technology processes is very much proven and hence it is an ever likely choice. Bipolar technology based widely used frequency mixers often found earlier in consumer communication equipments is obsolete now. They are migrated to the updated and highly integrated chip based transceiver architectures.

Frequency mixer plays a pivotal role as frequency translator (heterodyner) and does multiplication of input signals to produce sum and difference frequencies (up and down conversion). It is a non-linear circuit, one of the most significant blocks in the front end of an RF receiver. Phase detection, modulation, frequency multiplication and product detection are a few applications of general mixers.

The signals  $Asin\omega_1t$  and  $Bsin\omega_2t$  usually take the form of RF and local oscillator (LO) inputs respectively while the output term consisting of sum frequency represents the up conversion where as the difference frequency term corresponds to the down conversion as depicted in Fig. 1.

Mixer classification can be done in many ways. A mixer which produces conversion gain (voltage or power ratio of output signal to that of the input) is usually referred as an active type while the one that produces conversion loss is passive. A mixer of unbalanced type has a disadvantage that the components of input signals appear at the output in addition to the main product signal where as in the case of a single balanced (differential) mixer either of the input signals get suppressed at the output. Double balanced mixer, whose inputs are fed as differential and their components do not appear at the output, offers input balancing and rejection at the output, inherent port isolation, better linearity (intercept points and gain compression) and spurs suppression. Due to its compact layout (MOSFETs), Gilbert cell mixer, relying on circuit symmetry became the most popular double balanced mixer.

Current switching is the key for operation of the mixer where the load resistors are offered direction changing current depending on the switch positions X and Y as shown in Fig. 2. (b) [1]. TCS/RFS represents the transconductance/RF stage, SS/LOS indicates the switching/LO stage while LS/IFS denotes load/IF stage and thus forms a stacked stage mixer configuration as shown in Fig. 2. (a). Rest of this section

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# Hybrid Data Transmission Approach for Unmanned Aerial Vehicles

Katikala Saitheja\* and R V S Satyanarayana\*\*

In the last few years, wireless communication technologies have undergone several advancements. In this context, Unmanned Aerial Vehicles (UAVs) play a vital role. It is a big challenge to get accurate data with minimum collision in UAVs. The features of Direct Sequence Spread Spectrum (DSSS) like multiple access and antijamming are useful to get accurate data with minimum collision. DSSS can transmit and control data. DSSS is a common technique for data transmission. As the number of users increases, DSSS may not be sufficient to transmit and control data. To overcome this problem, we propose a novel hybrid technique for data transmission. The paper introduces a hybrid approach with the combination of Time Division Multiple Access (TDMA) with DSSS. TDMA can divide the frame into equal time slots, so it is easy to access more number of users with minimum data collision. In DSSS, the user data is multiplied with Barker code for spreading and TDMA allocates time slots to each user to allow the same frequency channel by dividing the signal into time slots. The paper uses 13-bit Barker code with the spread spectrum, i.e., 13 users can allow at a time and Bit Error Rate (BER) is evaluated. The work can be carried out in MATLAB.

**Keywords:** Unmanned Aerial Vehicles (UAVs), Time Division Multiple Access (TDMA), Direct Sequence Spread Spectrum (DSSS), Bit Error Rate (BER)

## Introduction

There are many advancements in Unmanned Aerial Vehicles (UAVs). They can be used for navigation, commercial purposes, weather forecast, etc., (Imad et al., 2017; and Mohammad et al., 2019). They can solve many real-world problems. Due to their broad range of applications and flexibility, they can be used for both Line of Sight (LOS) and long distance communication. In wireless communication, the major problem is interference. In this paper, a novel hybrid technique is used with the combination of both Time Division Multiple Access (TDMA) and Direct Sequence Spread Spectrum (DSSS) to get communication with many users at a time.

DSSS is a standard technique which spreads information signal into wider bandwidth. With DSSS, interference can be reduced, and it provides accurate data

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# Design of high speed approximate multipliers with inexact compressor adder

Sudharani B.<sup>a</sup> , Sreenivasulu G.<sup>b</sup> 

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## Abstract

In most practical applications, approximate computation is being used. By using approximate computing, the system performance metrics like area, power and speed can be improved. In this paper an approximate circuit was proposed and developed by modifying the circuit architecture but not the circuit operation. An approximate multiplier using AND-OR logic approximation with Wallace tree reduction, and 3:2 inexact additive designs were proposed for partial product generation and addition. Four different kinds of Approximate Wallace Multiplier (AWM) were implemented using 3:2 compressor adder designs. The concept was discussed, considering an 8×8-bit multiplication as an example. The proposed multipliers achieve substantial improvements in terms of both area and delay. Compared to the conventional multipliers, the AWM1 achieves up to 35.577% reduction in area and 35.224% in delay. AWM2 has an area and delay reductions of up to 48.077% and 36.532% respectively. AWM3 has area savings of up to 48.077% and delay reductions of up to 46.633%. Finally, the AWM4 has area savings of up to 53.846% and delay reductions of up to 56.482%. © 2021 B. Sudharani and G. Sreenivasulu.

Author keywords

3:2 compressor adder design; AND-OR logic; Approximate circuits; Approximation; Wallace tree reduction

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# Land use and land cover change detection by using principal component analysis and morphological operations in remote sensing applications

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## Abstract

In remote sensing, the land use and land cover (LULC) play a vital role in analyzing Earth information for human development. These objects of change detections are helpful for finding the increased or decreased areas due to limitations of Landsat panchromatic images (gray scale) are not appearing identification of land object areas. To overcome this problem, multispectral bands are applied to individual channels by using principal component analysis (PCA) and morphological operations. Classification can then be performed for the identification of objects. This study focused on separating forests, land, and the vegetation area, including areas under crops and urban development. Regions of localized change in a multitemporal data set were enhanced using dimensional reduction and edge sharp techniques on a simple data set. This technique is feasible for extracting LULC information through remote sensing applications. The performance of the proposed method is superior to that of conventional methods, such as PCA, the normalized difference vegetation index (NDVI) method, and

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## A Review on Underwater Acoustic/Optical Modems: Design Issues, Recent Developments and Challenges in Underwater Communication

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### Abstract

Underwater communication (UWC) has become an important data transmission technology for commercial and military marine applications in the past couple of decades. Besides regular water, other applications include Remotely Operated Vehicles (ROV), Underwater Sensor Networks (UWSN), Autonomous Underwater Vehicles (AUV), underwater sports, coastal environmental research, oil-rig maintenance, linking submarines to land, etc. The main limitations of Underwater Acoustic Communication are frequency-dependent attenuation, short range, low bandwidth, and very low data rates for monitoring applications because of velocity of sound in water. To beat the restrictions of acoustic communication is to use optical communication. The wavelength lies within the visible region. Consistent with our survey on the properties of acoustic and optical communication, results have shown significant trade-offs between bandwidth and power consumption, SNR, BER and effective communication range. We propose a hybrid solution that mixes the uses of both acoustic and optical communication with the assistance of optical communication. This hybrid approach leads to high data rates, low latency, and an energy-efficient system. Thus, an underwater opto-acoustic modem plays an important role for long distance underwater communication. This paper provides a comprehensive study of the recent developments and challenges in various underwater modems and also addresses the gaps in development of underwater communication. This paper not only provides exhaustive research in underwater acoustic/optical communication using opto-acoustic modems but also aims to provide the information that would help in the growth of future underwater communication using fifth generation (5G) communication techniques.

### Keywords

Underwater Communication (UWC), Underwater Sensor Networks (UWSN), Opto-Acoustic Modem, Attenuation, Bandwidth, Data Rate.

### How To Cite This Article?

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3-4-5

# AN EFFECTIVE IMAGE DEBLURRING SCHEME USING CLUSTER BASED SPARSE REPRESENTATION

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## Abstract

Sparse based representation is being used extensively for image restoration. The dictionary learning through patch extraction is central to the sparse based schemes. In the process of dictionary learning, a large number of patches will be extracted from high quality images and dictionary will be formed. Hence, over-complete dictionaries will be built. To overcome the complexity associated with over-complete dictionaries many schemes were proposed. Of them, the adaptive sparse domain is the popular one. Many variations of adaptive sparse domain schemes were proposed. Selection of obvious patches is common to all. In all these schemes, individual patches will be considered as the basic entity and will be used. This is the reason for the complexity involved in sparse representation. In this paper, to avoid the complexity, the patches are grouped according to the similarity among the patches. In addition to reduce the complexity the proposed cluster based scheme considers the self-similarity of the patches involved. Hence better performance with less complexity is possible with the proposed schemes. In the process of testing, in addition to uniform blur and Gaussian blur, a combination of the two blurs is also considered.

**Keywords:** Cluster of patches, Image restoration, Mixed blur, Self-similarity, Sparse coding

## Introduction

The purpose of image restoration is to recover the original undistorted image from a degraded image. This mechanism is formulated as:

$$Y = Hx + n$$

Here, 'y' is the observed image, 'x' is the original image and 'n' is the additive noise. Depending on the nature of 'H' the degrading phenomenon will have different effect on the original image. In the context of image blurring, 'H' is an image blur operator [1][2]. Ill-posed characteristic of image deblurring necessitates the prior knowledge and the deblurring has been modelled as follows.

$$\arg \min_x \frac{1}{2} \|Hx - y\|_2^2 + \lambda \Psi(x) \quad (1)$$

Here  $\frac{1}{2} \|Hx - y\|_2^2$  is the  $l_2$  fidelity term,  $\Psi$  is the regularization term and  $\lambda$  is regularization parameter. Based on the above model, many optimization schemes were proposed in the



# A CAD system design to diagnose alzheimers disease from MRI brain images using optimal deep neural network

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## Abstract

Memory related issues in brain are mainly caused by Alzheimer disease (AD) which is the most common form of dementia. This disease must be diagnosed in its prodromal stage known as Mild Cognitive Impairment (MCI) also it needs an accurate detection and classification technique. In this paper, a computer-aided diagnosis (CAD) system is implemented on Magnetic resonance imaging (MRI) data from ADNI database. This disease highly affects the Hippocampus and cerebrum regions which are normally found in the grey matter region of brain. At first, MNI/ICBM atlas space of every three dimensional MRI images are constructed using normalization procedure, then grey matter region of brain is extracted. Subsequently, feature extraction is done by two dimensional Gabor filter in three scales and eight orientations. Then, the proposed optimal Deep Neural Network (DNN) classifier is used to classify the images as Cognitive normal (CN), Alzheimer disease (AD), and Mild Cognitive Impairment (MCI). Here, DNN classifier is optimized by selecting optimal weight parameter using Enhanced Squirrel Search Algorithm. The experimental results prove an efficiency of the proposed method using MR images. The proposed algorithm beats existing techniques in terms of accuracy, sensitivity, and specificity.

**Keywords** Alzheimer disease · Mild cognitive impairment · Gabor filter · Deep neural network · Enhanced squirrel search algorithm

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# Brain MRI Examination for Alzheimer's Disease Finding Utilizing CAD System Design based on Deep CNN

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## Abstract

Alzheimer's illness is a serious, reformist neurological cerebrum issue. Prior identification of Alzheimer's sickness can assist with appropriate action, forestall mind nerve harm. A few factual and AI replicas devour abused by analysts for Alzheimer's infection determination. Researchers have used a variety of mathematical and machine learning methods to diagnose Alzheimer's disease. In clinical studies, investigating magnetic resonance imaging (MRI) is a standard protocol for diagnosing Alzheimer's sickness. Location of Alzheimer's infection is demanding because of the closeness in Alzheimer's sickness MRI information and typical solid MRI information for more seasoned individuals. As of late, progressed profound learning strategies have effectively shown human-level execution in various fields including clinical picture investigation. We recommend a profound CNN organization of Alzheimer's illness conclusion employing mind MRI evidence investigation. Although vast majority of the existing approaches accomplish harmonizing grouping, our prototype can recognize numerous stages of Alzheimer's illness and gets predominant implementation aimed at commencement stage determination. Although most current methods use binary arrangement, our prototype can distinguish between various phases of Alzheimer's disease and achieves high-class results for premature period verdict.

Keywords: Alzheimer's disease; Brain Imaging; Neuroimaging; Deep CNN;

## 1. Introduction

The furthestmost communal method of dementia is Alzheimer's disease (AD). In developing republics, the pervasiveness of AD is assessed of about 5% after 65 years older and a whopping 30% after 85 years old. Round 0.64 billion people will be diagnosed with Alzheimer's disease by 2050, according to estimates [1]. AD causes cerebrum tissue to die, leading individuals to evade individuals memories, cerebral abilities, desire to go on with everyday activities. At first, Alzheimer's sickness influences the piece of cerebrum that regulates linguistic and reminiscence. Thus, AD affected person experience the ill effects of cognitive decline, disarray and trouble in talking, perusing or composing. They sometimes lose track of their lives and may not remember their regular activities even. They find it difficult to do simple tasks like brushing their hair or flossing their teeth. All of these things make Alzheimer's patients nervous, hostile, and prone to wandering away from home. In the end, AD destroys the portion of the mind that controls heart rate, breathing function, resulting in demise.

Mainly 3 significant phases in Alzheimer's sickness extremely gentle, gentle, modest. Identification of Alzheimer's infection has yet not exact till sufferer arrives at modest AD phase. On behalf of appropriate clinical evaluation of AD, a few possessions are required like substantial and neurobiological assessments, Mini Mental State Inspection (MMSI) and affected person's itemized history. As of late, doctors are utilizing mind MRI for Alzheimer's illness determination. Promotion recoils the limbic system and pallium of mind, extends the cavities [2]. Limbic system is dependable piece of mind for wordy and three-dimensional reminiscence. It likewise functions as a transfer structure amongst our physic and cerebrum. The decrease in limbic system origins cell misfortune then harm explicitly to neurotransmitters and nerve cell closes. So nerve cells can't impart any-more by means of neurotransmitters. Accordingly, mind districts identified with recollecting (momentary reminiscence), discerning, organizing, adjudication are influenced. Deteriorated synapses have muffled power inside MRI pictures [3]. Figure 1 displays certain mind MRI pictures of 4 distinctive AD arranges.

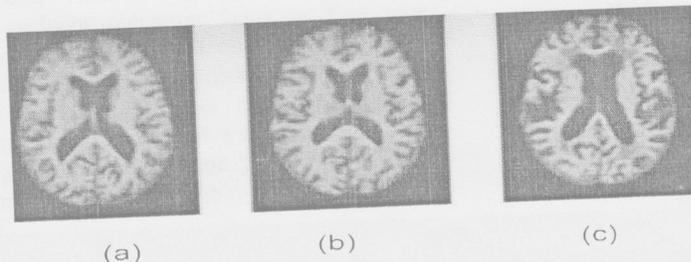


Fig. 1 Mind MRI pictures shows various AD phase: (a) Non-demented, (b) Extremely minor dementia, (c) Minor dementia

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## Survey on Power Optimization Techniques for Low Power VLSI Circuit in Active & Standby Mode of Operation

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### ABSTRACT

CMOS technology is the key element in the development of VLSI systems since it consumes less power. Power optimization has become an overridden concern in deep submicron CMOS technologies. Due to shrink in the size of device, reduction in power consumption and over all power management on the chip are the key challenges. For many designs power optimization is important in order to reduce package cost and to extend battery life. In power optimization leakage also plays a very important role because it has significant fraction in the total power dissipation of VLSI circuits. This paper aims to elaborate the developments and advancements in the area of power optimization of CMOS circuits in deep submicron region. This survey will be useful for the designer for selecting a suitable technique depending upon the requirement.

**KEYWORDS:** leakage power, low power, voltage scaling, power gating, transistor stacking, adiabatic logic.

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### I. INTRODUCTION

Energy efficiency is the critical feature of modern electronic systems, due to desirability of portable devices, demand for reliability and performance, to extend battery life, need to reduce package cost, to reduce Green cost etc. Advancements in scaling with reduced threshold and supply voltages lead to increased leakages in MOS transistors. Many studies presented that leakage power consumption is up to 40% of total power consumption in nanometre technology. To overcome the power dissipation problem many researchers have proposed different ideas from the device level to the architectural level. However, there is no universal way to avoid trade-offs between power, delay and area. Thus, designers are required to choose appropriate techniques that satisfy application and product needs. In VLSI circuits, to control the power consumption supply voltage plays an important role. Supply voltage scaling without scaling of threshold voltage degrades the performance of the device. The reduction of threshold voltage and supply voltages proportionally retains the performance. The threshold voltage reduction leads to five times higher leakage current. The requirements for power optimization continue to increase significantly and the motivations to optimise power differ from application to application. Power consumption has become primary design issue and needs suitable power management in the design of digital

circuits where switching and standby mode affects the performance of system. The design of a low power circuits mainly focuses on a problem occurred due to the performance, power dissipation and chip area.

This paper is organised as follows in section I we discussed about the sources of power dissipation in CMOS. In section II we mention the power optimization at different levels of abstraction broadly. In section III we focussed on different power optimization techniques. In section IV we presented the advanced power recovery technique and in section V we concluded about the selection of different techniques for different approaches.

### II. POWER DISSIPATION IN CMOS

#### Sources of Power Consumption

The main sources of power consumption, that affect CMOS circuits are dynamic power and standby power.

The following equations define the power within the device:

$$P_{total} = P_{dynamic} + P_{short} + P_{leakage}$$

$$P_{dynamic} = \alpha * C * V_{dd}^2 * f$$

$$P_{short} = \alpha(\beta/2) (V - 2V_{th})^3 * f * T_{rr} * P_{leakage} (I_{doff})$$

$$I_{subthreshold} * V_{dd}$$

$$\alpha = \text{Switching Activity, } C = \text{Total load}$$

$$\text{Capacitance, } V_{dd} = \text{Supply Voltage, } f = \text{Clock}$$

$$\text{Frequency, } \beta = \text{Gain Factor, } T_{rr} = \text{Rise/Fall Time}$$

# Skin Tone Recognition and Face Detection using Local Binary Pattern and Sparse Coding

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## Article Info

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## Abstract

Face detection deals with the identification and delineation of facial features from a collection of object features in the image. Due to increased intra class variance in facial images, low level features deficit adequate meaning. This will lead to unsatisfactory retrieval results. An advanced method for face detection is implemented in this paper to overcome these problems. This system utilizes human attributes containing semantic cues of facial images to improve detection efficiency by computing semantic code words. Initially face region is detected from the image of interest. Then Local Binary Pattern (LBP) is obtained from the face region detected. These LBP features are the input to the sparse coding along with the facial skin tone to optimize the retrieval process. Sparse coding is applied as an offline step for constructing sparse code words of all images in the data set. Inverted indexing is applied in the online stages for efficient face image detection. By combining these methods efficient face image detection can be achieved by utilizing the advantages of higher level attributes and lower level features.

## Article History

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**Keywords:** Face Detection, Skin Tone Recognition, Local Binary Pattern, Optimal Sparse Coding.

## I. INTRODUCTION

Face detection has numerous applications such as face tagging, face image clustering, crime investigation, automatic face annotation, etc. Facial attributes are important parameters in matching face images [1]. These are high level features in the images and very useful in retrieval tasks. Even though face images are partially damaged or occluded, facial attributes helps in retrieval process. Facial attributes are physical characteristics including colour, mouth shape, nose size and face similarity. These attributes seldom change over life

time and can refine the dataset to narrow down to face images of the candidate. To surmount such drawbacks of low level features, the proposed system combine facial colour attribute with the low level features. Facial attributes are seldom precisely exploited in existing face detection algorithms. Appropriate conflation of attributes and features is anticipated to produce improvement in recognition accuracy. Sparse coding provides promising results in various applications such as feature extraction, noise reduction, image compression and classification.



## Vectored Machine Learning Rearing Process: Early Detection of Leaf Diseases

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Over the past years, the plant leaf analyses through image processing have drawn a remarkable approach in assessing leaf disease severity through accurate and precise conclusions. We proposed, 'Scale Invariant Feature Transform' (SIFT) based Distinctive Scale Invariant Mapping Procedure (DSIMP) for training images. Random Separation Propagation (RSP) Procedure and Redundant multiclass Support Vector Machine (RM-SVM) are implemented to detect the rice and groundnut leaf diseases at its early stages. Discriminative Gray Level Co-occurrence Matrix (DGLCM) and K means clustering is used for recognition and quantification to give the best color analysis. Experiments with 1000 samples of rice and groundnut leaf images show promising performance.

**Keywords:** Clustering, Disease Severity, Plant leaf analyses, Quantification, Recognition

### Introduction

Plant Disease assessment is required for aiding in settlement of crop insurance claims. It is vital to choose the one that is most appropriate and will provide the most accurate and precise assessments to obtain the right level of disease intensity. This issue in hand received much immersion in the scientific and image processing applications with many researchers focusing on the automatic detection of plant diseases<sup>1-3</sup> combining the features and method to characterize the leaves from multi spectral images. Segmentations algorithms<sup>4</sup> are compared with the proposed models. Noises in the images are filtered using wiener filter by the process called denoising.<sup>5</sup> In order to improve the accuracy of the diagnosis, many researchers proposed different models such as extraction of Abnormalities using ROI segmentation<sup>6</sup>, Probabilistic neural network.<sup>7</sup> A Survey on image processing algorithms for leaf disease detection is presented in Barbedo, 2013.<sup>8</sup> Damaged leaf detection and Stress analysis in fruits are performed in Dubey *et al.*, 2013<sup>9</sup> and Fenyvesi *et al.*, 2013<sup>10</sup> using computer vision.

### Materials and Methods

The proposed rearing process is described in Fig. 1 in detail; the disease affected images are trained and tested proposed work. During training, the detection of feature key points and feature clusters are

identified to train the leaves through RM-SVM. During testing, the recognition using DGLCM and RSP is performed to extract the disease characteristics followed by quantification using k means clustering (KMC) algorithm to create the disease and non-disease clusters and classification process using fuzzy logic. RM-SVM is performed to regions of disease and non-disease areas. Images analyzed for diseases identification in this proposed work are: Afla Root, Alternaria leaf spot, Anthracnose disease, Bacterial Blight, Bacterial Leaf Streak, Bacterial sheath brown rot, Brown Spot of Rice, Bud Necrosis Virus, Collar rot or seedling blight or crown rot, Dry root rot or dry wilt, Early and Late leaf Spots, Flase Smut, Grassy stunt disease, Groundnut Rust, Groundnut Yellow Mold, Leaf Scald, Narrow Brown Spot, Peanut Clump, Root Rot, Ragged stunt virus, Ring Nematode, Root-knot nematodes, Root-Lesion Nematode, Sheath Blight, Sheath rot of Rice, Sheath blight of Rice, Stem rot or Sclerotium wilt, Tungro Virus, Yellow dwarf.

The detected disease area were analysed for feature patterns for performance metrics analysis. For proposed rearing process the images were taken from early stage to final stage and in training, the set of training vectors were represented as  $T^{m,n} = \{t_i, i = 1, 2, \dots, l\}$  and the set of output vectors are represented as  $O_I^{m,n} = \{o_i, i = 1, 2, \dots, l\}$  where  $l$  is training,  $O$  is output,  $I$  is input image.  $(m, n)$  are image pixels,  $i$  is the total number of input images and the  $(t_i)$  and  $(o_i)$  are represented in n-dimensional

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## EARLY DETECTION OF PLANT DISEASES USING A HYBRID ENSEMBLE FEATURE SELECTION WITH DEEP NEURAL NETWORK FOR MODERN AGRICULTURE

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### Abstract

Plants play a significant role in Indian agriculture as well as the economy of the country. However, the expected growth of plants are affected by diseases, which may cause complete damage to leaf, fruits, flower, and stem, which also leads to economic losses in agriculture. Therefore, plant disease detection is an essential task for improving crop quality and production process. Researchers developed popular techniques, namely Support Vector Machine (SVM) and Convolution Neural Network (CNN), to recognize plant diseases. However, the classification accuracy is diminished due to the high curse of dimensionality with redundant data. Feature selection techniques are developed to address these issues, but single feature selection techniques, namely ReliefF, F-score are unstable in nature, which affects the classification accuracy for various subsets of features. So, as to settle all these issues, a hybrid ensemble feature selection technique is introduced in this research study. The input images are pre-processed using a multi-scale retinex algorithm, where the segmentation of leaf images is carried out by using Kernel Fuzzy C Means (KFCM), and affected area segmentation is carried out by using the multilevel Otsu Thresholding technique. The features are extracted using a hybrid feature extraction technique, and optimal features are selected using the ensemble feature selection technique with Mutual Information (EFS-MI). Finally, Deep Neural Network (DNN) is developed to categorize the healthy and affected leaves of Plant Village Dataset (apple and potato) and collected dataset (rice and groundnut). The experimental results proved that the proposed DNN achieved 98.77% of accuracy while existing multi-class SVM (M-SVM) achieved 97.03% of accuracy on potato data.

**Key words:** Agriculture; Deep Neural Network; Hybrid Ensemble Feature Selection; Mutual Information; Plants; Redundant Data; Segmentation; Support Vector Machine

### Introduction

Agriculture is seen as an important sector in the Indian economy and an income source for many individuals. Agriculture is the basic need for human existence. In developing countries like India, the production of food products such as wheat, fruits, and vegetables need to be maximized to meet human needs. In addition, the quality of the products must meet specific quality standards to maintain the safety of human health and welfare 1,2. The importance of plants has continued to evolve in modern life, and many researchers from various scientific disciplines connected directly or indirectly with plants. Plants influence the climate and the ecosystem. They have many uses, such as agriculture, environment, energy, health, medicine, etc. 3. However, farmers also face water shortages, natural disasters, plant diseases, and many other challenges. In general, the leaves of the plant are essential components and symbolize the properties of the whole plant 4; it is the first source for identifying most plant diseases. The approach for early diagnosis of plant diseases is a significant

# Millimeter-Wave Microstrip Antenna Array for 5G Smartphone Applications

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**Abstract:** In this paper, a phased array antenna is designed for 5G smartphone applications. A Microstrip rectangular patch antenna is devised at millimeter-wave frequency bands. The antenna array operates at 28GHz. The antenna is printed on RTRogers 5880 substrate of thickness 0.787mm with 2.2 of dielectric constant. Ten elements of the microstrip patch antenna are designed with five power sources. The antenna is designed by using HFSS software, the simulated array antenna at 28GHz frequency shows good performance in terms of gain and S-parameters which makes it suitable for fifth-generation smartphone applications.

**Keywords:** Millimeter-wave, Microstrip patch antenna, 5G.

## I. INTRODUCTION

There has been a rapid development in wireless communication starting from analog(1G) to digital(2G,3G&4G) systems, as all these generations operate below 6GHz frequency which leads to a shortage of frequency band [3]. The Quick and wide development of wireless communication leads to higher data rates, to achieve these higher data rates higher frequencies are required. The millimeter-wave(mmw) communication technique uses unlicensed bandwidth beyond the traditional licensed wireless microwave bands and this millimeter wave(mmw) is recognized as a key technology in fifth-generation mobile communication systems [2]. Millimeter-wave (mmw) is a new and less used band where higher frequency wave carries much more data than lower frequency wave. In the future small cells are expected to provide several services with high data rates nearly Gigabit per second, for this a small cell should cover up to hundreds of meters and the line of sight propagation can be achieved using the directional antennas with a high gain property which reduces the intrusion with other communication systems and make possible the outdoor implementation for millimeter-wave communication [1].

Microstrip patch antenna has several advantages like low cost, lightweight, simple and conformable to planar and nonplanar surfaces [4]. Due to its planar configuration, it is easy to integrate into arrays and produces the best results for mobile radio and wireless communication [4, 10].

Microstrip antenna array operating at 28GHz is proposed in this paper which is suitable for 5G smartphone applications.

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# A Novel Approach Of Image Forgery Detection Using Lateral Chromatic Aberration

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**Abstract-** In image forgeries the image data is copied and changes done in image structure, inconsistencies in an imaging feature called lateral chromatic aberration (LCA). A new method for detecting forged image regions to identify localized LCA inconsistencies. This proposed method has a new statistical model that shows the inconsistency between global and local estimates of LCA. Using an efficient LCA estimation algorithm, we implement a block matching algorithm called diamond search. It efficiently measures the LCA in a localized regions and performs with different experiments, characterize the effect of up sampling factor and forgery size on forgery detection. Calculates the performance with standard systems to reduce estimation time.

**Keywords-** Lateral Chromatic Aberration, Forgery Detection, Efficient Block Matching.

## 1. INTRODUCTION

In Digital image forgery the identification of a forged image is essential for originality and to preserve truthfulness of the image. Image forgery detection had gain more attention and incredible investigation in various fields such as computer visualization, image processing, biomedical tools, immoral analysis, image forensics, etc. The, image forensic has found a way to identify these forgeries to avoid the illegal issues. Numerous techniques are utilized to recognize the forged images but still there is a need to be more focus on accuracy and time complexity[1].Forgery detection technique uses lateral chromatic aberration (LCA) as imaging feature to detect image regions that was copy-paste or copy-move type manipulations. Forgeries are detected by comparing the inconsistencies in local and global observations of LCA displacement vectors. This method classifies in two distributions;

- (1) LCA inconsistency in original image regions, has a random noise variable that is Gaussian, which identical distributed with near-zero mean and independent.
- (2) The distribution describes LCA in forged regions with related assumed properties and with a forgery related bias.

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# Mitigating the pilot contamination for uplink massive MIMO systems

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## Abstract:

Multi-cell Massive MIMO System utilizes a large number of antennas in a base station that serves a group of users at the same time, suffers from pilot contamination(PC) due to the reuse of pilots in adjacent cells that isn't able to avoid. In this paper, mitigating the pilot contamination based on soft pilot reuse scheme and weighted graph coloring scheme. All users in a cell are foremost divided into cell-center users and cell-edged users. By choosing the best pilots we tend to propose a suboptimal allocation algorithm by exploitation with optimum conditions and weighted graph color methodology is applied. Simulation results show that the proposed scheme alleviating the pilot contamination significantly compared with existing schemes.

*Keywords:* Pilot contamination, Massive MIMO, Soft pilot reuse, weighted graph coloring

## 1. INTRODUCTION:

Massive Multiple Input Multiple Output (MIMO) is an extension of MIMO. In Massive MIMO, a massive number of antenna groups together at the transmitter and receiver to maintain better throughput and spectral efficiency. The future generation of wireless data network meets the development of capacity and reliability, investigate the massive MIMO system that is badly suffering from the pilot contamination problem because of reusing the limited pilots in adjacent cells.

Much effort had been made to solve this challenging pilot contamination problem. The condition of pilot contamination and channel estimation (CE) performance in a massive MIMO system are analyzed<sup>2,3</sup>. The time-shifted pilot scheme was good resolution exploitation with asynchronous transmission among adjacent cells however it creates mutual interferences between pilot and data<sup>1</sup>. A data-aided minimum mean square error (MMSE) estimator and practical channel estimator addresses the performance under serious pilot contamination (PC) without previous knowledge<sup>5,6</sup>. These techniques haven't contemplated the pilot reuse scheme. A modified pilot reuse scheme to alleviate PC is necessary why because CE requires pilot resources but those resources are limited which are reused in multi-cell situations this leads to PC. Pilot sequences employed by every user ought to be orthogonal and assigned to single-cell and neighbor cell<sup>4</sup>. Pilot allocation schemes are proposed which are based on coloring graph and weighted coloring graph<sup>7,8</sup>. These methods are reducing the PC and also improve the uplink rate. Soft Pilot Reuse Scheme (SPRS) is proposed which separates the users into cell-centered users and cell edged users. The cell-centered users (having slight PC) using the same pilot resources and cell edged users (having serious PC) using cell-edge pilot subgroups in adjacent cells<sup>9</sup>.

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# ENERGY-EFFICIENT DATA COLLECTION IN WSN REGION USING 3D-UAV TRAJECTORY PATH AND VARIABLE RICAN-FACTOR

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## ABSTRACT

The adaptation of Sensor Nodes (SNs) in Wireless Communication is a prevailing research topic in recent years. By utilizing Unmanned Aerial Vehicle (UAV) in this Wireless Sensor Networks (WSNs) can serve as aerial base stations or mobile data collection. This way of implementation will enhance both the coverage and performance of communication networks in various scenarios and it is expected that the deployment of UAVs in WSNs will become predominant in the next decade. By considering a general fading channel model with variable Rican Factor for the SNs-UAV links, we jointly optimize the SNs wake-up schedule and three-dimensional (3D) UAV trajectory to attenuate the utmost energy consumption of all SNs, while ensuring that the specified amount of sensed data is collected reliably from each SN by the UAV. In this paper, we proposed an energy-efficient optimization framework for the UAV-SNs link compared to the existing model. The mathematical problem finding will give us a non-convex solution. Thus, we formulate our design as a mixed-integer non-convex optimization problem by applying the block coordinate descent (BCD) and successive convex optimization or approximation (SCA) techniques. Therefore, an energy-efficient iterative algorithm is proposed to seek out a sub-optimal solution.

**Index Terms:** Unmanned aerial vehicle, Trajectory design, Energy minimization, Data collection, Wireless sensor network, Line-of-Sight, Rican factor, Wake-up schedule.

## I. INTRODUCTION

Wireless sensor networks (WSNs) usually constitute an outsized number of low-cost sensor nodes (SNs) that are typically powered by limited energy sources like a battery, which are difficult to be recharged once depleted [1]. Therefore, energy-efficient sensing and communication techniques for SNs are crucial to prolong the lifetime of WSNs. There has been a growing interest recently in employing the unmanned aerial vehicle (UAV) as a mobile data collector for the terrain SNs in WSN [2]. By leveraging high mobility, UAV is capable of collecting data from the SNs energy-efficiently, since it can sequentially visit the SNs and collect data from them when only it moves sufficiently on the brink of each SN. Thus, the link distance from each active SN to the UAV is significantly reduced, which saves the transmission energy of all SNs. It has been proved that the short-distance line-of-sight (LoS) communication links between UAV and ground terminal SNs are often efficiently exploited in various UAV-enabled wireless networks for performance enhancement, by properly designing the UAV's trajectory [3]–[5]. For UAV-enabled WSNs, sleep and the wake-up mechanism is another useful technique to save lots of the energy consumption of SNs [6]. With such a mechanism, the SNs remain within the sleep state until they receive the awakening beacon signal with good strength from the nearby UAV, at which era they're going to awaken and begin sending data to the UAV and return to the sleep state after the transmission.

The major issues in designing UAV-enabled WSNs for sensed data collection are limited battery energy of SNs and high dynamic wireless channels between the SNs and therefore the mobile UAV, which susceptible to packet loss [7], especially for the sensible case when multi-path induced channel fading is present. The wake-up schedule of each SN should be appropriately designed so that it can achieve complete data transmission with minimum energy consumption. Thus, the trajectory of the UAV should be properly designed to make sure that every SN can transmit data with low outage probability when it's in its wake-up state. Thus, the matter of jointly designing the SNs wake-up schedule and the 3D-UAV's trajectory for energy-efficient data collection is new and challenging, which has not been rigorously studied to our greatest knowledge.

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# Multi Sensor IoT Network System for Safety Applications Based on LoRa Technology

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**Abstract** – Poor environmental conditions leads to severe health problems. Especially, for people working under hazardous environments. So it is necessary to develop a reliable systems for environmental monitoring. This paper presents a low-power sensor nodes for environmental monitoring Internet of things (IoT) applications, forming a wireless sensor network based on LoRa technology. Environmental data is monitored by the sensor node in real-time and then transmitted to remote cloud server via WSN. The data can be displayed to authorized users through a web-based application located in the cloud server and this will alert the user via a mobile application called “Blynk” when an emergency condition is detected.

**Keywords** –LoRa-based sensor node, safety applications, Sensors, Monitoring, Internet of things

## I. INTRODUCTION

Internet of things (IoT) is a new technology that is gaining attention from the vast research fields in the past few years [1]. This provides the connectivity of embedded objects like sensors and other devices with software technologies for the purpose of exchanging information over the internet.

Wearable sensor network field have become more ubiquitous now-a-days, carrying more sensors, due to advancements in miniaturization and manufacturing. Here the technology is at the point where these smart devices can embed multiple sensors and continuously monitor the environment [2]. This work presents the prototype of smart, low power, reliable system that can be used for environmental monitoring[10]. It is a customized node, where we can use multiple number of sensors based on our requirements.

Each sensor node consists of a sensing unit and a wireless module. The total sensor node is low power consuming 5.6μA. The collected data is transmitted to gateway via a long-range LoRa technology and it is delivered to authorized users through a web-based application located in the cloud server.

Sensor nodes are the key components in wireless sensor network as they collect the data from the environment for further usage. Researchers from multiple disciplines have presented different sensor systems for various applications. In [3] the authors presents a wearable wireless sensor network for indoor smart environmental monitoring in safety applications. Another wearable sensor is presented in [4], Which is designed for real-time monitoring of toxic environmental volatile organic compounds. Smart, low power wearable multi-sensor data acquisition system for environmental monitoring is presented in [5]. Seeger et al propose a middleware solution for the wearable sensor node system of WBAN. Which is based on the smartphone applications [6]. The remainder of the paper is organized as follows : section II describes the system architecture, section III describes experimental results of the sensor node. Lastly, the paper is concluded with a discussion of future improvements in section IV.

## II. SYSTEM ARCHITECTURE

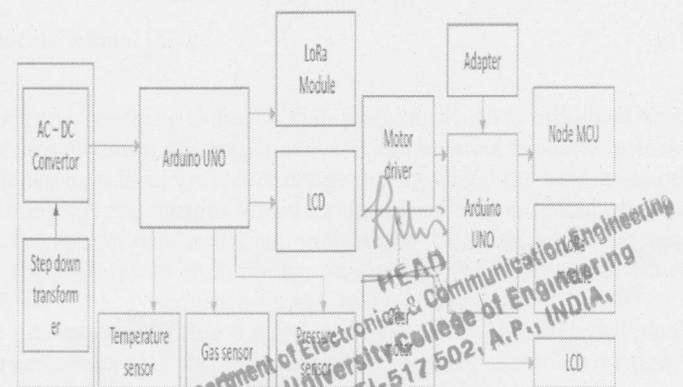


Fig.1 Multi sensor IoT network system architecture

# Automatic Detection of Exudates in Retinal Images using Saliency Map Method

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## Abstract:

Exudates are in the form of a fluid that has leaked out of blood vessels and closely resembles blood plasma. It is a major complication of causing blindness in Diabetic Retinopathy (DR) patients. The main objective of this study is to develop a novel method to finding the exudates with high accuracy and classify exactly what are mild and severe exudates based on color indication with complete and distinguished patient information in color retinal images by using a saliency map algorithm. The Proposed approach starts with a normalization of retinal image, contrast enhancement, noise removal, and the localization of Optical Disc (OD). Then, a segmentation method by using Saliency map to detect only exudates regions. Finally, classification using the support vector machine (SVM) is applied to detect what type of exudated retinal image based on color indication with patient information. Based on a comparison between the results and ground truth images, the proposed method obtained an accuracy for detecting exudates as 98.50%, 98.35% and 98.15% respectively.

**Keywords –** Retinal images, Exudates, Saliency map, Support vector machine (SVM), Optical Disc (OD).

## I. INTRODUCTION

Exudates are bright lipids leaked from a blood vessel. In retinal images, exudates exhibits as a chromatic localized regions with variable sizes, shapes and locations. [1]. Current strategies of exudates detection take longer time and to identify only exudates. However, identifying the small exudates remains inadequate. In doing therefore the patients won't receive proper treatment as early as possible. [2]. Several examples of the methods for exudates detection in retinal images are often found within the literature. Few investigation within the past have detected exudates using Fuzzy C-means clustering (FCM) and thresholding algorithms applied to detect the exudates. [3]. The abovementioned methods have certain limitations in detecting small exudates regions. Hence the proposed approach of exudates detection easily Identify the small and mild exudates with proper color indication. [4]. We Investigate a new method towards identifying the small, mild, severe exudates with proper color indication. The most contributions of the new methods are twofold:

- 1) The main objective of this propose method is develop a study for type of exudates detection with proper color indication and displaying the patient information in color retinal images by using Saliency map algorithm. This might benefit the retinopathy patients, as their treatment are getting to be more adequately and functionally. [5].
- 2) Finally, the support vector machine (SVM) algorithm is used to classify what kind of exudates based in exudated image with color indication. Figure (1) shows an example of exudates.



A) Original image

B) Exudated image

Figure 1: Normal and abnormal retinal image

## II. PROPOSED MODEL

The proposed method are constructed to solve the problem of exudates using Saliency map method, which is presented and evaluated on two different databases. The Saliency map is proposed for segmentation of retinal images. It can separate exudates lesions and background parts of the retinal image with great information. Saliency map is an grayscale image during which the brightness of an pixel is directly proportional to its saliency. It is used in medical imaging, and various visual models. Exudates in retinal images generally have a brighter intensity than background. Finally, Based on the types of exudates it will indicate a color using support vector machine (SVM). The representation of an retinal image in RGB color space allows to studying separately the various channels of the spectral response. The three colors are (red, green, blue) each of which has intensity value starting from 0 and 255.

The extended work to detect and recognise the exudates and their regions within the retinal images with high accuracy and that we created a framework to classify exactly what are mild and severe exudates with complete and distinguished patient information. We indicate a color supported the type of exudates presented within the retinal image.

# Route Allocation using Gain and Interference for 5G Self-Backhauled mmWave Network

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**Abstract** – The path selection and rate selection of multiple users from the single base station is tough task and it should follow many constraints. In the proposed method this path selection is based on the power, probability, gain and interference of the signal with other. Here, we followed a multi hop network with four flows and eight sub flows. This process provides a low delay. Though the mean arrival rate is high this method produces better efficiency when compared to state of art methods.

**Keywords** – Millimeter wave, Ultra dense small cell self backhaul, Multi hop scheduling, Macro base station (MBS) and Massive multi input multi output (MIMO).

## I. INTRODUCTION

Rapidly increasing on the demand of device technology which increases the utilization of frequency and bandwidth, so we will change into new technology that will provide number of users to serve the services to user and that new technology is called 5G. It has frequency range from 30 to 300 GHz range that will provide services to massive number of devices and will helpful for feature generation [1]. On the other hand fourth generation (4G) radio access network has poor cell edge user experience found by many researchers and industry scientist this will boost the upgrade of 5G networks [2].

In higher frequency band we must focus on improvement on spectral density and energy, to improvethiswe are using Massive Multi Input Multi

Output [MIMO]. A macro base station [MBS] is a part of MIMO which consists of massive number of antennas which provides wireless connectivity to small cells. To increase network capacity we use ultra dense small cell network, which leads to increase more than 100× or more. In massive MIMO here use full duplex small cells relays data which reduces deployment cost of small cells and provides MBS to users Equipment (UE) at the same frequency band. In case power consumption a recent study in massive MIMO [7] has less. The reception has done by directional transmission of direct consequence which was main issue in the millimeter wave transmission, to overcome this problem between transceivers use the procedure of beam searching [3], by this transmission has done by sequence of pilot transmission. Time required to find beam searching will takes more time which increases the transmission delay which further increases the latency, so latency is one of the main parameter in 5G technology. Low latency will provides better communication and also increase the speed of the communication. This paper will improves Gbps data rate, low latency and reliable communication between MBS and UE's.

## II. SYSTEM MODEL

For high frequencies which have very short waves lengths, short wavelengths are very sensitive to blockage and human body also acts absorber, so to transmission distance we use it requires large number of antennas higher transmitted power.

Here we use multihop transmission instead of



## Design of UWB MIMO Antenna to Reduce the Mutual Coupling Using Defected Ground Structure

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### Abstract

A novel compact monopole UWB antenna is described and analyzed using defect in ground plane (DGS). This MIMO design has an area of  $60 \times 35 \text{ mm}^2$  with total size of  $2100 \text{ mm}^2$  which maintained between the square type patches separation is  $0.05 \lambda_0$ . The current design achieved tri-band frequencies at 3.5, 4.8 and 9.0 GHz due to introducing arcs at the edges of square type patches. For the impedance bandwidth of the design covers an average peak gain of radiator is 5.04 dBi with a little-bit variations in the current design is  $\pm 1.20 \text{ dBi}$ . The measured Impedance Bandwidths of the MIMO design are 1000 MHz (3.0–4.0 GHz), 1300 MHz (4.3–5.6 GHz) and 1100 MHz (8.4–9.5 GHz) covered the frequency range from 2.0 to 10.0 GHz. These frequencies covered the applications of WLAN, bluetooth and ultra-wide band which maintained  $\text{VSWR} \leq 2$ . The proposed structure resembles a omnidirectional radiation patterns with narrow compact size at the resonant band of frequencies.

**Keywords** Impedance bandwidth · Peak gain · Ultra wide band antenna (UWB) · Group delay · Envelope correlation coefficient

### 1 Introduction

The demand for ultra-wideband antenna systems (UWB) requires present emerging wireless applications of communication system requires high data rate and channel capacity. The federal communication commission system (FCC) with unlicensed spectrum which is ranging from 3.1 to 10.6 GHz. In [1], packaging and design of UWB antenna operated from 2.83 to 20.83 GHz produced ECC and DG are less than 0.006 and greater than 9.88 dB. A compact size of  $18 \times 34 \text{ mm}^2$  UWB MIMO system operated from 2.93 to 20.0 GHz produced the MIMO parameters within the acceptable limit produced

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# Enhanced Video processing for denoising the darken videos

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## Abstract:

Nighttime low illumination video enhancement is highly desired for outdoor computer vision applications. However, few works have been studied towards this goal. In addition, the low illumination enhancement problem becomes very challenging when the depth information of a low illumination video is unknown. Night time video captured in low- or non-uniform illumination scene always suffers from the loss of visibility and contains various noise and objectionable artifact. When we enlarge the amplitude of the brightness, the noise and artifact will be amplified as well. Hence, we propose a nighttime video enhancement approach based on image decomposition. Nighttime videos are often obtained with low intensity, deficient contrast, and hidden colors. In addition, the video is converted into frames. Before enhancement operation denoising is performed by using guided filter. Using the results of the achieved experiments and comparisons, it became patent that the proposed algorithm can provide satisfactory outcomes, in which it provided visually pleasing results and the contrast algorithms in terms of counted accurateness and visual superiority.

## Keywords:

segmentation, denoising, guided filter, Feature Extraction, illumination.

## I Introduction:

Nighttime image captured in low- or non-uniform illumination scene always suffers from the loss of visibility and contains various noise and objectionable artifact. When we enlarge the amplitude of the brightness, the noise and artifact will be amplified as well. Hence, we propose a

nighttime image enhancement approach based on image decomposition. We decompose the input image into two components: Structure layer contains main information of the image, and texture layer contains details, noise, and artifacts. We implement an improved retinex image enhancement algorithm to enhance the structure layer. To remain details and suppress noise and artifact in the texture layer, we use mask-weighted least squares method. In the final, we fuse these two components to obtain the result. The experimental results demonstrate that the proposed approach can improve the perceptual **quality of nighttime images** and suppress noise and artifact without excessive reinforcement. Images captured under low-light conditions suffer from many degradations, such as low visibility, low contrast, and high-level noise. Although these degradations can be somewhat alleviated by professional devices and advanced photographic skills, the inherent cause of the noise is inevitable and cannot be addressed at the hardware level. Without sufficient amount of light, the output of camera sensors is often buried in the intrinsic noise in the system. Longer exposure time can effectively increase the signal-to-noise ratio (SNR) and generate a noise-free image, however it breeds new problems such as motion blur. Thus, low-light image enhancement technique at the software level is highly desired in consumer photography. Moreover, such technique can also benefit many computer vision algorithms (object detection, tracking, etc.) since their performance highly relies on the visibility of the target scene. However, this is not a

# REAL TIME RECOGNIZATION OF RASH DRIVING AND ALCOHOL DETECTION TO AVOID ACCIDENTS

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**Abstract:** Recent surveys states that, the increase in vehicles speed is one of the major constraints for the causes of road accidents. In this paper, we mainly focus on the systems implemented in order to avoid collisions. In this system avoidance of collision is achieved by designing an automatic barking system and automatic horn system. By our proposed solution the collisions due to rash driving and the driver's alcohol consumption state can be detected. These both can be achieved by monitoring the surrounding with the help of ultrasonic sensor and eye blink sensor. The rash driving is determined by the ultrasonic sensor and similarly the alcohol detection of the driver is determined by the MQ3 sensor, then it will atomically apply the brakes by controlling the DC motor. Then, the vehicles GPS coordinates will generate and SMS will be sent to the nearest police station, hospital and family members respectively. Mainly our proposed idea will help the driver when he pays less attention to the driving during night time.

**Keywords:** ES, DC Motor, MQ3, MEMS

## 1 INTRODUCTION

In the present scenario, the numbers of accidents happening in our surroundings are increasing day by day. This is becoming a great challenge [1-2] for the people living in the country. The day begins with the newspaper that which at least contain a couple of headlines about the road accidents. The deaths occur in our society are mostly about the road accidents. More than 1.51 million fatalities occurred in 2018. An increase of 3,500 deaths [3] occurred when compared to 2017. According to the latest accident report most of the accidents happen in the states like UP, Tamil Nadu, Maharashtra. The report declared [4] that around 2.4% has been increased every year. The count of the deaths occurred because of accidents is more than the number of soldiers died in the war fields. The accidents [5] that are happening in our country have many reasons such as less road quality maintenance, improper constructions of the bridges, overcrowding on the busy lanes and many other. Apart from these the under aged people according to the

# IoT Based Smart Pill Box Using Arduino Microcontroller

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**Abstract:** The main aim is to make a Smart medicine box for those users who regularly take medicines and the prescription of their medicine is very long as it is hard to remember to patients and also for their care giver. Also Old age patients suffer from problems of forget to take pills on proper time which causes certain health issues for patients having Permanent diseases like diabetes, blood pressure, breathing problem, heart problems, cancer diseases etc. We saw these problems in hospitals & people around us who have such kind of diseases and thus based on these two problems we made smart medicine box which solve these problems by Setting up time table of prescribed medicines through push buttons as given in prescription. Therefore at the time of taking medicine system generate Notification sound and display the Bright light in certain pill boxes. So, patient can know the specific number of box from which he has to take out medicines. All pill boxes are pre-loaded in the system which patient needs to take at given time. And our system has quality that it can sense if the patient had taken out pills from the box or not. Another advantage of our system includes of Sensing capability if the patient tries to postpone the time of taking medicine by suddenly opening and closing the medicine boxes to stop the sound. Compare to other devices available in market are capable to generate sound at one time and afterwards it stops. Thus, final result of our system provides fast curing of patient health by using our advantageous system. There can be a lot of individuals out there who need constant help – may it be our elderly people, family members, the ones who have special needs. These people apparently need the kind of care which most busy family members cannot provide. Some people may forget to take the medicines at the correct time and can forget the medicines which they have to take. So in order to help them with this liability we have developed this project. The people are provided a smart med box on which there will be a display which notifies the people about the medicine. Along with this we can alert them with an alarm and light indications. So that even if the person is sleeping or busy with some work the alarm helps in alerting him. to confirm that the person has taken that medicine or not we can put one button at the opening end of the pill box. so when the person tries to open the box the button is pressed and the alarm will be off only if the buzzer is pressed. by this data we can tell that the person has taken the medicine. It comes with one more feature that when the person is feeling uneasy or in case of some emergency he can notify the people by pressing the button on the device. There are different buttons, one is used to notify the doctor and the other one is used to notify family members about the emergency. And also we have another future is that to find the heart rate and temperature of the patient.

**Index Terms** – Arduino UNO, Pill box, Buzzer, Push Button, IoT, heart Rate sensor and Temperature Sensor etc...

## I. INTRODUCTION

Currently, worldwide aging and regularity of persistent diseases are flatterer a broad concern. Numerous countries are undergoing hospital restructuring by reducing number of hospital beds and escalating home healthcare, which is envisioned to perk up health care quality, has fascinated wide-ranging attention. In order to track the physical status of the elderly and, in the meanwhile, to keep them healthy, the proposed idea will be helpful. IOT expands the Internet into our everyday lives by wirelessly connecting various smart objects, and will bring significant hangs in the way we live and interact with smart devices. The new wave in the era of computing will be outside the sphere of the conventional desktop. Internet of Things (IOT) is a network where many of the objects that surround us will be networked in one form or another. By using this technology the health statistics of medication are observed. In this process of encryption the schedule data or doctor's prescription are send to pill box through mobile app. The LEDs are placed for indication and buzzer for alarm alerts and reset button is used to count for medicine in cloud platform. The existing techniques to the market for the reminder include a pill box. But this does not help in checking the medicine. This proposed idea is valuable solution to the medical noncompliance problem. The innovation scheme to help patient keep trail of their

medicine consumption through a series LED alarm indicator signal and audio alarm indicator signals.

**The main objectives of the project are:**

- Dispense of medicines from pill box at scheduled time.
- Medical alerts to care taker and retailer.
- Online report generation of medicine.
- Real-time health statistics monitoring of medicines.
- Configuration data is send through IoT.
- Easy to find temperature and Heart Rate of the patient.

## II. INTERNET OF THINGS

The Internet of Things (IOT) is an important topic in technology industry, policy, and engineering circles and has become headline news in both the specialty press and the popular media. This technology is embodied in a wide spectrum of networked products, systems, and sensors which take advantage of advancements in computing power, electronics miniaturization, and network interconnections to offer new capabilities previously possible. An abundance of conferences, reports, and news articles discuss and debate the prospective impact of the "IOT revolution"—from new market opportunities and business models to concerns about security, privacy, and technical interoperability.



# Arduino Based Automatic Smart Medicine Box using IoT

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**ABSTRACT:** The main aim is to make a Smart medicine box for those users who regularly take medicines and the prescription of their medicine is very long as it is hard to remember to patients and also for their care giver. Also Old age patients suffer from problems of forget to take pills on proper time which causes certain health issues for patients having Permanent diseases like diabetes, blood pressure, breathing problem, heart problems, cancer diseases etc. We saw these problems in hospitals & people around us who have such kind of diseases and thus based on these two problems we made smart medicine box which solve these problems by Setting up time table of prescribed medicines through push buttons as given in prescription. Therefore at the time of taking medicine system generate Notification sound and display the Bright light in certain pill boxes. So, patient can know the specific number of box from which he has to take out medicines. All pill boxes are pre-loaded in the system which patient needs to take at given time. And our system has quality that it can sense if the patient had taken out pills from the box or not. Another advantage of our system includes of Sensing capability if the patient tries to postpone the time of taking medicine by suddenly opening and closing the medicine boxes to stop the sound. Compare to other devices available in market are capable to generate sound at one time and afterwards it stops. Thus, final result of our system provides fast curing of patient health by using our advantageous system. There can be a lot of individuals out there who need constant help – may it be our elderly people, family members, the ones who have special needs. These people apparently need the kind of care which most busy family members cannot provide. Some people may forget to take the medicines at the correct time and can forget the medicines which they have to take. So in order to help them with this liability we have developed this project. The people are provided a smart med box on which there will be a display which notifies the people about the medicine. Along with this we can alert them with an alarm and light indications. So that even if the person is sleeping or busy with some work the alarm helps in alerting him. to confirm that the person has taken that medicine or not we can put one button at the opening end of the pill box. so when the person tries to open the box the button is pressed and the alarm will be off only if the buzzer is pressed. by this data we can tell that the person has taken the medicine. It comes with one more feature that when the person is feeling uneasy or in case of some emergency he can notify the people by pressing the button on the device. There are different buttons, one is used to notify the doctor and the other one is used to notify family members about the emergency. And also we have another future is that to find the heart rate and temperature of the patient.

**KEYWORDS:** Arduino UNO, Pill Box, Buzzer, Push Button, IoT, Heart Rate Sensor and Temperature Sensor Etc...

## I. INTRODUCTION

Currently, worldwide aging and regularity of persistent diseases are flatter a broad concern. The world countries are undergoing hospital restructuring by reducing number of hospital beds and escalating the quality of care. The elderly and, in the meanwhile, to keep them healthy, the proposed idea will be helpful. IOT expands the Internet into our everyday lives by wirelessly connecting various smart objects, and will bring significant changes in the way we live and interact with smart devices. The new wave in the era of computing will be outside the sphere of the conventional desktop. Internet of Things (IOT) is a network where many of the objects that surround us will be networked in one form or another. By using this technology the health statistics of medication are observed. In this process of encryption the schedule data or doctor's prescription are sent to pill box through mobile app. The LEDs are placed for indication and buzzer for alarm alerts and reset button is used to count for medicine in cloud platform. The existing techniques to the market for the reminder include a pill box. But this does not help in checking the medicine. This proposed idea is

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# Hand Written Character Recognition Using CNN and PSO Techniques

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**ABSTRACT:** Hand Written Character Recognition is one of the major areas of research topics in Machine Learning. It is because there are lot of areas to improve in the existing system. This paper is about the usage of Particle Swarm Optimization (PSO) with Convolutional Neural Networks (CNNs), that is one of the basic methods in deep learning. The reason to use PSO in the training process is to optimize the results of the solution vectors on CNN in order to improve the recognition accuracy. The dataset used in this research is handwritten characters from EMNIST. The experiments conducted has shown that the accuracy can be attained in 4 epoch is 96.03%. The results obtained were better than the conventional CNN and DBN and the execution time is approximately similar to the conventional CNN. Hence, the proposed method is a promising method.

**KEYWORDS:** Hand Written Character Recognition, Particle Swarm Optimization, Convolutional Neural Networks, EMNIST Dataset.

## I. INTRODUCTION

Optical Character recognition is becoming more and more important now a days in machine learning and computer vision. There exists numerous methods for extracting the text from a given input image, which will be discussed in the coming sections, but still there is a lot of areas to be improved in Hand written Character Recognition. They are accuracy, errors while detecting lower case letters, large time taken to recognize text.

CNN is a type of feed forward neural network inspired by the structure of visual system. In CNN, there are many neurons with weights and biases, where every single neuron receives many inputs and perform dot products. In terms of architecture CNN is composed of single or multiple convolutional layers along with subsampling stages and single or multiple layers which are connected to each other as found in a standard multi-layer neural networks.

Although conventional CNN provides considerable accuracy, there is still much space for improvements. In order to improve the performance of CNN in recognition task, we have used PSO to optimize output vector from CNNs. PSO is used because of its powerful performance in optimization problems.

PSO in an optimization method developed by Eberhart and Kennedy. PSO method is inspired by social behaviour of animals which don't have a leader in the group. PSO includes a swarm of particles, which represent a potential solution.

In order to assess our proposed system, we have compared the results obtained from proposed method with other existing results. The existing algorithms used for comparison are the original CNNs and Deep Belief Networks (DBNs). The performance criteria used in this research are error and accuracy.

### 1. Convolutional Neural Networks: -

Convolutional neural networks (CNNs) are widely used in the fields like pattern and image recognition since they possess a lot of advantages when compared to other techniques. A neural network is defined as a system of artificial "neurons" that are interconnected and exchange messages with each other. The connections consist of numerical weights that are tuned while training process, as this network is expected to respond correctly when given with an input of pattern or image to recognize. The network has multiple layers which consists of feature detecting neurons. Each layer has many neurons that respond to different combinations of inputs from the previous layers. As shown in Fig.1 below, the layers are built up so that the first layer detects a set of primitive patterns in the input, the second layer detects patterns of patterns, and the third layer detects patterns of those patterns, and so on. Generally, CNNs use 5 to 25 unique layers of pattern recognition.

3-4-5

# Advanced Hand Written Character Recognition with PSO in CNN

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**KEYWORDS:** Hand Written Character Recognition, Particle Swarm Optimization, Convolutional Neural Networks, EMNIST Dataset.

## I. INTRODUCTION

Optical Character recognition is becoming more and more important now a days in machine learning and computer vision. There exists numerous methods for extracting the text from a given input image, which will be discussed in the coming sections, but still there is a lot of areas to be improved in Hand written Character Recognition. They are accuracy, errors while detecting lower case letters, large time taken to recognize text.

CNN is a type of feed forward neural network inspired by the structure of visual system. In CNN, there are many neurons with weights and biases, where every single neuron receives many inputs and perform dot products. In terms of architecture CNN is composed of single or multiple convolutional layers along with subsampling stages and single or multiple layers which are connected to each other as found in a standard multi-layer neural networks.

Although conventional CNN provides considerable accuracy, there is still much space for improvements. In order to improve the performance of CNN in recognition task, we have used PSO to optimize output vector from CNNs. PSO is used because of its powerful performance in optimization problems.

PSO is an optimization method developed by Eberhart and Kennedy. PSO method is inspired by social behaviour of animals which don't have a leader in the group. PSO includes a swarm of particles, which represent a potential solution.

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## DESIGN OF MULTIBAND MIMO ANTENNA FOR VARIOUS INDOOR APPLICATIONS

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**ABSTRACT:** A novel and compact planar multiband multiple-input–multiple-output (MIMO) antenna is presented. The proposed antenna is composed of two symmetrical radiating elements connected by neutralizing line to cancel the reactive coupling. The radiating element is designed for different frequencies operating in GSM 900 MHz, DCS 1800 MHz, LTE-E 2300 MHz and LTE-D 2600 MHz, which is consisting of a folded monopole and a beveled rectangular metal patch. The presented antenna is fed by using 50  $\Omega$  coplanar waveguide (CPW) transmission lines. Four slits are etched into the ground plane for reducing the mutual coupling. The measured results show that the proposed antenna has good impedance matching, isolation, peak gain and radiation patterns. The radiation efficiency and diversity gain (DG) in the servicing frequencies are pretty well. In the Ericsson indoor experiment, three kinds of antenna feed system are discussed. The proposed antenna shows good performance in Long Term Evolution (LTE) reference signal receiving power (RSRP), download speed and upload speed.

**Index Terms**—Multiband, multiple-input–multiple-output (MIMO) antenna, Long Term Evolution (LTE), indoor, antenna feed system

### 1. Introduction:

To increase the system capacity, one of the possible way is to use MIMO systems which have high bandwidth, to decrease the effects of fading due to multipath effect and to improve the spectral efficiency and reliability the MIMO antenna systems (Multiple Inputs and Multiple Output antennas) is used, which provide multiple antennas at receiver end and transmitter end. In MIMO antenna system data rates are achieved very high due to the adding of number of antennas at the transceiver, which will transmit and receive power using multiple antennas. In the previous works different configurations are implemented for the MIMO antennas is discussed [1-5]. For movable devices, it is very crucial that the Multi-input and multi-output antennas design is to be

3.4.5

# DESIGN OF MIMO ANTENNA AT VARIOUS BANDS FOR WIRELESS AND MOBILE COMMUNICATIONS

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**ABSTRACT:** : A planar compact MIMO antenna with coplanar waveguide (CPW) feed is designed using HFSS software. The proposed antenna is composed of two symmetrical radiating elements which are connected by a neutralization line. This neutralization line plays a vital role in the improvement of isolation between the antennas. The proposed antenna has slits that are etched to avoid interference and thereby used at multiple bands. The proposed antenna is fed by a coplanar waveguide transmission lines having characteristic impedance of 50 ohms. The simulated results show that the proposed antenna has good isolation. The diversity gain and the antenna efficiency at the operating frequencies are very appreciable. The proposed antenna has acceptable TARC and ECC values. The proposed antenna can be operated at different frequencies such as LTE-E 2300 MHz, LTE-D 2600 MHz and WiMAX 3400MHz.

**KEYWORDS:** Multi Input Multi Output (MIMO) antenna, Total Active Reflection Coefficient(TARC), Envelope Correlation Coefficient(ECC).

## I. INTRODUCTION

Very often radio signals reaching the receiver faces signal degradation due to multipath propagation. This results in the degradation of link capacity and link reliability. So in order to cope with this degradation Multi Input Multi Output (MIMO) systems are used. There are many techniques involved in MIMO systems. Spatial diversity technique is used to enhance the link performance. Spatial Multiplexing technique is used to improve the link efficiency. Generally, the principle of diversity is to provide the receiver with multiple versions of the same signal which results in the reduction of signal degradation considerably and effectively improves the link performance. This can be achieved by three methods. First method involves time diversity technique. In this technique, the same message is transmitted at different time slots. Second method includes frequency diversity technique. In this technique, the same message is transmitted at multiple distinct frequency slots. Third method involves Space diversity technique. In this technique, separate antennas are used to send messages which are located at different positions in order to take advantage of different radio paths that exist in a typical terrestrial environment. In most of the cases, Space diversity technique is used in MIMO systems. Up until 1990's, Space diversity is used in the systems that switches between two antennas or combined the signals in order to provide the best possible signal. To get such best possible signals, high level of signal processing is required which is limited then. However as the years go by, with the improvement of processing power it is possible to implement MIMO systems. Signals can take multiple paths between transmitter and receiver due to obstacles and objects in the medium. Traditionally these various multiple paths will introduce interference. By the introduction of MIMO, with these various multiple paths can be used to provide additional robustness to the radio link by spatial diversity or to enhance the link data capacity by spatial multiplexing. Consider a stream of data [0100] is transmitted

# ELECTRONIC GLOVES IN THE HELP OF CONVERTING SIGNS TO SPEECH

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**ABSTRACT:** On an average a normal person spends 70-80% of waking hours to communicate. Sharing feelings, thoughts and ideas are important to lead a happier life, whereas for the people with hearing and speaking disability communication become laborious. This project helps them to have facile communication. For the people with hearing and speaking disability signs are principal means of communication with which they can only communicate with the persons who are familiar with sign language. Using sign language converting gloves they can communicate with ease. These gloves convert signs to speech with the help of flex sensors, accelerometer, Arduino and text-to-speech converter. Two-way communication is also possible by converting speech to text using a software and sending that to Arduino to display on LCD with the help of Bluetooth.

**KEYWORDS:** Sign language, Flex sensor, Accelerometer, Bluetooth, Text-to-Speech Converter.

## I.INTRODUCTION

Communication plays a major role in human survival. To share emotions, ideas and knowledge communication is necessary. Communication can be done in many ways like speaking out, writing down messages, showing some gestures whereas speaking is the easiest and fastest

way to communicate compared to other means of communication. Without communication there would be less personal development and career growth. People with hearing and speaking disability communicate using sign language. Sign language includes hand gestures and facial expressions whereas in the present project only hand gestures are taken to give speech output. Deaf and dumb people communicate easily with the person who know sign language than the one who do not. Present project acts as sign language interpreter to break the barriers to communicate with the person who do not know sign language.



Fig.1. Sign language symbols

Flex sensors are used to capture finger movements, accelerometer is used to get hand orientation. Output from both flex sensors and accelerometer are given to Arduino to match with pre-defined text.

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# MLSE Equalizer based MIMO-UFMC Data Transmission System

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**Abstract** — Modulation with UFMC is one of the most highly regarded methods for formation of higher frequencies outside OFDM for wireless networks to come. In this paper, we will implement a linear modulated signal equalizer using Viterbi algorithm. The Viterbi Algorithm produces the maximum likelihood sequence estimator which estimates the successive states from the sequence of its outputs which have been corrupted by successively independent interference terms. The quantitative results reveal that the improved transceiver methods are successful and also that this model produces better results in terms of Bit Error Rate (BER), Root Mean Square Error (RMSE) and Throughput when compared to traditional methods.

**Keywords**- 5G, UFMC, MIMO, OFDM, Viterbi, Maximum Likelihood Sequence Estimator (MLSE)

## I. INTRODUCTION

Fifth generation wireless networks offer a wide range of data transmission connections with high speed and data rate. As population increases day by day and the users utilizing the spectrum is also increasing day by day, hence 5G came into existence for transmission of multiple user data with high signal strength. Researchers studied on 5G systems, which is not only meant for enhancing the signal strength but also for reducing the latency in the data transmission. They also much focused on the physical channels and reference signals that are related to this 5G scheme [1].

As 5G scheme works under millimeter Wave length, it is necessary for considering the best technologies for transmission without losses. Here we have considered the OFDM technique at initial stage of research. OFDM is a multiplexing technique which encodes the data in multi carrier frequencies. To enhance the performance of the OFDM technique Index modulation is applied to the input data before multiplexing using OFDM technique.

Researchers studied with different Index modulation techniques like index modulation with spatial modulation, index modulation with channel modulation and OFDM with index modulation. They studied on the above techniques based on considering the MIMO systems with parasitic elements in order to obtain the low complexity and to increase the spectrum & energy efficiencies [2].

As data transmission can be done in the synchronous and asynchronous mode. The earlier studies pact with the data communication in the synchronous mode [3]. While to explain the OFDM based asynchronous transmission technique here introduces a WOLA- OFDM technique which is abbreviated as weighted overlap and add based OFDM which provides extra benefits for 5G data transmission.

All the above studies reveal that OFDM has merely significant drawbacks in timing considerations and in synchronizing the data [4]. Hence, to overcome these drawbacks UFMC modulation technique was introduced. In Universal Filtered Multi Carrier system (UFMC) modulation technique multi carrier scheme was implemented. It achieves the maximum capacity by considering the offset quadrature amplitude modulation (OQAM).

# Stress Detection Using Smart-Watch By Automated Machine Learning Approach

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**Abstract** — Continuous vulnerability to stress is injurious for psychological and Physical health, but to tackle and with stand the stress, we should first detect the stress. In this paper we introduce a fast and high accurate method for continuous stress detection using the data collected by a commercial wrist device. Applying machine learning models to real-life data is complex. But by using automated machine learning it is easy to apply for real-life datasets. So we have used AUTOGLUON an automated machine learning model for stress detection. In this paper we propose two models for stress detection. One model uses heart rate information and activities like walking, working, cycling, driving, playing soccer, climbing stairs and doing lunch for classifying stress. And another model uses smartwatch FITBIT daily summary data like Body related information, Heart rate information during physical activity, physical activity information and sleep information for classification of stress level.

**Keywords-** stress; automated machine learning (AutoML); smart watch; heart rate (HR); human activities; sleep quality; autogluon;

## I. INTRODUCTION

Stress can be simply defined as a “State Of Mind” because a person can take the situation or work in an easy way or in a hard way which can lead to the person to be stressed. It completely depends on how the person has seen the situation. It is a general term applied to various psychological (mentally) and physiological (bodily) pressures experienced or felt by people throughout their lives. In this paper, we propose a stress detection model by analyzing multi-physiological features. “The process of physiological stress response starts from the moment the body realizes the presence of the stressor, followed by the sending of signals to the brain, and to the specific sympathetic and hormonal responses to eliminate, reduce or cope with the stress.” [1] Features use to detect physiological stress: Pulse rate: A stressful situation sets off a chain of events. Body releases adrenaline, a hormone that temporarily causes your breathing and heart rate to speed up and your blood pressure to rise. Regarding the economic costs of stress, work-related stress results in increased absenteeism and decreased productivity [4] and Therefore, a stress-detection system will help for self-management of mental (and consequently physical) health of workers [5], students and others within the stressful environment of today’s world.

To develop a stress-detection application, first we should understand the stress process. When humans undergo a vigorous event (e.g., intense training, meeting, exam, etc.), the body is faced with a large physical and psychological stressors, invoking a response of the sympathetic nervous system to meet the increased metabolic demands [6]. The sympathetic nervous system essentially speeds up certain processes within the body (“fight-or-flight” response) [7]: it raises the heart rate, sweating rate, blood pressure, etc., some of which can be detected with wearable sensors. After the vigorous event, the sympathetic nervous system slows down, and therefore the parasympathetic nervous system initiates the rest and repair processes [8]. Ideally, these two nervous systems remain balanced in their efforts.

If the sympathetic-parasympathetic (“yin-yang”) balance isn’t maintained (e.g., the body experiences stressors too often), and therefore the activation of the sympathetic response is continuously higher, chronic stress is triggered. To prevent chronic stress from exposure within the first place, prevention is better than cure”), a continuous acute stress detection system [1] can be used which may recommend relaxation

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# A Novel Regression Architecture for Underwater Image Enhancement

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**Abstract** — underwater image enhancement is an important section in order to construct a more visually appealing image. They do not depend on the image formation. These varieties of methodologies are usually very simple and quicker than other deconvolution approaches. A novel architecture is used for training and we calculate the parameters including such as PSNR, BRISQUE and MAE values for comparing the results. However, the underwater image acquired by the camera has low prominence due to haze induced by light reflected from the surface and isolated by the water particles, attenuation of different wavelengths leads to color deviation. In our proposed implementation to enhance the underwater images more by using the Deep learning convolution neural network (DLCNN) with contrast adaptive histogram equalization (CLAHE) by considering the network depth as 10. The DLCNN-CLAHE technique gives better results when compared with VDSR techniques.

**Keywords**- contrast limited adaptive histogram equalization, YCbCr color space, and high resolution

## I. INTRODUCTION

In article [1] it is potential to eliminate the complex interference and rebuild the underwater images by enhancement techniques. The underwater images are enhanced by using the algorithms like grey world for clearance and dark channel prior for processing of underwater images by applying the BP network for restoration of details in the underwater image. The TV model procedure is executed because to covering the blank area after the recognition and elimination of object. The article [2] describes the enhancement technique by using the wavelet fusion for underwater images which is due to the absorption and reflection of light while capturing the images in water. By using this implementation, we can evaluate and dehaze or enhance the contrast and color of the image. Owing to the scattering and absorption of light color alteration is emerged in underwater images. For improving the underwater images color distortion CC-Net is used and for contrast enhancement we are using HR-Net which consist of single transmission coefficient. These two Nets are the grouping of UIE-Net which is one of the frameworks in CNN architecture. This implementation progresses the learning process and convergence speed simultaneously [4]. It overcomes the several optical transmissions, hazing and color distortions. For features extraction these two are trained to the CNN framework.

G. Yadav, S. Maheshwari and A. Agarwal researches in [5] describe that in order to raise the visibility of the hazy image or video we utilize the contrast limited adaptive histogram equalization. When compared to other enhancement techniques CLAHE algorithm gives better enhancement results because it applies for both color and gray images for both regions. A new frame is generated after the adjustment of intensity values over the image is named as histogram equalization. Based on the neighboring pixel values AHE adjust the intensity levels over a particular region of any fog (homogeneous) type of images only. For histogram equalization shape in CLAHE Distribution parameter is utilized. For noisy image we are applying clip limit. The light travelling in the water with altered wavelengths leads to the color variation due to the attenuation. Here, by employing the image processing techniques we can enhance the underwater images. In this paper we have both enhancement and restoration operations. There are different types of image enhancement techniques for enhancing the image. Image restoration is nothing but the degradation is used to restore the loss of information. In this paper, UIQM is utilized for measuring the quality of the underwater images. This implementation gives the better-quality results when compared with other enhancement techniques [6-7].

# An Efficient Cognitive Radio Spectrum Sensing Approach Using Modulation Schemes

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**Abstract-** Due to the various number of diverse wireless devices and technologies, there is a increase in the number of wireless subscribers. Thus the radio frequency (RF) spectrum is becoming more crowded. The main wireless Communication resources are bandwidth and power. Hence conservation and proper utilization of available spectrum is needed. Thus, spectrum sensing is becoming progressively more important for identifying underutilized spectrum. Spectrum sensing in cognitive radio (CR) is an essential method that identifies the presence or absence of primary user signals in a channel. In this paper average information based spectrum sensing is used for the modulated signal to identify the presence of the primary user (licensed user) accurately. I.e. Here, QAM/PSK modulation schemes are used for spectrum sensing. Here average information based spectrum sensing is used. Here the average information refers to entropy. The average information of primary users (with and without the presence of licensed or primary users in spectrum) is calculated using MATLAB. The Entropy that occurs when the primary user is present or absent is H0 hypothesis and H1 hypothesis respectively and a threshold is calculated. If Entropy for H1 hypothesis is less than the threshold then the primary user presence is identified.

**Keywords**—Cognitive radio (CR), Entropy, Spectrum sensing, QAM, PSK, Threshold value, SNR

## 1. INTRODUCTION

The growing demand for wireless applications usage has put a lot of constraints on the usage of the available radio spectrum which is a limited in resource. This limited resource leads to congestion or data traffic in the usage of the spectrum. The above data traffic is because the spectrum is not utilized properly due to the static allocation spectrum sensing. So, for proper utilization of spectrum, dynamic spectrum allocation management is introduced. This dynamic spectrum allocation laid as a principle for Cognitive Radio (CR) i.e. this cognitive radio has the ability to sense the unused spectrum. The main task in implementing the cognitive radio is for Spectrum Sensing (SS).

So, the Cognitive radio (CR) technology is used to predict the unutilized spectrum in wireless communication. The users of wireless communications are divided in to two types, they licensed or Primary User and unlicensed or Secondary User. Allocated spectrum portions are not always used by their owners (licensed users), which creates spectrum holes.

With the vast number and diversity of wireless devices and technologies, exponential increase in the number of wireless subscribers, the emergence of new applications, and the continuous demand for higher data rates, RF spectrum is becoming increasingly crowded. These developments in the communications market demand systems and devices which are aware of their RF environment and can facilitate flexible, efficient, and reliable operation and utilization of available spectral resources. Therefore, spectrum sensing and its ability to identify underutilized spectrum is becoming progressively more important to current and future wireless communication systems to identify underutilized spectrum with characterizing interference and consequently, achieving reliable and efficient operation

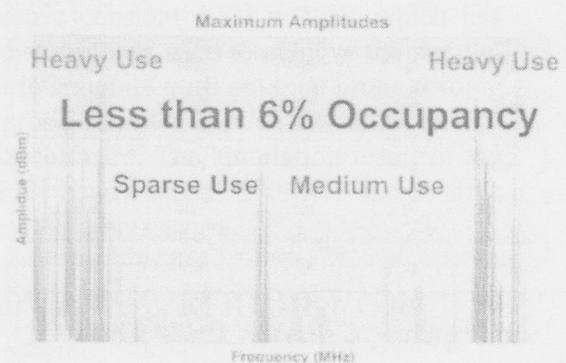


Fig1:Band Occupancy

A spectrum hole, is a frequency band assigned to a primary user, but it is not being used at a particular time and at a particular location. Therefore, the radio spectrum is inefficiently utilized. Thus, the scarcity and inefficiency of the spectrum management needs an enhancement in the radio spectrum access and to achieve high network performance. The spectrum scarcity issue is solved by sharing unoccupied channels with unlicensed users, called secondary users.

### 1.1 Cognitive Cycle

A cognitive radio network performs a 3-process cycle called sensing, deciding, and acting

- The first process i.e. sensing, is a critical stage where the measurements are taken and the also sensing of spectrum is performed. Due to multipath fading, varying channel conditions and uncertainty affects this

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## Design of 2x2 Array Microstrip patch Antenna with High Gain and Directivity for RFID Reader Applications

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**Abstract-** The objective of this study is to design and analyse “2x2 Array Microstrip Patch Antenna with High Gain and Directivity for RFID Reader Applications”. Microstrip antenna plays a tremendous role in today world of wireless communication systems, such as RFID (Radio Frequency identification), Mobile Communication and healthcare. Aiming at the problem of low gain, a simple microstrip antenna array is designed at 2.5GHz frequency, with multilayered substrate one RT/duroid-5880 ( $\epsilon_{r1} = 2.2$ ) and another C- foam material. C-foam material with low dielectric constant ( $\epsilon_{r2} = 1.03$ , which has dielectric constant value close to air. T-type power distributor is used to achieve the parallel feed network with matching network having symmetric structure with co-axial probe feeding to match the array antenna. The performance of the proposed antenna is analysed in terms of return loss, VSWR, gain and directivity using HFSS software. The simulation result of the proposed antenna shows a maximum gain of 14.34dB, bandwidth of 290MHz and relative bandwidth of 11.6%.

Keywords - Microstrip Patch antenna, air substrate, RFID, High Gain

### I. INTRODUCTION

RFID (Radio Frequency Identification) Technology is an automatic identification technology without any physical contact between the reader and electronic tag. It uses radio frequency signals to automatically indentify and exchange the information present on electronic tag. RFID devices works mainly in four frequency bands between 120KHz to 10GHz in various applications such as Low Frequency (LF) 120 to 150 kHz, High Frequency (HF) up to 13.56MHz, Ultra High frequency (UHF) 433MHz, UHF ISM band 865-868 MHz (Europe) 902-928 MHz (North America), Microwave ISM band 2.45 – 5.80 GHz and Ultra Wide band 3.1-10GHz. RFID devices has many applications in different areas such as electronic toll collection, access control, service industries, logistic systems, animal tracking and government agencies etc [1,2].

The RFID system consists of two main components i.e, RFID tag or transponder and Reader or interrogator. In the operation of RFID system, the reader transmits a radio signal through the antenna. All the passive transponders or electronic tags passing through the electromagnetic energy get powered and transmit the information present in the tag [1,2]. The communication between the RFID tag and the reader is done through a predefined protocol as shown in fig 1.

# IMPLEMENTATION OF FAST-RCNN TO DETECT SHIPS FROM OPTICAL SATELLITE IMAGES

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**ABSTRACT:** Ship detection plays an important role in several applications like avoiding illegal fishing activities, controlling illegal transports, and to detect warships. The surface of the sea can be observed with satellite images rather than with radar and video cameras. The main objective is to focus on the detection and localization of ships. The ships were detected by using Regional Convolution Neural Networks. But R-CNN takes more time to detect ships and accuracy is low. To overcome these limitations the proposed method is fast RCNN. Fast-RCNN detects the objects in very less amount of time and with more accuracy.

**Keywords:** Ship detection, optical satellite image, Deep learning-RCNN and Fast-RCNN

## I. INTRODUCTION

Ship detection in remote sensing images has attracted wide attention for its broad applications. The surface of the ocean can be observed by video cameras, optical satellite imaging, or synthetic aperture radar. The field view of the video cameras is more limited and synthetic aperture radar images were usually with high-level speckles and also the number of SAR sensors are limited which results in low resolution and revisit cycle is also more. Hence, the ships were detected from the Optical satellite images with high resolution and no speckles at high frequencies. At this point Machine learning offers the great solution. Convolutional neural network is one of the neural networks which can be used to detect the objects in the image but doesn't localize the objects. In existing method Regional Convolutional Neural Network was implemented which can detect and localize the objects but with low accuracy and takes more time to detect ships. This work aims to propose an algorithm i.e. Fast-RCNN to detect ships with more accuracy and takes less time to detect. This was implemented in the MATLAB, since it is the easiest and most productive computing environment for engineers and scientists

## II. LITERATURE REVIEW

In [1] the ships were detected by simple shape analysis, image segmentation, and supervised hierarchical classification method. But the accuracy is low.

In [2] the ships were detected by using both IR band and

visible band in the highly cluttered background video camera images of boats. But the range of video cameras is very limited.

In [3] the ships were detected by using the K-Nearest Neighbourhood method (KNN). But KNN is not robust to noisy data.

In [4] the ships were detected by Synthetic Aperture Radar (SAR). But images with SAR have high-level speckles and insensitive to wood materials.

In [5] the detection of ships from the video camera image via using Local Gabor Binary Pattern Histogram Sequence and implemented Multi-Layer Perceptron and Support Vector Machine (SVM) for classification. But LGBPHS takes more time for matching.

In [6] developed a ship detection method at the coastal zone via optical satellite image. An initial mask was created by thresholding the normalized difference water index (NDWI) using the zero level of the current global elevation data. But difficult to implement in complex scenarios.

## III. EXISTING METHOD

Machine learning is a form of artificial intelligence (AI) that teaches computers to think in a similar way to how humans do: learning and improving upon past experiences. It can learn information from existing pictures or texts. Deep learning has neural networks like ANN, CNN, R-CNN, and Fast-RCNN. RCNN uses selective search to extract objects in the image. The selective search identifies varying scales, colours, textures, and enclosure patterns in the image, and based on that various regions were extracted.

Steps involved in RCNN:

1. An image is given as input.
2. The Region of Interest was obtained from the images by using selective search approach method.
3. These region proposals are warped into a square and fed into a convolutional neural network.
4. CNN then extract features for each region and SVMs was used to divide these regions into different classes.
5. Finally, a bounding box regression was used to predict the bounding boxes for each identified region.

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# Brain Tumor Classification Using CNN

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**ABSTRACT-** Several imaging techniques are accustomed for brain tumors classification. However, MRI is commonly used because of its superior image quality and also the fact that it has less radiation. Deep learning (DL) which is a part of machine learning and recently showed a better performance, especially in classification and segmentation issues. The main objective is to obtain and classify the tumor which grows inside and around the brain. In order to obtain this we can use Convolution and Fully-connected layers which are part of Alexnet used in CNN. These Layers extract features of the tumor and classify the grade and locates the tumor in the brain accurately.

**Key words:** CNN, Alexnet, Deep Learning, Convolution and Fully Connected layers.

## I. INTRODUCTION

The formation of abnormal growth of cells in brain is known as Brain Tumor. Identifying the tumor in earlier stages is very important. Ultrasound images are useful in identifying the abnormal growth of cells in any part of our body. Usually Magnetic Resonance Imaging is useful in categorizing the abnormal cells in the brain at temporal length of event's existence particularly. Using of high standards of specific images to decrease the deaths from brain tumor is very important. No one can predict the growth of tumor in the brain and treatment is done depending on the tumor location, size and its growth. Treatment is meant to eradicate or eliminate the tumor part without affecting the other parts or cells of the brain. The following steps shows the different kinds of methods to classify and to detect the tumor location in the brain of patients.

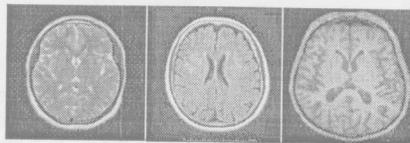


Figure -1 normal images

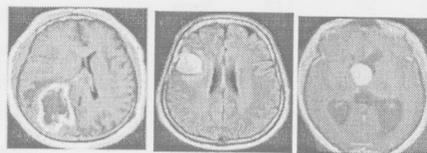


Figure -2 Abnormal images

Here a new technique has brought into light to classify brain tumors from the MRI images. In the preprocessing state various types of images are given as input. Feature extraction, parameters calculation is done in second stage. The input image is grayscale, it is converted to an RGB image by replicating the single channel to obtain a 3-channel RGB image. Random crops of size  $227 \times 227$  were generated from inside the  $256 \times 256$  images to feed the first layer of AlexNet.

## II. LITERATURE REVIEW

1. Tian, JieJianXue, Yakang Dai, Jian Chen, JianZheng, used a Novel Package platform to integrate the thought algorithms for medical image process and analyzed intervals of standard deviation framework, as well as

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# Compact Penta-Band Rectangular Ring Monopole Antenna Loaded with Split Ring Resonator and L-Shaped Slots



Kranthi Kumar Andhe and Narayana Reddy Sanam

**Abstract** A compact penta-band metamaterial (MTM) loaded double slot rectangular ring monopole (RRM) antenna for X, C, and S-band wireless applications is proposed. The design contains RRM, MTM split ring resonator (SRR) as a radiating element with two slots for resonating of L-shape in ground. Compact dimensions of  $25 \times 21 \times 1.6 \text{ mm}^3$  using FR4 substrate of relative permittivity 4.4 are used. The proposed antenna consists of RRM with sides 14 mm, 18 mm with a ring width of 2 mm to resonate at 8.73 GHz. SRR is introduced inside of RRM causes to resonate antenna at 7.41 and 9.23 GHz. Further, L-slots in the ground produce multibands at 3.06, 6.16, 7.28, 8.63, and 9.25 GHz. The experimental results are validated with simulated results.

**Keywords** Rectangular ring monopole · Metamaterial · L-shaped slots · Split ring resonator · Penta-band

## 1 Introduction

The slot antenna design is simple, interesting, and easy to implement in the antenna analysis. MTM-based SRR offers compactness in the design of the antenna. Wireless communications require multiband antennas.

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**National:**

- 1) Published an article entitled ***Migration Workers in Construction Sector of Kurnool district; an empirical analysis.*** Published by Mayas publication August-2020 (ISSN.2395-5929). 1<sup>st</sup> I.Narendra Kumar 2<sup>nd</sup> K.Sudha 3<sup>RD</sup> Dr.K.Suneetha.

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- 2) Participated in one day workshop on Professional Development of Teachers in Higher Education ; NEP 2020 Organized by the Department of Education, North-Eastern Hill University (NEHU), Shillong, Meghalaya, India, , on 5<sup>th</sup> September , 2021.

# Modular Multi Level Cascaded H-bridge PV Inverter for Grid Connected Systems

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**Abstract**— a modular cascaded H-bridge multilevel photovoltaic (PV) inverter with Modified Controller for three-phase grid-connected applications is presented in this paper. This topology helps to enhance the flexibility and efficiency of PV inverter systems. Due to the PV mismatches, unbalanced current is injected into the grid which leads to many power quality issues. Modulation compensation scheme is proposed in the control scheme of inverter to eliminate the adverse effects of PV mismatches. A distributed maximum power point tracking scheme is applied to inverter topology for better utilization and to maximize the solar energy extraction from PV modules. For efficacious functioning of cascaded inverter, Modified Controller is utilized in the control scheme. To verify the feasibility of the proposed approach, a three phase seven level cascaded multilevel inverter is modeled and simulation results are presented by utilizing MATLAB/SIMULINK.

**Index Terms**— Photovoltaic (PV), Distributed maximum power point (MPP) tracking (MPPT), modulation compensation, Modified Controller Membership Functions,.

## I INTRODUCTION

Renewable energy technologies are clean sources of energy that have a much lower environmental impact than conventional

energy technologies. There are many types of renewable energy sources. Among them, solar energy plays a key role in the power generation sector. The demand for the solar energy has increased by 20%–25% for every annum over the span of late 20 years [1], and the development is for the most part in Grid connected systems. With the rapid market development in photovoltaic (PV) systems, there is incrementing scope for grid connected Photovoltaic applications.

There are five types of inverter topologies related to different PV system configurations namely: 1) central inverters; 2) string inverters; 3) multistring inverters; 4) ac-module inverters; and 5) cascaded inverters [2]–[7]. These PV system topologies are shown in Fig. 1. Cascaded inverter comprises of number of converters connected in series and are commonly used in medium and large scale grid-connected PV applications [8]–[10]. Since the converters are connected in series, high power and/or high voltage is available without the necessity of boosting stages. Cascaded inverter topologies are categorized into two types.

A cascaded dc/dc converter connection of PV modules is presented in Fig. 1(e) [11], [12]. Each dc/dc converter is fed by an individual dc source, and these dc/dc converter modules are connected in series to produce a high dc voltage, which is supplied to a simplified dc/ac inverter.

This methodology cumulates features of string inverters and ac-module inverters and

# Fractional Order PID Based Coordinated Control Strategies for DG units in an Unbalanced Microgrid

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**Abstract**—This paper presents the Fractional order PID based voltage and current control schemes for the Voltage Source Converter (VSC) based Distributed Generation (DG) units, in order to compensate for voltage unbalance in a microgrid. The objective of these scheme is to control the positive, negative and zero sequence components (separately and independently) of the voltage at the Point of Common Coupling (PCC) and the VSC currents to their respective reference commands. Dynamically varying limits have been proposed for the positive and negative sequence references for the current control schemes in order to protect the VSC from overloading (under unbalanced conditions) and unsymmetrical faults. The active power control, frequency control and the reactive power–voltage droop control schemes decide the references of the positive sequence voltage control scheme in order to fulfil the objective of using the same control schemes for the grid connected and the islanded modes of operation of the microgrid, thereby eliminating the need for islanding detection. The performance of the various control schemes employed for controlling the VSC based DG unit have been tested on two identical VSC based DG units feeding power to the IEEE 34 node distribution network implemented in MATLAB.

## I. INTRODUCTION

MOST of the renewable energy sources (like PV, FC, etc) generate DC power, and most of the storage systems (like Battery, Supercapacitor, etc) handle energy in the form of DC. These energy sources and storage systems need to be interfaced with the AC Microgrid through Voltage Source Converters (VSC). AC Microgrids are usually low voltage distribution networks with Distributed Generation (DG) units supplying power to the local loads [1] (which are inherently unbalanced). Thus the VSCs will be supplying unbalanced currents for most of the time and therefore a proper control scheme needs to be chosen for the VSC so that the performance of the VSC doesn't get drastically affected. Another challenge involving the control of VSCs is in the control schemes for the Grid Connected and the Islanded modes of operation. When the microgrid is in the Grid connected mode of operation, the voltage and frequency of the microgrid will be imposed by the Main Grid, but when the microgrid is in the Standalone or Islanded mode of operation, the VSCs need to set the voltage and frequency of the microgrid. Therefore researchers initially proposed the idea of separate control schemes for VSCs operating in the Grid connected and the islanded modes of operation [2]. The same concept was extended in [3] in order to deal with unbalanced loads. However, a transition from the grid connected mode to the islanded mode of operation and vice

# Mitigation of Voltage Sag/Swell using Fuzzy based DSTATCOM in Hybrid PV-Wind Distribution System under Fault Conditions

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**Abstract:** This paper describes the solar wind hybrid power system for the generation of electricity over renewable vitality means. The integrated power generation systems are resourceful in generation areas. Power quality issues such as disturbances in voltage, current or frequency in sensitive industrial lots out comes in letdown of end handler tackle. This paper signifies the techniques for the perfection of sag, swell and disruption in a supply schemes with power grounded tackle D-STATCOM (Distribution Static compensator).As this device is most effective and efficient in injecting current and mitigating the sag, swell and reduction in interruption. The D-STATCOM as Voltage source inverter; the switches are skilful by pulse-width-modulation technique (PWM). The DSTATCOM provides the reactive compensation for voltage stabilization in distribution systems; it also provides the protection over voltage sag which is caused due to reactive current demand. During the transient events the D-STATCOM provides the power factor correction, system stability and load balancing. The compensation characteristics and reliability, control schemes of the planned system is designed and carried out in MATLAB/SIMULINK.

**Keywords:** DSTATCOM, voltage sag, Swell Mitigation, hybrid systems, Fuzzy Logic Control (FLC).

## I INTRODUCTION

The quality of available supply power has a direct economic impact on industrial and domestic sectors which affects the growth of any nation [1]. This issue is more serious in electronic based systems. Level of harmonics and reactive power demand are popular parameters that specify the degree of distortion and reactive power demand at a particular bus of the utility [2]. The harmonic resonance is one of most common problem reported in low and medium level distribution system. It is due to capacitors which are used for power factor correction and source impedance [3]. Power converter based custom power devices (CPDs) are useful for reduction of power quality problems such as power factor correction, harmonics compensation, voltage sag/swell compensation, resonance due to distortion, voltage flicker reduction within specified international standards[4-6]. These CPDs include Distribution Static Compensator (DSTATCOM), Dynamic Voltage Restorer (DVR) and Unified Power Quality Conditioner (UPQC) in different configurations [7-9]. Some new topologies

# Fuzzy based Coordinated Control Strategy for Hybrid STATCOM Using Required Reactive Power Estimation Method

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**ABSTRACT:** The penetration level of renewable energy resources has grown in such a way that their effects on the power system can no longer be neglected. In order to cope with these problems, grid operators are forced to improve the stability of the grid connection point, and the static synchronous compensator (STATCOM) with Fuzzy Logic Controller (FLC), which has a fast dynamic response, is emerging as an alternative. Due to the prohibitive cost of STATCOM, however, grid operators have begun applying a new concept of hybrid STATCOM, which is a combination of mechanically switched capacitors (MSCs) and STATCOM. Thus, this paper investigates the use of new coordinated control between STATCOM and MSCs, and the solution relies on the required reactive power estimation method using online grid strength level (OGSL) index, which is newly proposed in this paper, and the optimal MSCs allocation algorithm. Following the proposed procedure, an improved coordinated control scheme is obtained whose objective is to reduce the switching times of the MSCs while maximizing the reserve reactive power margin of the STATCOM in transient state. This proposal is analyzed on the IEEE 3 Machine power

system in India with the developed hybrid STATCOM model.

**INDEX TERMS:** *Fuzzy Logic Controller (FLC), Hybrid STATCOM, MSCs, online grid strength estimation, and coordinated control.*

## I. INTRODUCTION

In the grid planning and operation of a stressed power system due to a high level of renewable energy penetration, the ability to maintain a stable voltage has become a growing concern. Since power transfer limitations have frequently been observed due to reactive power unbalances and load change, grid operators have tried to apply high-voltage, high-current power electronic devices like static synchronous compensator (STATCOM) [1], static var compensator (SVC) [2], thyristor controlled series capacitor TCSC) [3] and unified power flow controllers (UPFC) [4] into the power system. The main advantages of these flexible ac transmission systems (FACTS) solutions are their rapid dynamic response [5], frequent variations in output, and ability to maintain grid stability and grid code [6], [7]. In the operation of FACTS, it is desirable to have a systematic and efficient tool to investigate how FACTS can impact

# Design and Analysis of Fractional Order PID Control for Three Phase Stand Alone Hybrid PV-Wind Generation

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**Abstract**—A novel configuration of a Three Phase inverter that can integrate solar photovoltaic (PV) - Wind with battery storage in a Stand-Alone system is proposed in this paper. The force of the proposed topology lies in a novel, elongated unbalance three-level vector modulation technique that can engender the correct ac voltage under unbalanced dc voltage conditions. This paper presents the Fractional order PID design philosophy of the proposed configuration and the theoretical framework of the proposed modulation technique. An incipient fraction order PID controller for the proposed system is additionally presented in order to control the puissance distribution between the solar PV -Wind, battery, and load, which simultaneously provides maximum power point tracking (MPPT) operation for the solar PV-Wind. The effectiveness of the proposed methodology is investigated by the MATLAB simulation of several scenarios, including battery charging and discharging with different calibers of solar and wind input Changes. The proposed methodology and design is tested on MATLAB/SIMULINK Environment.

**Index Terms**—Fractional Order PID (FOPID), Battery storage, solar photovoltaic (PV), Wind-PMSG, three-phase inverter.

## I Introduction

At present, due to population outbreak the day to day energy demand has been increased which affect the resources of conventional energy sources, as the major amount of generated electricity has come from the fossil fuel [1], [2]. Generally after generating the electricity fossil fuel is exhausted. By increasing the capacity of generation of electricity using fossil fuel enhances the depletion fuel resources. So to compensate the future energy demand the only alternative is the renewable energy sources, which does not exhausted after generation of electricity [3]-[5]. On the other hand, during

generation of electricity the fossil fuel emits harmful gases to the environment and pollutes our environment. Hence, to protect our environment and support the nation's sustainable development the renewable energy sources got the prime attention to generate electricity [6]. Due to the absence of the load connectivity the battery maintains the reliability of the supplied electricity. The battery stores the generated electricity during the availability of the renewable energy sources and the stored energy supplied to the consumer whenever required [8]-[11]. The integration of different renewable energy sources reduces the dependency on the battery and increased the overall generating capacity without increasing the size of the energy storage unit [12]-[15]. The present study is addressing a new technology to integrate the generated electricity from solar and wind energy sources in a standalone distributed generation system to ensure optimum reliability to the consumer. This paper provides an effectiveness of the Standalone Hybrid PV-Wind MPPT method with FOPID proposed. It computes the instantaneous and junction array conductance. Hence, it is proposed FOPID control as an analytical model with fractional parameters to estimate them, which helps reducing the searching time. The simulation results are provided to validate the proposed FOPID – PV-Wind based Control capabilities. This paper is organized as follows: Section II provides an overview of System Configuration. Section III provides an overview of Modeling of PV system. Section IV provides an overview of Modeling of wind system. Section V provides the Power Flow Management is developed. Section VI provides the Operation of charge controller for the hybrid solar-wind off-grid power supply system. Section VII provides an overview of FOPID based Control Design. The simulation results based on MATLAB are presented in Section VIII, and Section IX gives a conclusion.

# Mathematical Evaluation of Solar PV Array with T-C-T Topology Under Different Shading Patterns



V. BalaRaju and Ch. Chengaiah

**Abstract** Solar photovoltaic (SPV) array topologies are formed by the electrical interconnections between module to module in SPV arrays which consists of PV modules connected in series and parallel. The main conventional SPV array topologies are series, parallel, Total-Cross-Tied, series-parallel, honey comb, and bridge linked types. The performance of Total-Cross-Tied (T-C-T) type of topology or configuration is better as compare to other type of connections. This paper presents the mathematical evaluation of  $6 \times 6$  size conventional Total-Cross-Tied (T-C-T) SPV array topology under different shading patterns such as short shading, half array shading, and long shading patterns. The electrical equivalent circuit of SPV array TCT topology is analyzed by Kirchhoff's laws at different nodes and loops in SPV array topology. In this paper, the performance of SPV array with the TCT topology in different shading patterns are investigated and theoretical measurements in output power voltage characteristics of the global maximum power point (GMPP) locations are examined.

**Keywords** PV array · Topology · Shaded patterns · Array power

## 1 Introduction

The increased electrical energy demand in worldwide, environmental problem, and global warming effect due to fossil fuels has resulted in the growing adoption of renewable energy for power generation. To meet the energy demand, renewable energy is alternative sources of electrical energy. Among all renewable energy sources, the photovoltaic (PV) system has more advantage than other sources due to latest development in PV technology and price drop of PV modules, rugged and

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# Performance of Series-Parallel and Total-Cross-Tied Type of Solar PV Array Configurations under Different Fault Conditions

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**Abstract-** Solar photovoltaic (SPV) cell converts solar energy directly into electrical energy. The output power of single SPV cell is less, to increase the required power by connecting solar cells in series formed as PV module. The SPV array configuration such as series-parallel, total cross tied, bridge linked and honey comb types are made by series and parallel connection of PV modules. The output power of array configuration depends on solar insolation falling on the modules. Electrical fault is the abnormal condition that occurs in any electrical circuits due to open circuit and short circuits. The output Power-Voltage characteristics of SPV array configuration or topology are affected more under faults in the PV system. In this paper, investigate the performance of 6x6 size SP and TCT array topologies under different electrical faults mainly short circuits, LG, LL, LLL, LLG, open circuits, shading faults and simulate the SPV array configurations under different fault conditions in MATLAB/ Simulink software.

**Keywords-** PV module and array power, configuration, Faults, Mismatch loss, Irradiances, modules in Stings.

## I. INTRODUCTION

Now a day's power generation from renewable energy sources are increased due to depletion of fossil fuels, increased cost of oil and environmental conditions mainly global warming effect etc. Renewable energy sources are mainly solar, wind, biomass, geothermal etc., among these solar PV power has more advantages. In India, installation capacity of renewable energy sources has reached 10 GW and installed capacity of solar is increasing to 100 GW by 2022. Due to fast developing technology in solar PV system, increases the PV system installation around the world. To avoid the damage and shutdown of PV system due to faults, it is essential to detect and diagnosis the faults in time and minimize the damage, maintenance cost of the SPV system [1].

Faults in SPV systems leads to energy loss are often it is difficult to avoid. Fault detection in PV system is essential for improving the reliability, continuity, safety and efficiency of the SPV system. The direct current (DC) side faults of a SPV system mainly open-circuit (OC) faults, hotspot faults, short circuits

(SC) faults, total and partial shading faults, degradation faults are often it is difficult to avoid it results in energy loss occurs, reduction of lifespan of PV module, fire hazards occurs due to serious fault conditions and finally shutdown occurs in entire SPV system. Generally, fault detection and protection methods mainly over current protection devices (OCPD's) i.e., fuses are used in series with the PV components. Compare to conventional power, the solar power is unique because it may have uncleared and undetectable fault current by OCPD's due to SPV arrays non-linear output characteristics, MPPT of the PV inverters, low irradiance, degradation of solar cells. However, due to the current-limiting nature, these OCPDs are may not be cleared the faults in PV system [2].

Due to uncleared faults in SPV system, causes power losses and it leads to safety issues and fire hazards. This paper investigates the performance of SPV 6x6 Series-Parallel and Total-Cross-Tied (TCT) array topologies under different faults mainly Line to ground (L-G), line to line (LL), line to line-line (LLL), line-line to ground (LL-G) faults, open circuit fault i.e., one sting is open in 6x6 array, Short circuit faults between modules in an array, inter string and intra string faults [3-4].

This research paper starts with the modeling of single diode solar cell, module and PV array are presented in section-2. Different faults in SPV array configuration and modeling, simulation of 6x6 SPV array for SP, TCT topologies are discussed in section-3 and 4 respectively. Performance analysis of SP, TCT and results, conclusions are given in section-5 and 6 respectively.

## II. SYSTEM DESIGN

### 2.1. Modeling of Photovoltaic Array

The modeling of Single diode solar PV cell by defining the mathematical equations shown in fig-1.

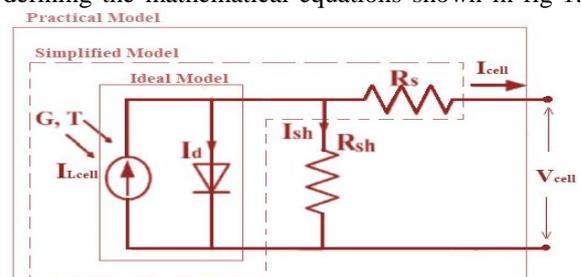


Figure-1: Single diode Solar PV cell

**PAPER ID: RE29**

**A New TCT configuration based on KenDoKu puzzle to maximize the power output of solar PV array**

**V Bala Raju and Ch. Chengaiah**

SV University Tirupathi

In shade conditions, the efficiency of the photovoltaic(PV) solar system decreases. Shading is caused by surrounding buildings, adjacent tall structures, dust, bird drops, clouds, and so on, causing a significant reduction in solar PV system generation capacity. The primary purpose of this paper is to enhance the total output power of a shaded PV array by reconfiguring the existing Total-Cross-Tied(TCT) arrangement or configuration using the shade dispersion (SD) technique. The proposed SD technique was developed on the basis of a handmade math-doku puzzle called the Ken-Do-Ku (KDK) puzzle sequence. This SD technique is used to reconfigure or rearrange the un-shaded and shaded modules in the TCT PV array configuration so that mismatches in row-currents are effectively eliminated by expanding the shading to modules throughout the array. In TCT configuration, the physical position of the modules is reorganized by using the KDK sequence without altering the electric ties among the array modules. The performance of a 6x6 arrays in various shading cases is tested in MATLAB /Simulink software, and the result shows that the reconfiguration of TCT by means of a KenDoKu puzzle increases the PV array's output power under various shading conditions.

# Mathematical modeling and simulation of energy management in smart grid

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## Abstract

A Smart Grid (SG) or Intelligent Grid is the solution for modernizing the electric power system and infrastructure to create a smarter and more reliable electricity grid. The synergies of Electric Vehicles (EVs) and Renewable sources of energy in a Smart Grid play an important role in promoting energy savings and reducing emissions. This paper portrays a strategy for Energy Management (EM) to maintain energy sustainability in the environment of smart grids. The system is modeled by considering solar source, loads, energy storages and utility grid. The different operating modes of Energy Management System is presented. The simulation outcomes emphasize the efficacy of the proposed management strategy and the possibility of Electric Vehicle storage system in enhancing the renewable exploration.

*Keywords: Electric vehicles, energy management, smart grids*

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## 1. Introduction

Electric Power is considered as one of the significant and most vital technologies in the 20<sup>th</sup> century giving rise to the rapid industrialization and globalization. A Smart Grid (SG) is an electricity transmission and distribution network that incorporates digital and other advanced Information and Communication Technologies (ICTs) for sensing, monitoring, communicating and managing the energy flow. It takes online decisions from all generation sources to meet the varying electricity demands of end users. Smart Grids oversees the generation, transmission and distribution asset's real time capabilities [1]. It enables the power system operators to manage the most efficient way of controlling the balance between generation and load demands. The use of storage devices is essential due to the intermittent nature of the solar, wind powers and also due to sudden variations in the power produced by intermittent sources.

Electric Vehicles (EVs) are becoming popular due to their potential to reduce fuel consumption, emissions and ability to increase Renewable Energy Sources (RESs) penetration into the transportation sector [1]. The integration of the electrical mobility in a smart grid should be considered in a complex system characterized by several factors, mainly including the generation of electricity from renewable resources distributed across the territory, the energy storage systems and the management tools that bind together the various elements.

## 2. Representation of Smart Grids in Smart Cities

Smart Grids play an important role for the sustainable use of energy in Smart Cities [2]. Smart grid helps the consumers to be energy suppliers known as prosumers. It allows the two-way flow of information and electricity between consumers and electric power companies. Smart cities are a logical extension of the concept of smart grids and the realization of smart cities is closely linked to the modernization process of traditional power system. The features of a Smart Grid include:

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\* Manuscript received December 16, 2019; revised June 17, 2020.

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# Effect of Soil Probiotic on Water Quality and Soil Quality Maintenance and Growth of Freshwater Fish *Pangasius hypophthalmus*

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**Abstract:** In recent decades, various procedures have been introduced to improve the conditions of the cultural ponds' conditions in aquaculture. Numerous biological products, including live bacterial inocula, preparation of enzymes, extracts of plant products, and many others, are being promoted to induce water and soil quality conditioners in aquaculture ponds. However, several studies have shown no significant effect of bacterial inoculums, and also the treatment with enzymatic preparation led to an enhancement of microbial mineralization of organic matter, but no effective net production of fish was observed. Probiotics have recently been applied to aquaculture. Probiotics are the live cells or a substrate that induce its benefits by stimulating growth, digestion, and active immune response. Probiotics can also improve water and soil quality. The current study summarizes the role of commercial probiotic 'Super-PS' on water quality and soil quality maintenance during the culture of freshwater fish *Pangasius hypophthalmus* fingerlings.

**Keywords:** water quality maintenance; growth performance; *Pangasius hypophthalmus*; probiotic *Rhodo bacter* and *Rhodo coccus* species.

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## 1. Introduction

Aquaculture, known as the fastest-growing food-producing sector globally, is heading towards new directions, intensifying and diversifying [1, 2]. The industry is now facing many challenges with the increase in the intensification and commercialization of aquaculture production. Pragnya et al., 2020 [3] reported bioaccumulation of heavy metals in different organs of fish *Pangasius hypophthalmus*, from Visakhapatnam, India, because coastal areas are prone to heavy metal pollution. The challenges majorly include combating diseases, broodstock improvement and domestication, development of appropriate feedstuffs and feeding mechanisms, water quality management, etc., [4]. Among these, disease outbreaks are one of the important problems that affect aquaculture production [5,6]. Probiotics in aquaculture have been widely used as an agent for controlling diseases, enhancing immune response, giving nutritional and enzymatic contributions to the host's digestion, and improving soil and water quality [6]. Probiotics are also regarded as an eco-friendly method in aquaculture. The probiotics may be added to experimental diet feed as live microorganisms to create a balanced indigenous microfloral community in the gastrointestinal tract [7,8]. Moreover, probiotics are considered therapeutic agents for usage, and some farmers are already

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# Effect of Soil Probiotic on Water Quality and Soil Quality Maintenance and Growth of Freshwater Fish *Pangasius hypophthalmus*

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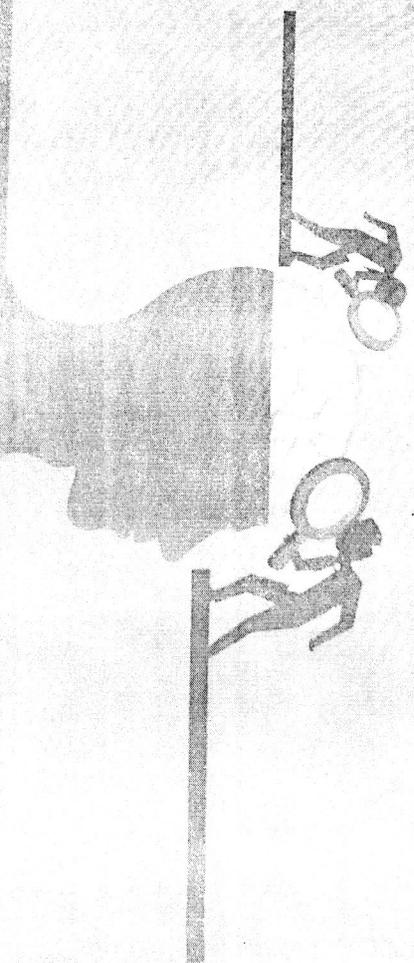
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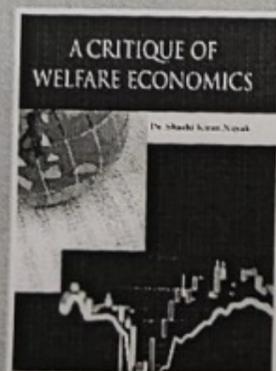
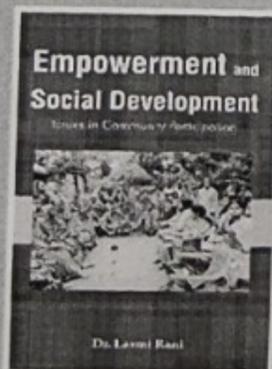
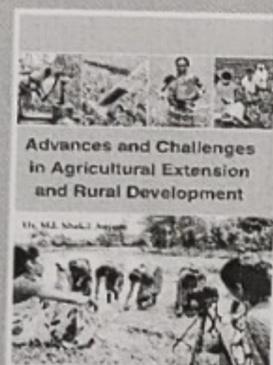
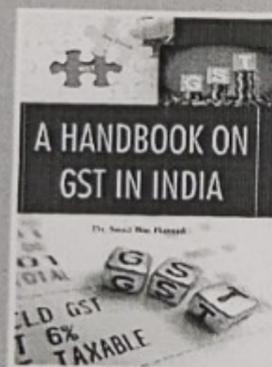
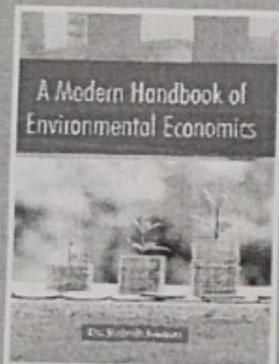
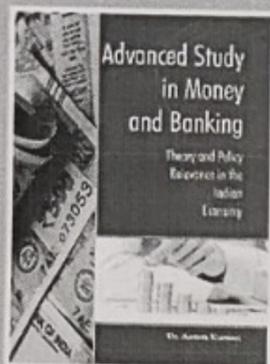
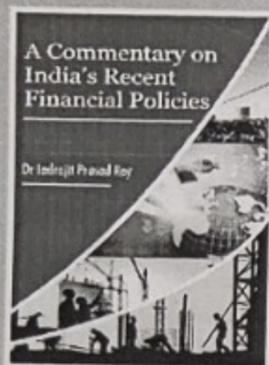
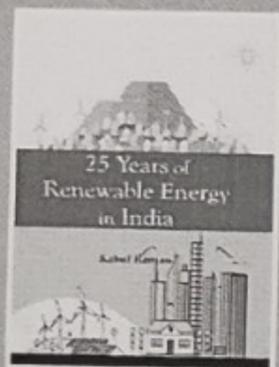
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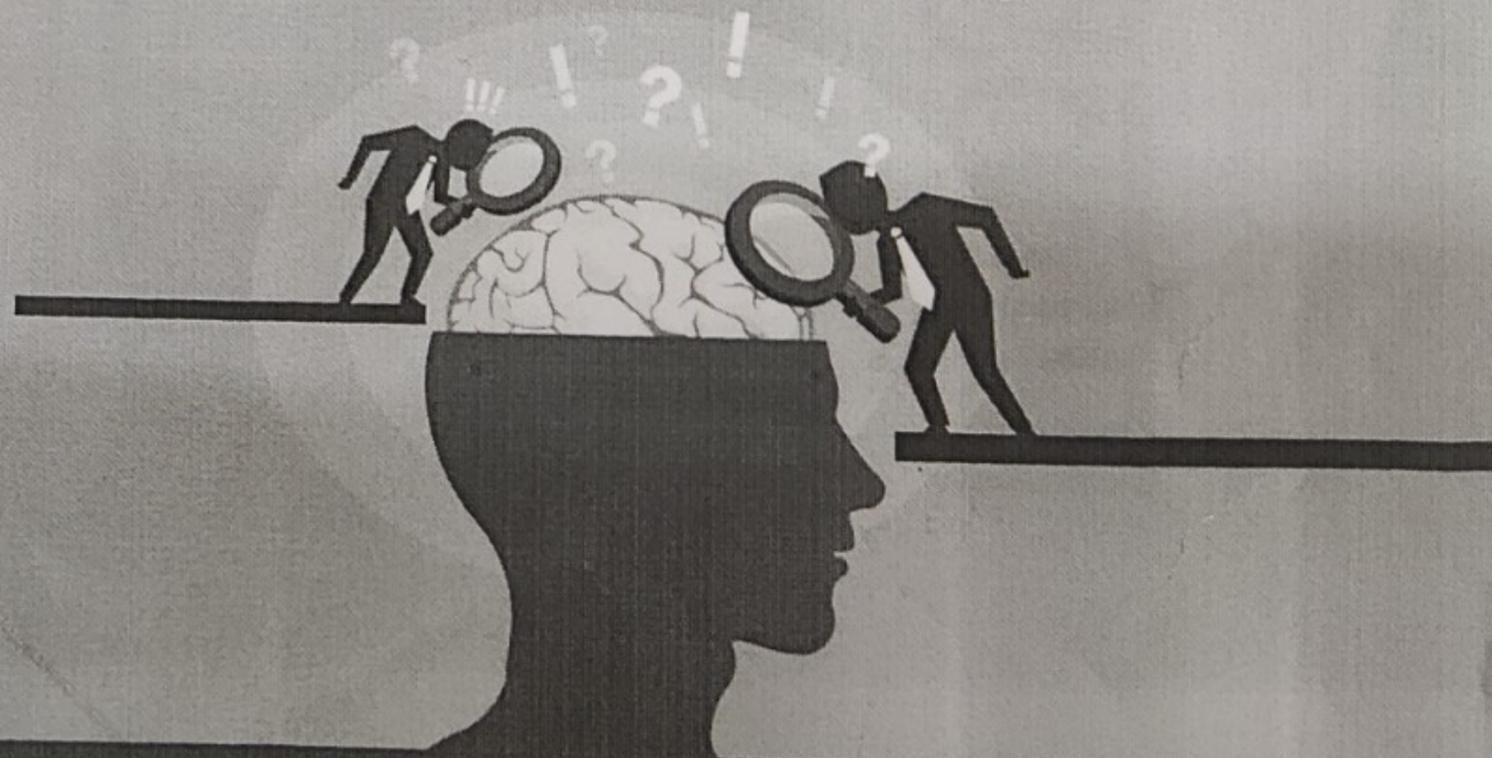
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## Shelf life studies of irradiated mushrooms and tomatoes

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### Abstract

The horticulture is an important and increasing sector, fruits and vegetables play an important role in providing essential nutrients. Post-harvest losses in fruits and vegetables are very high (20-40%). The need for novel processing technologies in the food industry is a direct result of consumer demand for fresh, high quality and healthy products that are free from chemical preservatives and yet are safe. Food irradiation technology has unique merits over conventional methods of preservation. The additional benefit of fruits and vegetables is due to a component in the food item that offers physical or biological i.e., functional benefits. Mushrooms are the only vegetative source of vitamin D along with all essential nutrients. Tomato is most important agricultural crop in India and predominant sources of Lycopene and contains antioxidant properties. Present study reveals that the application of gamma irradiation in low doses has satisfactorily increased the shelf life. Mushrooms and tomatoes irradiated at 0.75 kGy was more optimum in improving functional components than 0.25 kGy samples. The sensory evaluation scores of Mushroom and Tomato curry clearly indicates that the irradiation did not alter the sensory attributes. Gamma irradiation of Mushrooms and Tomatoes maintained the overall quality and sensory quality. Food irradiation promises to offer an effective means for minimizing the post-harvest losses and thereby increasing their availability, and stimulatory exports.

**Keywords:** Preservation, mushroom, quality, tomato, shelf life

### Introduction

Horticulture is the fastest and important growing sector in India, but also there is a need of effectively preserve and conserve what is produced. The seasonal nature of production, long distances between production and consumption centers, the rising gap between demand and supply. Among horticulture produce fruits and vegetables placed a major role both as a regular diet and also as a healthy diet. Fruits and vegetables are vital sources of proteins, vitamins, minerals, dietary fibres and other micronutrients in daily diet. Apart from nutrition, they also contain a wide array of potential phytochemicals and antioxidants (e.g. flavonoids, glucosinolates and isothiocyanates). In India, vegetables are valuable biological assets, especially genetic resources. Vegetables are important constituents of Indian agriculture and nutritional security due to their short duration, high yield, nutritional richness, economic viability and ability to generate on-farm and off-farm employment (Ranganathan, 2011) [1]. Fresh fruits and vegetables are highly sensitive to various stress factors due to improper handling and storage which causes physical damage leading to tissue breakdown. These can result in significant loss of nutritive value and in many cases the whole fruit or vegetable is lost (Kader, 1986) [2]. Minimizing these losses can increase their supply without bringing additional land under cultivation (Vanitha *et al.*, 2013) [3]. Improper handling and storage cause physical damage due to tissue breakdown. These losses are primarily due to insect infestation, microbiological contamination, and physiological changes due to sprouting, ripening and senescence. In horticultural commodities, the stages at which post-harvest losses occur can be divided into five such as production/harvest, post-harvest handling and storage, processing, distribution and consumption. Vegetables are having the functional components which help in regulating the diseases. A food can be regarded as "functional" if it is satisfactorily demonstrated to affect beneficially one or more target functions in a body, beyond adequate nutritional affects. Functional foods can be divided into two broad categories. The first category consists of functional foods that naturally contain a component that offers additional benefits to the consumer. The other category of functional foods consists of processed foods in which a component is added to the food to give the additional benefits (Amanda and Wendy, 2012) [4].

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## 24

## MOTHERS ATTITUDES TOWARDS THEIR CHILDHOOD UPBRINGING AND THEIR OWN PARENTING STYLES

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### Introduction

Parents own experiences of discipline in their childhood can also shape the particular attribution style they adopt when parenting their children. Parental childhood upbringing that is experience of parents when they were children was found to be the strongest predictors of parental use of physical punishment (Bugental and Happaney, 2002). Murphy and Stringer (1999), found that parents who have experienced physical punishment in childhood in working class families were found to use same with their children across the generations. However, the parental disciplinary strategies may be contradictory to their own childhood experiences. Studies have shown that parents who have experienced more physical punishment in their childhood were reported using lower levels with their own children (Park, 2011). Thus, parental experiences of discipline in their childhood also seem to be significant in determining the parental disciplinary strategies. To explore the relationship between attitudes of mothers towards their own childhood upbringing and their own parenting styles the present study was conducted with the following objectives.

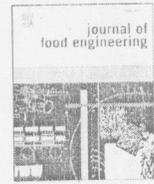
### Objectives of the study

1. To assess the attitudes of sample mothers towards their childhood upbringing
2. To assess the parenting styles adopted by sample mothers towards their children
3. To assess whether sample mothers differ in their parenting style according their own childhood upbringing

### Methodology

The following tools specially developed for the research purpose were used for the study

**Tools:** 1. Parental Attitude towards their Own Upbringing (PATUB) Scale



# Structural studies and bioactivity of sodium alginate edible films fabricated through ferulic acid crosslinking mechanism

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## ARTICLE INFO

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Sodium alginate  
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## ABSTRACT

Sodium alginate (SA) is a well-known naturally occurring seaweed biopolymer and the attracted interest of SA is proficient to develop a characteristic edible film which extended the shelf-life of fruits, vegetables, poultry, and seafood. The objective of the current study focuses on the fabrication and characterization of sodium alginate edible films crosslinked with ferulic acid (FA) at 25, 35, 45 mg/gm of SA and classified as FA150, FA210, FA270. These FA allied SA films are found to be transparent, homogeneous, stable, and more rigid due to the crosslinking of ferulic acid. Further, the experimental films were evaluated to understand the effect of ferulic acid on their characteristic changes i.e., thickness, opacity, water-solubility, solid mass, and moisture content. Likewise, the Tensile strength (TS) and elongation at break percent (E%) are also tested to estimate the film's barrier and physical strength. The intermolecular interactions, microstructure, and surface morphology profiles of developed films were studied using standard Fourier-transform infrared spectroscopy (FTIR), Scanning electron microscopy (SEM) and Atomic force microscopy (AFM) experimental parameters. Moreover, the FA linked SA edible films were shown potential antioxidant activity profiles with increased concentration of crosslinking agent (ferulic acid) through reducing both 2,2-Diphenyl-1-picrylhydrazyl (DPPH) and ferric ions. Whereas, the developed FA linked SA composite films did not show a potential zone of inhibition against the most common food spoiling bacteria i.e., *Klebsiella pneumoniae* and *Salmonella enterica*. Thus, the current study endorsed that the FA allied sodium alginate edible films are beneficial for the manufacturing and food processing applications with a key antioxidant function.

## 1. Introduction

The edible bio-films or coating materials have received innovative attention in recent times as they played a vital role in food preservation, manufacturing, and extending the shelf-life of food materials (Albort et al., 2007; Bastarache et al., 2011). Since the synthetic and traditional packaging materials can result in several health issues besides massive environmental pollution (Chen and Swartz, 2009). The researchers have been focused on the developing of innovative biopolymers for food packing and coating applications, as they are eco-friendly, easily degradable, and also the raw materials are abundant in nature. Moreover, the edible coatings do not cause serious health effects even if forgotten to remove them before serving the food, since

they are developed with active food ingredients (Gabus et al., 2020). Likewise, the choice of edible biopolymers for food packing is largely depends on its unique functions such as good barrier properties against oxygen, which intern resist the microbial growths and oxidation patterns (Lopez et al., 2020; Hong and Krochta, 2006). Therefore, edible biopolymers as coating and packing materials have extensive applications in various fields comprising fruit marketing, process food packing, poultry, meat and fish packing etc. that do not harvest massive environmental pollutions (Bhatti et al., 2020). In recent years, biopolymer materials such as carbohydrates, chitosan, proteins, lipids, and blend have been using most frequently for the production of edible films (Ali and Ahmed, 2015). Currently, some synthetic approaches to enriched edible and biodegradable films have been reported to enhance the

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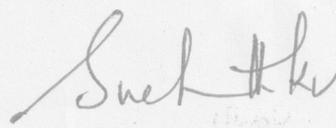
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# 19

## LEARNING DISABILITY WITH MENTAL HEALTH PROBLEMS - CURRENT SCENARIO AND COPING UP STRATEGIES

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### Introduction

A learning disability (LD) is a neurological disorder that affects the brain's ability to receive, process, store, and respond to information. "LD" does not stand for a single disorder. It is a term that refers to a group of disorders.

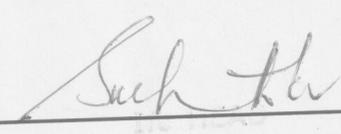
Learning disability generally includes the presence of: • A significantly reduced ability to understand new or complex information, to learn new skills (impaired intelligence), A reduced ability to cope independently (impaired social functioning) and Which started before adulthood, with a lasting effect on development.

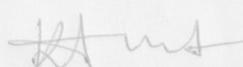
According to the World Health Organization (WHO), mental health is defined as a state of well-being in which every individual realizes his or her own potential, can cope with the normal stresses of life, can work productively and fruitfully, and is able to make a contribution to her or his community.

People with learning disabilities are at increased risk of mental health problems. People with learning disabilities can develop mental health problems for the same reasons as people without learning disabilities. Learning disability is often confused with mental health problems. Evidence suggest that mental health problems may be higher in people with a learning disability than in those without a learning disability. Mental health problems are commonly overlooked in people with learning disabilities.

A learning disability is a permanent condition developing at the latest in early childhood, whereas mental illness (or a mental health problem) can develop at any time, and is not necessarily permanent. People can get better and resolve mental health problems with help and treatment.

Generally child and youth mental health problems can be classified into two broad categories: *internalizing problems*, which include symptoms like withdrawal, anxiety, fearfulness, and depressed moods; and *externalizing problems*, which are characterized by such behaviours as aggression, defiance, rule-breaking, and destructive behaviour (Achenbach, 1991).



  
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**DEPT. OF HOME SCIENCE**  
**S.V. UNIVERSITY, TIRUPATI.**

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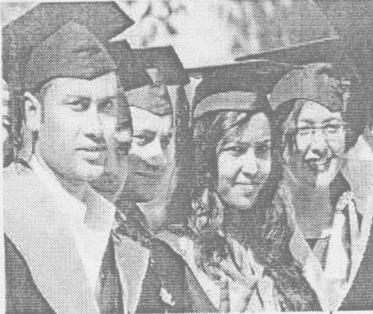
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# International Journal of Home Science

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## Impact of pre-school teachers' professional variables on children's performance

**K Goda Lakshmi and K Anuradha**

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### Abstract

Teaching in early childhood education is important as the early childhood period is the foundation period of human life. Early childhood educators with higher standards of training and expertise in the developmental aspects of children can provide rich, meaningful educational experiences for the children. Research has shown a significant relationship between the teacher's disposition and improved child outcomes. The present study was conducted to study the relationship between early childhood educator's professional variables and children's performance. One hundred pre-schools (50 Government and 50 private schools) were identified using stratified random sampling technique from Medak District of Telangana state. The teachers of selected schools were interviewed using a schedule. Children's Performance was assessed based on class room observation tool. Results revealed that there was significant association between teachers' educational qualification, experience and salary they receive with the type of management under which they were working. Teachers' implementation of creative activities differed significantly depending on their educational qualification and also on type of school.

**Keywords:** Childhood education, human life, attitudes, education

### Introduction

Providing quality early childhood education is an important need of present day educational system not only for framing good foundation through holistic development for young children but also to improve quality of academic performance of a child at primary and secondary levels. Teaching is a demanding job, and especially teaching in early childhood education significantly is important that an urgent approach to be applied to make quality pre-school learning available to children. In recent years, growing knowledge of the critical importance of early childhood development for lifelong learning and growth had led to increased calls for the professionalism of early childhood educators, including higher standards for their training and education. The knowledge, skills, and practices of early childhood educators are important factors in determining quality of young children's learning and their preparation for entry into elementary school. Although good teachers are crucial for every grade level, it is especially important that pre-school teachers are to be effective.

One of the main challenges for policy makers facing the demands of a knowledge society is how to sustain teacher quality and ensure all teachers continue to engage in effective on-going professional learning. Research on the characteristics of effective professional development indicates that teachers need to be evaluated for their personal and professional qualities. Evaluation can play a key role in school improvement and teacher development (OECD, 2005) [7].

Research has shown a significant relationship between the quality of a pre-school centre and improved child outcomes. There was also a positive relationship between the qualifications of staff and ratings of quality.

Children made more progress in pre-school centres where staff had higher qualifications. Having trained teachers working with children in pre-school settings had the greatest impact on quality, and was linked specifically with better outcomes in pre-reading and social development at age 5 years.

The Government of India approved the National Early Childhood Care and Education (ECCE) Policy in 2013. The Policy framework also includes the National Curriculum Framework and Quality Standards for ECCE.

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3.4.5 (1)

3.4.5 (6)

3.4.8 (2)

3.4.9 (5)

# AN OVERVIEW OF BALANCED DIET ON COVID-19

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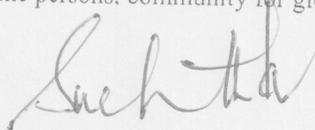
## Abstract

Covid19 is a respiratory disease which was declared as pandemic by world health organization (WHO). It was affected from animal to humans and now all humans are in self-isolation to prevent the spread of viral infection. Vulnerable groups especially children, women and old people are at risk of getting affected by respiratory infections. During quarantine due to self-isolation and less exposure to outside world might lead to consuming high rate of diets which are high in saturated fats, simple sugars, refined carbohydrates which might lead to metabolic disorders like obesity which can complicate other health issue like hypertension, cardiovascular disease, diabetes increasing the risk of covid19 pathology and mortality. Optimal nutrition and dietary nutrient intake impact the immune system and helps in strengthening the immune system. A proper diet can ensure that the body is in proper state to defeat the viruses. Nutrition plays a key role in health which most importantly when taken as balanced diet with adequate requirement of complex carbohydrate like whole grains, protein rich legumes and meats, vitamin and mineral rich fresh fruit and vegetable which have all antioxidants, known as protective foods helps in boosting the immune system and increase the potential response to viral vaccine preventing the infections of respiratory tract during self-isolation and quarantine lockdown.

**Keywords:** COVID-19, Respiratory infections, Vitamin-D, CRP, Vulnerable groups, Balanced diet, Immune system.

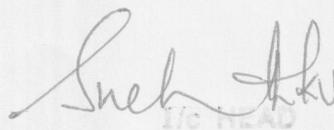
## Introduction

Covid-19, a viral disease which is caused by a novel corona virus, has become a global threat for humans which has turned into a pandemic. According to WHO, pandemic is defined as the "world wide spread of new disease". The corona virus is one of the major pathogens which mainly targets the respiratory system [1]. Reports suggested that the onset of a possible corona virus outbreak called SARS-COV2, which is causing the disease covid-19. WHO has declared that the present epidemic as global public health emergency[2]. The psychological and behavioral countermeasures of the individuals and the community have been the vital determinants which helps to improve the pliability and also enhance the effectiveness of the public health approaching the pandemic which are magnitude similar to covid-19 [3]. The nutritional status of the individual has been the indicates against destabilization. Inadequate nutrition leads to health effects. A poor diet quality has its effect on not only on physical health but also on mental health. Therefore, optimal nutrition is a resource that helps the persons, community for global influence [4].



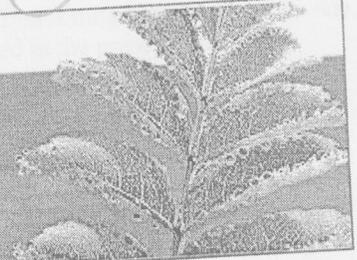
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## Impact of parenting styles adopted by mother's on academic achievement of elementary school children

**E Lakshmi Devi and Dr. B Swaroopa Rani**

### Abstract

Parenting styles are defined as set of attitudes; beliefs and goals parents have and put into practice in their daily interactions with their children. Baumrind (1971) has mentioned three types of parenting styles viz., authoritative/democratic, authoritarian and permissive parenting styles. The quality of the parent-child relationship influences how well children do in school. The present study was under taken to know the parenting styles adopted by mothers and impact on academic achievement of elementary students. The study sample were 200 (100 elementary school children from 3 Government and 3 Private schools and 100 mother's of sample children) of Kurnool town. Sample was selected by using multistage random sampling technique. Mothers were administered with Parenting Style Questionnaire and Academic performance of sample children were collected from school as a form of marks. Results revealed that Majority of the mothers were following authoritative parenting style. Sample children's did not differ significantly in their academic achievement according to child variable like gender, age, birth order, type of school, and class of studying. Sample children differed significantly in academic achievement in relation with parenting styles adopted by mothers. Children perform high whose mother's are using authoritative parenting style compare to other parenting styles. The t values (2.611  $p < 0.001$ ) was significant.

**Keywords:** Parenting styles, academic achievement, disciplinary techniques, parent child relationship

### Introduction

Parenting style refers to the normative patterns of behaviour and practices that parents use to socialize and control their children. Parenting style is a psychological construct representing standard strategies that parents use in their childrearing. Parenting practices are a way of expressing the parenting styles. According to Baumrind (1971) [2], the following are the methods of implementation of different parenting styles.

**Authoritarian Parenting Style:** This term describes parents, who show low support, control their children, and demand them to follow specific rules. Lower responsiveness and higher demanding are two elements that describe authoritarian parenting. Parents who scored higher on demanding and lower on responsiveness are considered as authoritarian parents. Authoritarian parents are frequently not warm.

**Authoritative Parenting Style:** This term refers to parents who are responsive, supporting, and attached to their children.

**Permissive Parenting Style:** This term describes parents who exhibit behaviors that highly support their children and are very lenient to their children. High responsiveness and lack of demanding are two elements that describe permissive parenting. Parents play a crucial role in academic achievement of children, in general, parental involvement is associated with children higher achievements in language and mathematics, enrolment in more challenging programs, greater academic persistence, better behaviour, better social skills and adaptation to school, better attendance and lower drop-out rates (Henderson & Mapp, 2002) [3].

### Methodology

**Sample:** The sample of the study constituted 100 elementary school children (48 boys and 52 girls) from Government and Private schools of Kurnool town. Mothers of the selected children that is (n= 100) constituted the sub samples of the study.

  
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3.4.5 (4)  
3.4.9 (3)

## OSMOTIC DEHYDRATION OF PINEAPPLE BY APPLYING THIN LAYER DRYING KINETICS

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### Abstract

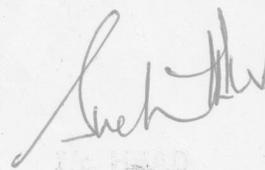
Osmotic Dehydration is a method for the partial dehydration of water containing foods, such as fruits and vegetables by immersing them in a concentrate solution of sugar or salt. Drying process play an important role in food preservation. This dehydration process can increase the shelf life of the products. They are defined as a process of moisture removal due to simultaneous heat and mass transfer. The combination of both thin layer drying and osmotic dehydration process was employed for pineapple. An attempt has been made to know the effect of drying on temperature and time taken for the different diameters of pineapple rings. Semi ripened pineapple fruits were peeled and made into rings of 1cm thickness and gently blotted with absorbent paper. The rings were immersed in 60<sup>0</sup> brix sugar syrup at 32<sup>0</sup> c temperature for 3 hours. The pineapple rings were taken out from osmotic solution, rinsed and blotted using blotting paper. The pineapple rings were placed in the laboratory model thin layer dryer. The weights of the samples were recorded for every 30 minutes. Drying was carried out at an air flow rate of 24M3/Min/m<sup>2</sup> (0.4ms). The thickness of pineapple rings effects the drying time at different temperatures i.e., 50, 55, 60 & 65<sup>0</sup> C. Hence the current investigation on "thin-layer drying kinetics of osmotic dehydrated pineapple rings" can be used as alternative technology for preservation of pineapple.

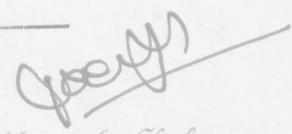
**Key Words:** Drying Kinetics, Mass Transfer, Shelflife, Osmotic Dehydration.

### Introduction

Fruits are highly seasonal and do come up only in favorable soil and climatic conditions. Fortunately, the agro climatic conditions in India favor for the cultivation of wide-variety of fruits and vegetables. In India about 3.3 million hectares of land is under fruit cultivation and the production was nearly 32.95 million tones. However, for various reasons, this abundance of production is not fully or satisfactorily utilized, as it should be about 25 to 30 percent of it is wasted due to improper handling, lack of transportation and storage facilities and by spoilage. To avoid the wastage, the surplus could be processed and preserved properly. Fruits are generally preserved by canning, refrigeration or by drying. Moreover, tropical fruits will not be stored well in cold storage and are not generally responsive to controlled ripening conditions.

Food is very essential part and parcel of living system. Food is classified as perishable, semi-perishable, based on its shelf life. Perishable foods are those that get spoiled faster due to relatively higher water content compared to other. Water is the major component

  
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# EFFECT OF CASEIN EDIBLE COATING ON THE POSTHARVEST QUALITY OF FRESH GUAVA FRUITS DURING AMBIENT STORAGE CONDITIONS

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## Keywords:

Casein;

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## ABSTRACT

Maintaining quality of fruits is an important task in fresh food retailing throughout the supply chain. Fruits fall under perishable foods because they quickly respond to chemical, physical, and biological changes which lead to quality aspects. Edible coatings are used to prevent the physicochemical changes in fruits during the storage and transportation. In the present study, Casein was chosen as a bio-based edible coating material, enriched with ascorbic acid and was applied on fresh guava fruits to study the delay of ripening and other quality properties. Different concentrations of casein were fortified with 1% of ascorbic acid and applied on whole guava fruits as coating. Fruits were treated with 5% and 10% casein with and without ascorbic acid, fortification process was established to maintain and enrich the vitamin C content in the fruits to reach maximum levels to the consumers. Experimental samples were coded as S1, S2, S3, S4 and sample (So) without coating is considered as control. The fruit samples were stored at (26±1°C) for a period of 16 days. Various physicochemical, biological parameters and microstructural studies were tested to evaluate freshness, nutritional status, and keeping quality during the storage. Fruit ripening, firmness and various visual quality aspects like appearance, defects, and shrinkage rates were studied to understand the physical quality of the fruits upon storage period. During storage, results shows that all casein treated samples were noted with decreased firmness, titratable acidity and delayed chlorophyll content, microbial load while the pH, TSS, carotenoids were increased along the storage when compared with control sample and all the coated samples were found glossy appearance with acceptable flavor. This study prompt that casein is an ideal, promising coating to preserve the quality and extends the post-harvest life of guava fruits.

## 1. Introduction

Guava (*Psidium guajava* L.) is a well-known subtropical fruit grown widely in tropical and subtropical regions of the world. Fruits are rich in vitamin C (260 mg /100g) and a fair source of calcium, phosphorus, iron, and vitamin A (Rashida et al., 1997). Due to its characteristic nature, ripened fruits are very perishable with a very short shelf life ranging from 2-3 days at ambient temperature. Simple, low-cost

technologies with improved post-harvest practices will minimize the qualitative and quantitative loss of harvested fruits from field to consumption. Edible coating (EC) is such type of post-harvest practice used to coat whole fruits to reduce the physical and biological reactions responsible for the quality deterioration. Edible coatings are formed a thin layer on the surface of the fruit, can be eaten as whole along with the fruit or can be removed with gentle washing with

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3.4.15 (1)

3.4.15 (7)  
3.4.19 (6)

# Effect of Calcium of Lactose Free Millet Milk on Growth and Development in Albino Weanling Rats

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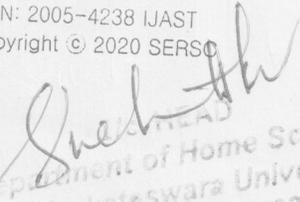
## Abstract

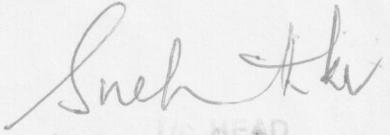
Background: Calcium, the very important mineral helps in growth and development of infants. Calcium helps in building strong bones, teeth, proper functioning of nerves and muscle, blood clot and in activating the enzymes that convert food into energy. Infants and Children are growing new bone all the time, they need continuous supply of calcium to support the healthy growth. Milk is the only food for infants which is richest source of calcium. Some infants are sensitive to lactose in milk because they have Lactose Intolerance. The present study aims to develop an alternate milk for lactose intolerance infants with finger millet and pearl millet. Method: Traditional methods were used to process the millets which help in retaining and increasing the nutritional content in millets. The millet milk was analyzed for calcium content using the ICPMS. The millet milk was supplemented for 6 weeks to albino rats in comparison with cow milk. The tibia weight and length were measured and calcium content in tibia was analyzed. Result: The calcium content of the millet milk was 80mg/100ml where as in cow milk it was 120mg/100ml. The mean calcium content of the tibia in albino rats was 15.35±3.50mg/dl fed with millet milk and 20.40±3.74mg/dl in rats fed with cow milk. Conclusion: The developed millet milk contain good amount of calcium on par with cow's milk, it can be used as substitute milk for lactose intolerant infants.

**Keywords:** Bone calcium, Cows milk, Finger millet, Lactose intolerance, Millet milk, Pearl millet, Tibia,

## 1.1. Introduction

Millets are traditionally processed using either malting or fermentation. Malting of millets helps in improving the digestibility with beneficial effects of lowering the antinutrients along with improving sensory and nutritional quality. Millets are rich in calcium [1]. Calcium is an important mineral which helps in strengthening of bones till the age of 20-25 and in later age it helps in maintaining bone density. The calcium requirement is high during the growth years of infancy and childhood [2]. It plays an important role in the formation process of new bone and maintenance of existing bone by collaborating with other factors such as phosphorous, vitamin- D and calcium-binding proteins [3]. Optimizing calcium and bone status during infancy can have immediate homeostasis and preventing disturbances in bone mineralization and can provide long term benefits by helping infants genetic

  
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# ROLE OF CONSUMER FORA IN CONSUMER PROTECTION IN INDIA

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## 1. INTRODUCTION

Consumer movements spread through out the world to protect consumers from exploitation of unscrupulous manufacturers, traders and service providers. Almost all the countries enacted statutes to protect consumers and to promote welfare of the society. In India too, Consumer protection Act, 1986 has been enacted and amended from time to time<sup>1</sup>.

Consumer protection has its deep roots in the rich soil of Indian civilization, which dates back to 3200 BC. In ancient India, human values were cherished and ethical practices were considered of great importance. In ancient India, all sections of society followed 'Dharma sastras' which were derived from 'Vedas', the primary sources of law in India. The ancient period documented the living conditions of the people 'smritis'. Among them, the manu Smriti (800 BC to 600 BC); the yajnavalkya Smriti(300 BC to 100 BC). The Narada Smriti(100 AD to 200 AD), the Bruhaspati Smriti(200 AD to 400 Ad) and the Katyayana Smriti(300 AD to 600 AD) are considered as authoritative texts. Consumer protection was also a major concern in these 'Smritis'.

In the medieval period, consumer protection continued to be of prime concern of the rulers. During Muslim rule, a large number of units of weights were used in India. During the Sultanate period, the prices used were determined by local conditions. During the rule of Alauddin Khilji, strict controls were established in the market place. Alauddin fixed the maximum price of a number of essential goods such as wheat, barley, rice, pulses, cloth, sugar, sugarcane, fruit, animal fat, besides slakes, horses and livestock. He ordered the merchants not to sell for more prices than the fixed price. He ordered the merchants to enrol their names in a register. Storing (hoarding) paddy, cereals was prohibited. Black marketing was also taken as a serious issue. For the violation of the orders, harsh punishments were imposed on the defaulters such as imposition of fines, imprisonment, expulsion from the capital, cutting flesh from the face etc. to implement and supervise the market reforms, the officers like 'Diwani-Riyasat', 'Sahana-i-mandi' were appointed. The merchants were severely punished for defective weights and measures. Sometimes the less weightage was compensated from the body of the merchant. The Sultan himself used to get reports from the market number of times on a day. To test practically, he used to personally send the slave boys to the market to get eatables.

In the modern period, the British system of administration continued the protection of consumers by enacting a number of Acts such as Sale of Goods Act, 1930, the Drugs and Cosmetics Act of 1940, the Indian Penal Code of 1860 and many others Acts.

## COMMON LAW AND THE CONSUMER (Caveat Emptor)

The English Common Law followed the principle of 'Caveat emptor' (Let the buyer beware) of Roman Law, which lays down that the vendor of land or goods is answerable in damages to the purchaser if the purchaser is evicted from the and or sustains any damage and it is the liability of the vendor to tender a good title and warranty for the property sold. The principle of 'caveat emptor' lays down that it is the duty of the buyer to satisfy himself before purchasing the article, that the article which he buys, is the one which he wants. This principle, later, is enunciated in Section 16 of the Sale of Goods Act, 1930, in England.

## SCHOLARLY E-JOURNALS ON LAW WITH REFERENCES TO DIRECTORY OF OPEN ACCESS JOURNALS (DOAJ)

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**Abstract:** *This paper study scholarly OA journals in law, with the advent of the Internet and electronic publishing, new models of scholarly communication have emerged that simultaneously complement and challenge established systems. Open Access is taken broadly to mean that accessing, downloading, and reading material is free to the entire population of Internet users, several options for the provision of that access have emerged. Library should introduce to their users to access full text e-books, e-journals, e-database those are freely accessible from Internet. This paper deals with scholarly and peer reviewed open access journals accessible from Directory of Open Access Journals (DOAJ) in law. Study found that the only 332 law journals are published in English language from 2005 to 2020. The majority of the journals are published in 2020 and most of them are Creative Common License publications, 17.77% of the journals publishing by Indonesia, and Maximum number i.e. 68.67% of the double blind peer reviewed e-journals.*

**Keywords:** Directory of Open Access journals, DOAJ, Law Journals, E-Journals, Scholarly e-Journals.

### **Introduction**

Librarianship has shifted from use of printed and manually operated system to world wide access to information. Libraries these days have consortia, and use electronic resources and databases so that they can provide better services to the users. Modern libraries have evolved from paper-based storehouse of books and journals into distributed network of digitized information and knowledge, now known as digital libraries. Now access of information is no longer restricted to what is physically available in a particular library. Information is accessible from a wide variety of globally distributed commercial repositories such as electronic publishers and aggregators with access charge. However, it is also accessible from open access journals, open access archives, few websites and

## **CRITICAL BOOK REVIEWS IN GOODS AND SERVICE TAX (GST)**

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### **Introduction**

Good reviews convey the content of the book, the author's approach to the subject, and the author's conclusions; the best reviews avoid a point-by-point listing of themes in favor of a more integrated approach. Good reviews place the work in the context of its field and give a sense of the work's significance. Good reviews present a balanced analysis of the book strengths and weaknesses and illustrate those points with examples. Good reviews are written in a clear and lively style. Style is not easy to define, but the best reviews illustrate that elusive quality which makes their piece both interesting and engaging.

Goods and Services Tax (GST) fast growing and extremely active subject. The last twenty years have seen an overwhelming accumulation of data, and a panoply of important discoveries. The purpose of Reviews in GST is twofold: to keep the reader up-to-date on achieved advances in the Law and Taxation rapidly expanding fields of taxation service and to offer perspectives on where these developments will lead.

### **Book Reviews on Goods and Services Tax (GST)**

**Ajay Srivastava (2017)** book is a factual, simply-written ready-reckoner to GST for business owners and practitioners starting from scratch, to understand the architecture and intricacies of the new tax system. The author's no-frills approach weeds out the legalese from the original Act and presents the changes in a ready-to-consume format. He also illustrates GST's more convoluted provisions such as those on stock transfers, input tax credit, the filing of returns and the taxation of e-commerce with live examples. The key concerns that SMEs flag with respect to the GST transition relate to the taxation of stock transfers, the treatment of job work contracts, the presumptive composition scheme, the transitional provisions on stock and the reverse charge mechanism. These get detailed treatment in this book. An entire chapter is devoted to record-keeping requirements under GST. There's also a live walk-through of how an SME can migrate to the new system. Also, several of GST rates and

## Awareness and Utilisation of "Web 2.0 To 4.0 Tools" Among the Students and Research Scholars of Yogi Vemana University, Kadapa, Andhra Pradesh

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**Abstract:** The advent of Web innovations and technologies made the Web as a great platform for Higher Learning and Research. Sitting somewhere and accessing the content from anywhere is a dream during the 1980's. Today the Web has grown like a Universe of interlinked web pages that contains Audio, Video, and Interactive content in addition to text and images. Existing web technologies and browsers make Web as a huge network of websites with vast content spread over millions of machines throughout the globe. Since Collaboration and Sharing of views and information plays a vital role in Higher learning, present Web tools like Learning Management Systems (LMS), Blogs, Wikis, Instant messaging (i.e. WhatsApp, Google hangouts, telegram & skype), Podcasting, RSS (Really Simple Syndication) feeds, cloud storage, Google docs, Social book marking (Delicious, dig & StumbleUpon), Social networks (Facebook, Twitter, Google +, LinkedIn) have enormous increase in adaptation. During the starting period of Web, when Tim Berners-Lee launched the concept of Web, the technical community called it as Read only Web. Now the scenario has been changed a lot with innovations related to web services. The present study is conducted to know the awareness and utilisation of Web 2.0 to 4.0 tools among the students and research scholars. It is clear from the study that most of the respondents are aware of and utilising Web 2.0 tools. The utilisation is less on Web 3.0 -4.0 tools among the students and scholars. The University has to conduct more number of awareness programs on how to utilise Web 3.0 and 4.0 tools for the benefit of the students.

**Keywords:** Awareness, Utilisation, Web 2.0 to 4.0 Tools, ICT, Yogi Vemana University.

### 1. Introduction

A Web is referred to as a collection of website and web services. It is constantly evolving by incorporating new technologies thereby increasing the services provided by the Web. When compared with the web, the Internet is treated as a hardware platform with network of networks connected throughout the globe, whereas Web is software with a collection of websites with vast content. Web 1.0 (Read-only Web) also referred to as a Content Delivery Network (CDN). It consists of Static websites intending to present the content to potential users, like a catalogue or a brochure. HTTP is a protocol used for communication. Open

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3.4.8

3.4.8

## Bibliometrics of the publications during the last academic year based on average citation index in Scopus// Indian Citation Index

No	Department	Title of the Paper	Name of Authors	Title of journal	Year of publication	Citation Index	Institutional affiliation as mentioned in the	Volume & Issue No. &	DOI
1	Mathematics	Heat and mass transfer in MHD Casson nanofluid flow past a stretching sheet with thermophoresis and Brownian motion	A.C. Venkata Ramudu, K. Anantha Kumar N. Sandeep, V. Sugunamma	Heat Transfer – Asian Research	10-Jul 2020	12	Department of Mathematics, S.V. University, Tirupati	49, Issue 8 pages 5020-5037ISSN: 2688-	doi.org/10.1002/h tj.21789
2	Mathematics	Physical aspects on MHD micropolar fluid flow past an exponentially stretching curved surface	K. Anantha Kumar, V. Sugunamma, N. Sandeep, S. Sivaiah	Defect and Diffusion Forum	15-Sep 2020	12	Department of Mathematics, S.V. University, Tirupati	Vol. 401, Pp. 79-91	
3	Mathematics	Effect of thermal radiation on MHD Casson fluid flow over an exponentially stretching curved sheet	Anantha Kumar K., Sugunamma V. & Sandeep N.	J Therm Anal Calorim	20-Oct 2019	55	Department of Mathematics, S.V. University, Tirupati	140, 237 7-2385	doi.org/10.1007/s 10973-019-08977- 0
4	Mathematics	Influence of viscous dissipation on MHD flow of micropolar fluid over a slendering stretching surface with modified heat flux	Anantha Kumar K., Sugunamma V. Sandeep N.	J Therm Anal Calorim	11-Nov	46	Department of Mathematics, S.V. University, Tirupati	139, 366. 1-3674	doi.org/10.1007/s 10973-019-08694- 8
5	Mathematics	Impact of Soret and Dufour on MHD Casson fluid flow past a stretching surface with convective-diffusive conditions	VenkataRamudu, A.C., Anantha Kumar, K., Sugunamma, V	J Therm Anal Calorim	22-Feb 2021	3	Department of Mathematics, S.V. University, Tirupati		doi.org/10.1007/s 10973-021-10569- w

### 3.4 Research Publications:

Sl. No	Department	Title of the Paper	Name of Authors	Title of Journal	Year of Publication	Valume & Issue No&ISSN
1	Mathematics	Heat and mass transfer in MHD Casson nanofluid flow past a stretching sheet with thermophoresis and Brownian motion	A.C.Venkata Ramudu,K.Anantha Kumar,V.Sandeep, V.Sugunamma	Heat transfer-Asian research	10-Jul	ISSN:2688-4542
2	Mathematics	Physical aspects on MHD micro polar fluid flow past an exponentially stretching curved surface	K.Anantha Kumar, V.Sugunamma, N.Sandeep, Sivaiah T.	Defect and Diffusion Forum	15-Sep	Vol.401,pp.79-91
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4	Mathematics	Influence of viscous dissipation on MHD flow of ,micropolar fluid over a slandering sstretching surface with modified heat flux model	Ananth Kumar K, Sugunamma V Sandeep N	J Therm Anal Calorim	11-Nov	139,3661-3674
5	Mathematics	Heat and mass transfer in MHD cassonnanofluid flow past a stretching sheet with thermophoresis and Brownian motion	Venkata ramudu A.C Anantha kumar K Sugunamma V Sandeep N	Heat Transfer	21-Dec	49, Issue 8 Pages 5020-5037
6	Mathematics	Impact of soret and dufour on MHD casson fluid past a stretching surface with convective-diffusive conditions	Venkataramudu A.C Anantha kumr K Sugunamma V	J thern Anal calorim	22-Feb	
7	Mathematics	Intnersection graph of zero divisors of the ring Z	Shaik sajana, K.K.Srimitra, D.Bharathi	AIP Conference	July,2020 2	2246, pp 020097-1-020097-6,ISBN 978-0-7354-2005-2
8	Mathematics	Generalized( $\sigma, \tau$ )-semiderivations on prime nearrings	C.Gangi Reddy, D.Bharathi	AIP conference	July, 2020	PP020043-1-020043-6 ISBN 978-0-7354-2005-2
9	Mathematics	( $\sigma, \tau$ ) semiderivations of prime nearrings	C.Gangi Reddy, D.Bharathi	Journal of xidian university		14,issue8,2020 pp1208-1213, Issn 1001-2400
10	Mathematics	Classical paris in Zn	T.Chalapathi, Shaik sajana D.Bharathi	Notes on Number theory and Discrete Mathematics		ISSN 1310-5132, vol,2020, No.1,59-69, 1-26-2020
11	Mathematics	Co-Fuzzy Bi-ideals and Co-Fuzzy prime ideals of finite T- nearring	D.Bharathi, P.Venkata rao, K.Balakoteswara Rao	Strad research journal	June, 2021	Vol.8,Issue 6 Page 402-413, ISSN 0039-2049
12	Mathematics	Co-Fuzzy sub ordered finite gamma near rings	D.Bharathi, P.venkatrao, K.Balakoteswara Rao	International journal of Advance Research ideas and innovations in technology	June, 2021	3-v713-1172, ISSN 2454-132x
13	Mathematics	Co-Fuzzy ideals of finite I- near ring	D.Bharathi, P.venkata rao, K.Balakoteswara Rao	International journal of Mathematical archive		ISSN 2229-5046
14	Mathematics	Co-vague subordered finite t-nearrings	P.Venkata rao, D.Bharathi,	Journal of engineering	May, 2021	Issue 05, page no.42-48

			K.Balakoteswara Rao	sciences		ISSN:0377-9254
15	Mathematics	Commutativity of prime rings with symmetric bi derivations on ideals	B.ramamoorthy Reddy, K.Amarnadha Reddy, C.Jaya Reddy	University of Architecture & Technology	Aug, 2020	Pp 1350-354 ISSN 1006 7930
16	Mathematics	Orthogonal reverse derivations and symmetric reverse bi derivations of semi prime ring	B.Ramamoorthy Reddy and C.Jayasubba Reddy	Journal of XI'an University of Architecture & Technology		Pp 21-25 ISSN 1006-7930
17	Mathematics	Life ideal and generalized $(\sigma, \tau)$ derivations in prime rings	C.Jayasubba Reddy, C.Venkata sai Ragavendra Reddy and K.Nagesh	Journal of XI'an University of Architecture & Technology	Nov, 2020	Pp 463-470 ISSN 1006-7930
18	Mathematics	Prime gamma rings with centralizing and commuting symmetric bi derivations	C.Jayasubba Reddy, C.Venkata sai Ragavendra Reddy and K.Nagesh	Journal of Xidian University	Feb,2021	Pp 181-187 ISSN 1001-2400
19	Mathematics	Homomorphism or Anti-Homomorphism of left $(\sigma, \tau)$ - Derivations in prime	C.Jayasubba Reddy, Sk.Haseena	International journal of Mathematical archive	May, 2021	Pp 45-49 ISSN 2220-5046
20	Mathematics	$(a,1)$ -reverse derivations on prime near-rings	C.Jayasubba Reddy, Sk.Haseena	International journal of Algebra		Vol.15 ISSN 1314-7595 Issue 4, PP 165-170
21	Mathematics	Sum of the degrees of an interval graph using Euclidean division algorithm	Dr.A.Sudhakariah, P.Obuleshu, T.Venkateswarlu, K.Narayana	STRAD research	2020	Vol.7 Issue 7 ISSN 0039-2049
22	Mathematics	Find labeling numbers of paths and squares of paths using an interval graph G	A.Sudhakariah, T.Sivaiah	IJRAR	Nov, 2020	Vol.7 Issue 4 ISSN 23481269
23	Mathematics	Find labeling numbers of all powers of paths using an interval graph G	A.Sudhakariah, T.Sivaiah, R.Jyosna Priyadarshini, P.Obulesh	IJS DR	Dec,2020	Vol.5 Issue 12 ISSN 2455-2631
24	Mathematics	Various properties on degrees on complimentary dominating sets per circular-ARC graph	A.Sudhakaraiah, T.Visalakshi, T.Venkateswarlu K.Narayana	STRAD research	2021	Vol.8 Issue 6 ISSN 0039-2019

24	Mathematics	Some properties on degrees of dominating sets for circular-arc graph	A.Sudhakaraiyah T.Visalakshi, T.Venkateswarlu K.Narayana	International journal of applied engineering research	2021	Vol.16 no.5 ISSN 0973-4562
25	Mathematics	Sum of the degrees of the vertices in the circular-arc graph using Euclidean division lemma	A.Sudhakaraiyah T.Visalakshi, T.Venkateswarlu K.Narayana	STRAD research	2021	Vol.8 Issue 7

3.4.5

## 3.4 Research Publications:

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Sl. No	Department	Title of the Paper	Name of Authors	Title of Journal	Year of Publication	Volume & Issue No&ISSN
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**Number of Research Papers per Teacher in the Journals  
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**1. Prof. G. Bhanodaya Reddy**

Title of paper	Name of the author/s	Department of the teacher	Name of journal	Year of publication	ISSN number	Link to the recognition in UGC enlistment of the Journal
Effect of Shot Peening Exposure Time on Mechanical Behavior of Al 7075-T6 Alloy	Venumurali Jagannati, Bhanodaya Reddy Gaddam and Bhanu Palampalle	Mech. Engg.	SAE Journal	2020	0148-7191	Scopus*

“\*” denotes in the journals which are indexed in scopus are all are listed in UGC care list.

**2. Prof. P. Venkataramaiah**

Title of paper	Name of the author/s	Department of the teacher	Name of journal	Year of publication	ISSN number	Link to the recognition in UGC enlistment of the Journal
Experimental Investigation on Surface Integrity of Inconel 718 under Hot Machining and Optimisation of its Process Parameters	Kiran Kumar and P. Venkataramaiah	Mech. Engg.	Advances in Materials and Processing Technologies (Taylor and Francis)	2021	2374-068X	Scopus*
Performance Analysis of Solar Parabolic Collector Using Al <sub>2</sub> O <sub>3</sub> Nanofluids	V. Hari Haran, Venkataramaiah P	Mech. Engg.	European Physical Journal (EPJ) Plus	2021	2190-5444	Scopus*

  
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Mathematical modelling and analysis of parabolic collector	V. Hari Haran, Venkataramaiah P	Mech. Engg.	Materials Today: Proceedings (Elsevier)	2021	---	Scopus*
Prediction of dynamic parameters in turning of aluminum metal matrix nano composite by using constitutive models and FEA	M. Madduleti., P. Venkata Ramaiah	Mech. Engg.	Manufacturing Technology Today	2021	---	---

3. Prof. V. Diwakar Reddy

<b>Title of paper</b>	<b>Name of the author/s</b>	<b>Department of the teacher</b>	<b>Name of journal</b>	<b>Year of publication</b>	<b>ISSN number</b>	<b>Link to the recognition in UGC enlistment of the Journal</b>
Effect of process parameters on petal height and heat generated during bushing formation in form drilling of A18011	Y. Bhargavi, V. Diwakar Reddy, P. Bhaskara	Mech. Engg.	Materials Today: Proceedings (Science Direct)	2021	2214-7853	Scopus*

4. Dr. P. Hema

  
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<b>Title of paper</b>	<b>Name of the author/s</b>	<b>Department of the teacher</b>	<b>Name of journal</b>	<b>Year of publication</b>	<b>ISSN number</b>	<b>Link to the recognition in UGC enlistment of the Journal</b>
Experimental Investigation on Similar and Dissimilar Alloys of Stainless-Steel Joints by Laser Beam Welding	Narayana Reddy Bijivemula, Hema P & G. Padmanabhan	Mech. Engg.	Advances in Materials and Processing Technologies (Taylor & Francis Group)	2021	2374-068X	Scopus*
Experimental Investigations on Inconel 625 Alloy Using Plasma Arc Machining	Hema Pothur, Ramprasad Ganesan and K. Aruna	Mech. Engg.	International Journal of Manufacturing, Materials, and Mechanical Engineering (IJMME), IGI-Global	2020	2156-1680	Scopus*
Influence of Process Parameters on 6065 – T6 Aluminum Alloy Using CNC End Milling – A Fuzzy Approach	Dr. P. Hema, U. Sainadh, B. Vinod Kumar	Mech. Engg.	Paripex - Indian Journal of Research of Research	2020	2250 – 1991	--
Experimental Analysis and Optimization of Process Parameters on Weld Characteristics of SS 410 Using TIG Welding	Dr. P. Hema, M. Vinay Kumar, U. Sainadh	Mech. Engg.	International Journal of Research in Engineering and Science (IJRES)	2020	2320-9356	--

  
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**Number of Research Papers per Teacher in the Journals  
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Department of Mechanical Engineering, SVU College of Engineering, Tirupati**

<b>Title of paper</b>	<b>Name of the author/s</b>	<b>Department of the teacher</b>	<b>Name of journal</b>	<b>Year of publication</b>	<b>ISSN number</b>	<b>Link to the recognition in UGC enlistment of the Journal</b>
Process Parameters Optimization of EDM for Machining on HCHCR D3 Steel Using ANOVA	Dr. P. Hema, G. Jagadish, B. Vinod Kumar	Mech. Engg.	International Journal of Creative Research Thoughts (IJCRT)	2020	2320-2882	..
Optimization of Process Parameters for the Machining of Microslot on Copper Workpiece Using LBM by Grey Relational Analysis and ANOVA	P. Hema, M. Reddeiah, B. Narayana Reddy	Mech. Engg.	International Journal of Research and Review (IJRR)	2020	2454-2237	..
Effect of Influential Parameters on MRR and Optimization of Abrasive Water Jet Machining Process Parameters of Glass – Epoxy Particulate PMC Using Grey Relation Analysis	Dr. P. Hema, A. Nagabhushana Rao, M. Reddeiah	Mech. Engg.	International Journal of All Research Education and Scientific Methods (IJARESME)	2020	2455-6211	..

5. Dr. A. Sreenivasulu Reddy

<b>Title of paper</b>	<b>Name of the author/s</b>	<b>Department of the teacher</b>	<b>Name of journal</b>	<b>Year of publication</b>	<b>ISSN number</b>	<b>Link to the recognition in UGC enlistment of the Journal</b>
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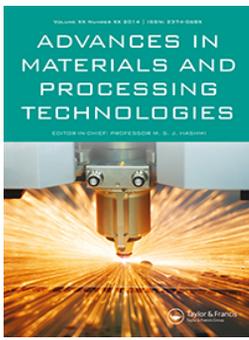
  
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Study on Application of Six Sigma in Shoe Manufacturing Industry	Sreenivasulu Reddy A, Yenupuri Sunil, Madhavi Reddy G V	Mech. Engg.	International Journal of Research in Engineering and Science (IJRES)	2021	2320-9356	--

  
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## Experimental investigation on surface integrity of Inconel 718 under hot machining and optimisation of its process parameters

A. Kiran Kumar & P. Venkataramaiah

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# Experimental investigation on surface integrity of Inconel 718 under hot machining and optimisation of its process parameters

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Department of Mechanical Engineering, S. V. University, Tirupati, India

## ABSTRACT

In the present paper, the Inconel alloy's heat-based machining has been conducted to analyse this influence on surface integrity. The pre-heating softens the workpiece, which indeed reduces the yield strength to make machining easier. However, the impact of pre-heating on residual stress required more focus, which indeed has an impact on fatigue life, so the experiments conducted with different cutting conditions such as speed, cutting tool, feed rate, and depth of cut with reducing of residual stress and surface roughness. The experimental results are compared with simulation results performed using ABAQUS/Explicit, which are acceptable. The optimal parameters determined using grey relational analysis (GRA) optimisation approach are TiN coated tool, speed 50 m/min, feed 0.11 mm/rev, depth of cut 0.3 mm, and pre-heating temperature 600°C. From the obtained optimum parameters, the experiment has been carried out to validate the result. From ANOVA, it is identified that the pre-heating temperature is the top influential factor among all the factors.

## ARTICLE HISTORY

Accepted 3 December 2020

## KEYWORDS

Hot machining; Inconel 718; surface integrity; GRA; ANOVA

## 1. Introduction

In the metal cutting industry, the major challenge in machining is to increase the machined parts of quality and productivity. Material like Nickel-based alloy requires improvement in machining because it is one of the remarkably hard-to-cut materials. Since it has ample scope in aerospace applications, specifically in aircraft engines and gas turbines, we need to find a better way to improve its productivity. Heat-assisted machining for hard-to-cut materials is the most encouraging method, and in this approach, the workpiece gets softened during heating, leading to reduced shear strength. Inconel 718 alloy is having wide applications in aerospace, chemical, automobile, etc. But properties like low thermal conductivity, great strength, hardness, etc., make machining difficult. Through heat-assisted machining of Inconel 718, machinability can be enhanced. From past research, it is observed that various heating methods have been attempted to improve hard materials' machinability. The influence of pre-heating temperature on chip formation of Inconel 718 alloy is studied and reported that the chip formation at

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# Performance Analysis of Copper Absorber Tube Parabolic Collector

V.Hariharan, P. Venkataramaiah

**ABSTRACT**---The solar parabolic trough collector technology is one of the most reliable technologies in the field of solar thermal. This is due to the fact that temperatures as high as 400° C can be achieved using this technology. The energy development from these systems used for hot water production, process steam requirement, power generation and many more. Majorly they have wide applications in cooking. They are also used to generate steam at higher temperatures which is used to run a subsequent engine.

In the present Paper, performance analysis of copper absorber tube parabolic collector is done for different parameters of the system such as Reflector sheet material, heat transfer fluid, Period of Sun Incidence at different levels the output responses such as Out Temperature of heat transfer fluid, Discharge, and Thermal Efficiency are recorded for each run. The optimization method S/N ratio analysis is applied for determining the optimal parameters level for better responses and the optimum results are confirmed experimentally

**Keywords**- parabolic trough collector, copper absorber tube, Taguchi Design of Experiment, S/N ratio analysis

## I. INTRODUCTION

The worldwide requirement of energy is persistently increasing and makes it ineluctable to make the use of unconventional resources. The sun is one of the substantial energy sources that have the potential to fulfill this rising energy need. Sun is inexhaustible and cleaner source of energy. Solar thermal technology is inevitable in growth of the community as well as the nation. Also, it is important to the nation and to the Earth [1]. Sun is an enormous pool of clean energy and this clean power reaches earth in the form of its rays is known as Solar Energy. Solar energy is an abundant source of energy and is available in plenty. Conversion of these incoming solar radiations can be done directly or indirectly in other useful forms of energy as heat and electricity which can be utilized further as per the requirement of the mankind [3]. The sun is providing an incredible supply of solar energy for over 4 billion years. Solar energy was used by the ancient people to warm their homes and dry clothes but their uses were mostly primitive. Drastic increase in global oil prices, extensive use of fossil fuels, threatening rise in pollution and greenhouse effect have led a large number of countries around the globe to carry out extensive research in this area [7]. This parametric analysis on a parabolic trough collector is performed and is optimized by using taguchi S/N Ratio analysis.

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## II. OVERALL SPECIFICATIONS OF THE SYSTEM

The specifications of solar parabolic trough collector system are given below

Table:I Overall Specifications of the system

component	Specification
Parabolic Reflector	
Length	2.000 m
Arc length	2.000 m
Depth	0.645 m
Focal length	0.340 m
Material	Aluminium Sheet and Glass Mirror
Absorber Tube	Copper with dia. 19.5mm
Working fluids	water and Brine solution
Storage Tank	1(Above the reflector sheet)
Different Meters	
Digital Thermometer	To measure Temperature



Fig.1 Parabolic Trough collector with Copper C101 as Absorber Tube

### Experimental Procedure

Steps that were followed during the experimental investigation are as follows:

Step 1: cleaning of the reflecting surface in order to remove the accumulated dust.

Step 2: Setting and positioning the reflector according to the sun's position. Switching on the mechanism in order to supply water and running the system for 30 min prior to recording the first reading.

Step 3: The time gap between each reading is set to one hour. Flow rate of the heat transfer fluid at the beginning was kept constant to ensure proper reading. The discharge value is noted for every hour.



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# Mathematical modelling and analysis of parabolic collector

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## ABSTRACT

The emphasis on utilizing solar energy is increasing now-a-days. Solar collectors are used to absorb solar radiation and transfer the heat to a working substance. Parabolic trough solar collectors are employed in several applications including in solar power plants. A significant number of researches are being done and efforts are being made to enhance the performance of the solar collectors. In this analysis, we tested the performance of parabolic trough solar collector in different absorber tube conditions: bare copper tube, copper tube enclosed in a glass tube without any heat transfer fluid and with Nano fluid as heat transfer fluid. The experiment was performed with three different working fluids (Water, Ethylene glycol, CuO-water based Nano fluid) in each condition and in each case, instantaneous efficiency, optical efficiency, heat removal factors, inlet and outlet exergies have been calculated. The efficiency was observed to be greater when using Nano fluid as heat transfer fluid.

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## 1. Introduction

Harnessing solar energy efficiently is one of the prime areas of research. The major component of any solar system is a solar collector or concentrator. Solar collectors, an important component of any solar devices, absorb/focus the radiation incoming from the sun and transfer the heat to a transporting material like oil, water and air as internal energy. Solar collector are classified into two categories a) non-concentration collectors example Flat plate collectors, Hybrid PVT collectors, Enhanced hybrid PVT collectors-Bifacial PVT b) Concentrating collectors Example: Parabolic trough collector (PTC), Heliostat field collectors, Parabolic dish collectors. Comprehensive list of these collectors are shown in Table 1 Table 2 Table 3 Table 4 Table 5.

We are mainly focus on the Parabolic trough collector because of it has a good efficiency as compare to the other concentrating collector and requires only single axis tracking.

According to his model the comparison between mathematical modeling and experimental data show some differences. The differences are regarding heat loss and assumption of low thermal absorptivity [1].

Thermal losses and efficiency of parabolic collector using two different absorber materials that are coupled with three different

receiver configurations i.e. air, vacuum and no glass envelope. Performance of collector decreases with the usage of air in annulus, higher performance was shown using cermet coating than black chrome coating [4] Fig. 1.

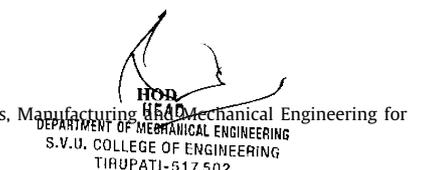
One dimensional numerical model of parabolic trough collector. Collector was divided into number of segments and heat balance equations. The observation was that accurate estimation of thermal efficiency and heat loss under different conditions of flow, operating conditions and selective coating [5,4].

Developed a numerical model of parabolic collector under Algerian climate. According to him rate of heat transfer depends on collector type, heat transfer fluid, ambient conditions and optical properties. He observed that with the increase in temperature of heat transfer tube and absorber tube there is increment in heat loss through parabolic collector and also decrement in heat gain. [2,10] model using heat transfer correlations and studied on optical and thermal properties of parabolic collector. Some differences are observed at high temperature due to optical properties of collector because of incorrect usage of equations related to heat transfer coefficient. Another error was accepting un-irradiated receiver experimental data. This model is uses in accurate determination of heat loss and temperature [6].

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## Study on Application of Six Sigma in Shoe Manufacturing Industry

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### Abstract

Footwear industries are mostly set up in developing countries considering labour rate, availability of raw materials and environmental restrictions as industry uses lot of chemicals in producing final product. It is one of the industries in India that contribute a lot to the economic growth, exports, and imports and provides employment to the backward community with 30% share of women employment. The production system comprises of different operations such as cutting, skiving, assembly, sewing, lasting, finishing, inspection and packing.

For any manufacturing or service industry, quality and customer satisfaction is the priority. To achieve quality product, process parameters or variables that influence the output of each process need to be consistently controlled and requires skilled manpower, quality raw material, machines, tools, proper environment conditions and proper inspection. Therefore, to attain customer satisfaction, product needs to be economical in cost, delivered in time and meet customer expectations. This paper deals with the DERBY shoe industry that registered with low process cycle efficiency due to high lead time and rejection at the rate of 26,435 per million opportunities, which means the industry is in the range of three sigma level which is not average industry level (Four sigma). With the implementation of six sigma DMAIC methodology, the rejection rate is expected to come down to 3365 per million opportunities through which the industry can achieve four sigma, which is acceptable.

**Keywords:** Six Sigma, DMAIC, Quality, Customer, lead time, Industry standard.

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### I. INTRODUCTION

Footwear industry is a labour oriented industry where a large number of workers are deployed in the production line. Among the resources like capital, materials, machines, energy, land, product information, technology etc., man power is very important and should be controlled in most appropriate manner. To attain the required quality and maximum productivity, proper operation sequencing and line balancing is indispensable because in a properly balanced line, machine and manpower utilisation would be much more and rate of production would be more.

#### 1.1 Stages involved in shoe manufacturing

Manufacturing of footwear involves movement of raw materials to different stages such as Cutting, Fitting and Assembly, Sewing in Closing Department, Lasting in Lasting Department, Bottom Department where soles are produced and Finishing in Finishing Department.

**Cutting:** It is the first step in the making of a pair of shoes. In the cutting stage, different parts of shoe upper such as toe, vamp, quarter and counter are chopped off from the raw material (Leather) in the required size and shape through either manual tools such as knife or cutting machines using die cutter.

**Skiving:** The purpose of the operation is to skive edges of the parts which are to be joined to maintain the uniform structure at the joint for good appearance i.e., to avoid overlapping of the parts. It is performed before assembly stage.

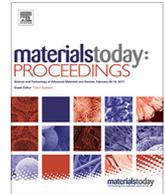
**Fitting and Assembly:** Here, shoe parts are bonded using adhesive for proper stitching of these parts in sewing stage. Proper care should be taken such that there should not be misplacement of parts which would result in rework or rejection. Proper attention is required in this stage.

**Sewing:** It is one of the highly skilled operations performed in stitching department. This operation is done because application of glue at the joints during assembly stage may not give guarantee to sustain high strain during lasting operation. For safety, long life and to resist those stress and strain, stitching operation is performed. Sewing operation can also be performed in the toe lasting, side and seat lasting process etc... depending on the type of construction.



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# Effect of process parameters on petal height and heat generated during bushing formation in form drilling of Al8011

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Analysis of variance (ANOVA)

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## ABSTRACT

The objective of this study is to identify the most effective parameter among Speed(V), Feed(f), Thickness (d) & Diameter of the tool(D), which give a cylindrical shaped bushing without significant radial fracture or petal formation and also to study the effect of Heat generated during bushing formation in form drilling of Aluminum 8011 work piece coated with Magnesium powder. The contemporary work uses conical Tungsten carbide (WC) tool for form drilling of Aluminum 8011 work piece with the help of CNC JV-55 machining centre. Eighteen experiments have been carried out based on the mixed factorial design matrix developed under Taguchi. Process parameters considered are Speed(V), Feed(f), Thickness(d), Diameter of the tool(D) and obtained responses are Torque(T), Heat generation(Q), Tool contact time with work material(t), Temperature( $\phi$ ), Force applied(F), petal height(h), diametrical error( $\epsilon$ ). The influential parameter affecting heat generated in form drilling is investigated by using ANOVA and same is confirmed by confirmation test of Taguchi method of analysis. The experimental results show that the process variable speed influence is more followed by feed. It is observed that Mg powder, work piece thickness, tool diameter, speed and feed affects the petal height formation by 2.98, 0.77, 85.85, 1.83 and 1.68 percentage respectively. Among all the process variables tool diameter influence is more, after the tool diameter the influencing parameter is Mg powder.

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## 1. Introduction

Form drilling uses a conical bit made of very high heat resistant material like tungsten carbide (WC) tool; its end is pointed but not sharp object. This tool is pressed against a target material with both high rotational speed and Pressure. The mechanics of hole formation in form drilling is due to thermal softening followed by penetration of tool into the work material. Form drilling also known as friction drilling, no-chip machining, friction stir drilling and thermal drilling which is a non-traditional hole making method that utilizes the heat generated from friction between a rotating conical tool and the work piece to soften, penetrate the work material and generate a hole in work material. The purpose of the bushing is to increase the thickness for threading and available clamp load. Extrusion of materials sideward to form boss can be acknowledged. The experimental results will explain the Metallurgical aspects when the work piece is coated with magne-

sium powder, and the tool behavior were analyzed under tested conditions when work is coated with magnesium powder as well as without coating the Magnesium powder on work piece see (Fig. 1).

## 2. Literature survey

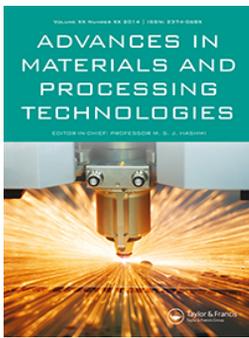
Scott F. Miller [1], observed thrust force and torque decreased by pre-heating the work piece temperature and bushing shape improvement with increased work piece temperature. Scott F. Miller [2], Studied the Tool wear due to friction. Han-Ming chow [3], studied the machining characteristics of Friction Drilling on AISI 304 Stainless Steel. France et al., [4-6] investigated the strength characteristics of friction drilled holes in metal tubes. Ku et al., [7], investigated the thermal Friction Drilling effects on surface roughness and bushing length and the machining characteristics of the process were improved. Jamie D. Skovron [7],

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## Experimental investigation on similar and dissimilar alloys of stainless steel joints by laser beam welding

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RESEARCH ARTICLE



# Experimental investigation on similar and dissimilar alloys of stainless steel joints by laser beam welding

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## ABSTRACT

Alloy and Stainless steel plates have to be welded to meet the present generation of smart manufacturing by Laser Beam Welding. Laser Beam Welding (LBW) plays an important role in joining of metals or welding the parts of similar/dissimilar metals. Due to its high-speed weldability with high laser beam power result in high strength and low heat affected zones with better appearance and quality. AISI Stainless steels which are widely used in various industries due to their resistance to corrosion. There is often a need to study the effect of process parameters, while fabricating stainless steel structures and/or when weld stainless steel to low-alloy steels. A solemn attempt is made in the present research work to join similar and dissimilar AISI 4130 Alloy and AISI 309 Stainless Steel joints by CO<sub>2</sub> Laser Beam Welding with an objective to investigate the effects of process parameters. The weld joints are studied based on their Bead Width and Micro Hardness. The performance characteristic curves are drawn and analysed the influence of the process parameters on the weld joints. The Whale Optimisation Algorithm is used to identify the optimal combination of process parameters based on the experimental output results of Bead Width and Micro Hardness.

## ARTICLE HISTORY

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## KEYWORDS

Laser beam welding; alloy steel; stainless steel; bead width; micro hardness; ANOVA; Whale Optimisation Algorithm

## 1. Introduction

Smart Manufacturing (SM) is regarded as the latest generation-manufacturing revolution in industry. Thus the manufacturing technology and manufacturing systems require great concentration to extract the larger and larger benefits in terms of production economics, quality and time. Use of advanced technologies such as robotics, mechatronics, smart nano materials, production/manufacturing, etc., on one side and Information of Things (IOT) on the other side determine the success of nanotechnology in manufacturing. In SM, one of such things can be considered as technology that allows the process improvement through optimisation and exploitation of advanced technologies that establish to achieve manufacturing model thereby leading to meet the Make-in-India concept by the application of Laser in joining of metals or welding the profiles of similar/dissimilar metals. LBW having high speed weldability with high laser beam power is used to join similar and dissimilar metals resulting in high strength and low heat affected zones with better appearance and quality of the parts are products or goods in service. AISI Stainless

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# Experimental Investigations on Inconel 625 Alloy Using Plasma Arc Machining

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## ABSTRACT

Plasma arc machining (PAM) is a non-traditional machining process widely used to machine intricate part profiles for alloys that are difficult to machine. The Burr height, Kerf ratio, and material removal rate (MRR) are predominant factors that influences the performance and quality of plasma cut surfaces. Present research focusses on the effect of plasma arc cutting (PAC) parameters such as gases used, cutting speed, current, arc voltage, and gas pressure on the cut quality characteristics of Inconel 625 alloy. The design of experiments (DOE) technique is used to develop a Taguchi design consisting of L18 orthogonal array. The Grey relational analysis technique is used for optimization of the above said cutting conditions. Finally, the most suitable gas to machine is selected along with the optimal PAM parameters for cutting the Inconel 625 alloy. Scanning electron microscope (SEM) analysis is carried out to inspect the surface morphologies at various cutting conditions.

## KEYWORDS

DOE, Grey Relational Analysis, Inconel 625 Alloy, Optimization, Plasma Arc Cutting, SEM

## 1. INTRODUCTION

Among the many super alloys used in manufacturing industries, Inconel 625 alloy materials are extensively used in aerospace and in many other chemical process applications. It is an austenitic nickel-based alloy having excellent resistance to corrosion, oxidation and fatigue. But the machining of this material is very difficult by using traditional machining processes. So among the various non-traditional machining processes, one of the most commonly used processes is PAM. Plasma Arc Machining is a thermal energy based process commonly used for cutting alloys to a stringent design requirements and complex cutting profiles. During the PAM process, a high intensity constricted jet of high temperature plasma arc is produced between workpiece material and electrode nozzle which melts/vaporizes the part profile and expels the molten metal from the cutting region. In spite of its

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**ORIGINAL RESEARCH PAPER**

**Engineering**

**INFLUENCE OF PROCESS PARAMETERS ON 6065 – T6 ALUMINUM ALLOY USING CNC END MILLING – A FUZZY APPROACH**

**KEY WORDS:** CNC Vertical Milling Machine, 6065-T6 Aluminum Alloy, Fuzzy Logic, ANOVA, Surface Roughness And Material Removal Rate.

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**ABSTRACT**

The present work deals with the investigation of performance parameters of surface roughness and material removal rate of the machined parts during milling of Aluminum alloy 6065-T6 using CNC vertical milling machine with High speed steel milling, Carbide tool cutter by optimizing the process parameters such as speed, feed, cutting environment, depth of cut and cutting tool. The experiments are conducted based on Taguchi design of experiments with an orthogonal array (L16) the optimization of process parameters based on performance measures are done by using Fuzzy Logic. Also, the most influential process parameters are finding out by using ANOVA technique. Ideal execution parameters are found for smaller surface roughness and larger MRR utilizing the MINITAB and MATLAB software's.

**INTRODUCTION**

The important goal in the modern industries is to manufacture low cost, high-quality products in a short time. Milling is the most common method employed for metal removal and especially for the finishing of machined parts. It is widely employed in a variety of manufacturing units such as aerospace and automotive sectors. Surface Roughness is a generally used commodity consistency index and is important for mechanical parts. It is of considerable significance for the pieces to attain the desired surface level. Surface roughness is an indicator of a product's consistency and a consideration that significantly affects the cost of production. It can be generally stated that the lower the desired surface roughness the more the manufacturing cost and vice versa.

An end mill is a type of milling cutter used in industrial milling applications as a cutting tool. In its operation, geometry, and development, it is distinct from the drill bit. While a drill bit can only be cut in the axial direction, it can be cut in the radial direction by other milling bits. Not all mills will cut axially; they are known as end mills, those designed to cut axially. In milling applications, such as profile milling, tracer milling, face milling, and plunging, end mills are used. For the present research work, High Speed Steel (HSS) milling, Carbide tool cutter is used for machining operations and they are shown in Figure 1(a) and 1(b).



**Figure 1(a): Carbide Tool Milling Cutter**



**Figure 1(b): Carbide Tool Milling Cutter**

A large number of researchers conducted research on CNC Vertical Milling Machine with different types of alloys as well as end mill cutters and find out the performance parameters related to optimized process parameters. Some of the research findings are summarized below:

**Dr. Mike S. Lou et al. [1]** developed a multi-regression model that can forecast the surface roughness on the surface of the specimen (Al-6061) on which end milling operation has been carried out using a CNC machine. **Ghani, et al., [2]** A research on AISI H13 hardened steel is presented in order to optimize cutting parameters in end milling machines with TiN coated P10 carbide insert tool under high cutting speed semi-finishing and finishing conditions using Taguchi optimization methodology. **Julie Z. Zhang, et al., [3]** is presented a study on surface roughness optimization of CNC face milling operation using Taguchi Design methodology for machining on aluminum blocks. **Bharat Chandra Routara, et al., [4]** studied a multi-objective optimization problem by applying utility concept coupled with Taguchi method through UNS C34000 Medium Leaded Brass CNC End Milling. **Seref Ayku et al., [5]** developed an ANN model to foresee the surface roughness of Castamide material after machining process. **Surasit Rawangwong, et al., [6]** In semi-solid AA 7075 face milling, the effects of cutting parameters on surface roughness are studied. **Avinash A. Thakre [7]** presented a work on 1040 MS material on CNC vertical milling machine using carbide inserts to optimize the milling machining parameter to minimize surface roughness by using Taguchi method. **B. Vijaya Krishna Teja et al. [8]** An experimental research was performed on the performance properties of AISI 304 stainless steel during the CNC milling process. **J. S. Pang, et al., [9]** is introduced the application of Taguchi methodology for optimization of CNC end milling cutting parameters for machining on the hybrid composite material hallosite nanotube with aluminum reinforced epoxy matrix (HNT/AL/Ep) under dry condition. **Lohithaksha M Maiyara, et al., [10]** The end milling process optimization parameter for Inconel 718 super alloy with multi-response parameters based on the Taguchi orthogonal array is analysed with grey relational analysis.

Based on literature survey, it is observed that most of the researchers are focused on single milling tool cutters and some lacuna in comparing the various end milling cutters. The present work focused with following objectives:

- To conduct the End Milling operations on Aluminum alloy 6065-T6 (AISI4130) workpiece by varying the process parameters using CNC Milling machine.
- To measure the roughness of the machine surface by using Talysurf instrument.
- To optimize the performance parameters for improving the machining characteristics such as Surface Roughness (R<sub>a</sub>) and Material Removal Rate (MRR) based on Fuzzy Logic.
- To find out significance of each process parameter on output responses by using ANOVA.

*Handwritten signature and initials: HOB HEAD*

## **Experimental Analysis and Optimization of Process Parameters on Weld Characteristics of SS 410 Using TIG Welding**

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### **ABSTRACT**

The main aim of the current investigation is to optimise the process parameters and the effect of the welding characteristics of grade 410 stainless steel welding joints by Tungsten Inert Gas (TIG) welding process. The consistency of the welding bead is also dictated by its geometry and configuration, which in turn, is affected by different control variables, such as the peak current, the base current and gas pressure of the welding process. Experiments are carried out by Gray Relation Analysis (GRA) based on a Taguchi design of experiment and optimization. Data from the tests are obtained and performance responses such as Hardness and Impact Strength are analyzed. For smaller hardness and greater impact strength by Taguchi using the MINITAB programming, ideal execution parameters are found. The effect of TIG process parameters is measured using ANOVA and S/N ratios of robust nature, and the optimal welding state is calculated to optimize the mechanical properties of the joint. An attempt is made using NDT-Magnetic Particle Tester to examine and measure the TIG welded joints.

**KEYWORDS:** Tungsten Inert Gas (TIG) welding, Hardness, Impact Strength, Taguchi Design, Gray Relation Analysis (GRA), ANOVA, NDT – Magnetic Particle Tester.

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### **I. INTRODUCTION**

Welding is a permanent bonding procedure used by applying heat and or pressure to bind various materials such as metals, alloys or plastics together on their contact surfaces. The workpieces to be joined are melted at the interface during the welding process and a permanent joint can be obtained after solidification. In order to form a welding pool of molten material that provides a tight bond between the materials after solidification, a filler material is also applied. Material weldability depends on numerous variables, such as the metallurgical modifications that arise during welding, changes in weld zone toughness due to rapid solidification, the degree of oxidation due to atmospheric oxygen reaction of materials and the propensity to develop cracks in the joint location.

#### **1.1 TIG Welding Mechanism**

TIG welding is an arc welding process that uses a non-consumable tungsten electrode to create the weld. The welding area is shielded by an inert shielding gas (argon or helium) from the atmosphere and a filler metal is usually used. The electricity is supplied from a welding torch from the power source (rectifier), which is transmitted to a tungsten electrode that is fitted into the handpiece. An electric arc is then generated between the tungsten electrode and the workpiece by a column of strongly ionized gas and metal vapours using a constant-current welding power supply that produces energy which is carried out through the arc. Tungsten electrodes and the welding field are shielded by inert gas from the ambient air. Temperatures of up to 20,000<sup>o</sup>C can be created by the electric arc and this heat can be concentrated on melting and joining two distinct material components. It can use the weld pool with or without filler material to connect the base metal. Figure 1 displays a graphical diagram of the principle of TIG welding.



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## PROCESS PARAMETERS OPTIMIZATION OF EDM FOR MACHINING ON HCHCR D3 STEEL USING ANOVA

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**Abstract:** Metal removal mechanism in Electrical Discharge Machining (EDM) is mainly a thermal phenomenon where thermal energy is produced in plasma channel, and is dissipated through work piece, tool and dielectric. The process is mostly used in situations where machining of very hard materials, intricate parts, complex shapes. The aim of this work is to pursue the influence of three design factors current, pulse on time ( $T_{on}$ ), and pulse off time ( $T_{off}$ ) which are the most connected parameters to be controlled by the EDM process over HCHCR machining specifications such as material removal rate (MRR) and characteristics of surface integrity such as average surface roughness ( $R_a$ ) quantify them. The experiments were carried out as per L9 orthogonal array. Each experiment were performed under different conditions such as Ampere rating, pulse on time and pulse off time.

**Keywords:** ANOVA, EDM, material removal rate (MRR), Surface roughness.

### I. Introduction

The need to machine newly developed metals and non-metals for unusual complex part geometries that cannot easily be accomplished by normal machining methods. It is impossible to find sufficiently strong and hard tools to machine aforesaid materials at economic cutting speeds with good surface finish and dimensional tolerance. Hence, there is great demand for new machining technologies to cut these 'difficult-to-machine' materials with ease and precision. Joseph Priestley, The English physicist, first noted the erosion of metals by electric sparks in 1770. Russian scientists B. R. Lazarenko and N. I. Lazarenko first introduced controlled machining by electric discharges in 1943 among modern machining processes, electric discharge machining (EDM) has become highly popular in manufacturing industries due to its capability to machine any electrically conductive material into desired shape with required dimensional accuracy irrespective of its mechanical strength. The metal removal takes place due to erosion caused by rapidly occurring discharge between tool and work. This process may be used for machining any material irrespective of hardness. Figure 1 shows a representative diagram of a typical EDM setup. When a suitable voltage is built up across tool and the workpiece, an electrostatic field of sufficient strength is established, causing cold emission of electron from the cathode. These liberated electrons accelerate towards the anode and after gaining sufficient velocity electrons collide with the molecules of dielectric fluid, breaking them into electrons and positive ions. A narrow column of ionized dielectric fluid molecules is established connecting the two electrodes and spark generates due to the avalanche of electrons. This results in a compression shock wave. Very high temperature (10000 to 12,000 °C) is developed which induces melting and evaporation of both the electrode and work piece. The machining process successively removes minute quantities of work piece material, in the form of molten metal, during discharges. The removed material solidifies to form debris. Dielectric fluid drives away the debris and thus preventing them from sticking to surface of tool.

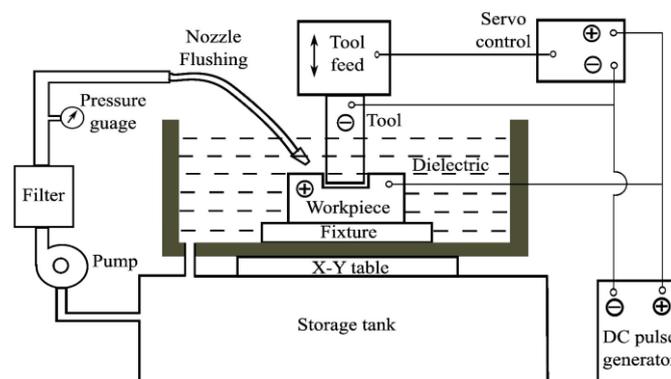


Fig. 1 A Typical EDM Setup

# Optimization of Process Parameters for the Machining of Microslot on Copper Workpiece Using LBM by Grey Relational Analysis and ANOVA

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## ABSTRACT

Laser-beam machining is a non-conventional machining process. Laser-beam machining is a thermal material-removal process that utilizes a high-energy, coherent light beam to melt and vaporize particles on the surface of metallic and non-metallic workpieces. LBM is newer thermal technique also widely accepted in industry today. Laser beam machining is based on the conversion of electrical energy into light energy and then to thermal energy. The main purpose of this paper is to analyse the impact of the parameters associated with the CO<sub>2</sub> laser cutting of the micro slot having a width of 0.3 mm and a length of 20 mm on a copper plate of 4 mm thickness. Micro-slots or micro-channels are one such type of feature which has more applications in the fabrication of miniature devices, micro-fluidic devices or heat exchangers. The experiments are planned and conducted on the basis of the typical L27 Taguchi orthogonal array with three laser cutting parameters viz. Laser power, gas pressure, cutting speed and organised at three stages. The result showed that the parameter like power has greater influence on MRR and cutting Speed has greater influence on Kerf Width and gas pressure has less significance compare to both.

**Keywords:** Copper material, Microslot, Design of experiments, Grey Relational Analysis, ANOVA.

## INTRODUCTION

Due to growing demand for micro parts and structures of various industries,

micro manufacturing techniques have become so important. Micro structures, including micro holes, micro slots, micro shafts, and micro gears are widely used micro products required in industries. Micro-slots or micro-channels are one such type of feature which has immense applications in the fabrication of miniature devices, micro-fluidic devices, micro-heat-sinks, or heat exchangers etc. Using CO<sub>2</sub> lasers, much laser cutting is carried out. In the industry, CO<sub>2</sub> lasers dominate. Mild steel and stainless-steel laser cutting has a long tradition and has been one of the major uses for CO<sub>2</sub> lasers. The diameter of the laser beam is usually 0.3 mm with a power of 3-6 KW. The acronym for Light Amplification by Stimulated Radiation Emission is Laser. Maiman showed the world's first laser by using a ruby crystal (Maiman 1960). Laser cutting is a thermal-based non-contact device capable of cutting complicated contours of high precision and precision materials. It includes the process of heating, melting and evaporating material in a small well-defined region capable of cutting almost all materials. Lasers have a wide variety of uses, ranging from military weapons to medical equipment. Laser is used in factories as an unconventional cutting and welding tool. The biggest advantage of laser cutting is that it is a non-contact operating technique from which it is possible to produce a successful accurate cut of complex shapes. Lasers may also be used to cut different materials such as wood,

# Effect of Influential Parameters on MRR and Optimization of Abrasive Water Jet Machining Process Parameters of Glass – Epoxy Particulate PMC Using Grey Relation Analysis

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## Abstract

Abrasive Water Jet Machine (AWJM) is a non-conventional machining technique in which, material removal takes place from the workpiece by impact erosion high pressure and high velocity water jet mixed with abrasive material to provide smooth surface finish. AWJM is widely used in Aerospace, Marine and Automotive industries for trimming composites. However, AWJM demonstrates some challenges when cutting Glass-Epoxy Polymer Matrix Composites (PMC) materials such as cut accuracy and quality. In the present paper, experiments are conducted to study the influence of various process parameters of abrasive water jet machining on Material Removal Rate (MRR) of Glass-Epoxy PMC. Three sets of experiments are carried out using L9 Orthogonal array by maintaining glass powder wt% as 5, 10 and 15 and also varying control factors such as Nozzle Pressure (p), Feed Rate (f), Abrasive Flow Rate (m) and Stand of Distance (d). An attempt has been made to optimize the AWJM process parameters of Glass-Epoxy PMC using Grey Relation Analysis (GRA).

**Keywords:** Abrasive Water Jet Machining, Glass-Epoxy PMC, Abrasive Flow Rate, Feed Rate, Nozzle Pressure, Material Removal Rate, Circularity Error, Grey Relation Analysis.

## I. INTRODUCTION

Abrasive Water Jet Machine (AWJM) is a non-conventional machining technique and also used for machining non-conductive materials in which, material removal takes place from the work piece by impact erosion with high pressure and high velocity water jet mixed with abrasive material to provide smooth surface finish. The working process of AWJM is shown in Fig. 1. AWJM provides some advantages over conventional machining process for cutting the composite materials like no thermal effect, high machining versatility and small cutting forces. Machining of composite materials is of great importance because of variety of reinforcement from particulates, flakes and high strength fibers to natural fibers. The use of polymer composites for various applications like Automobile, Aerospace, Defense, Marine and other industry is becoming highly advantageous owing to their lighter weight, higher strength and durability.

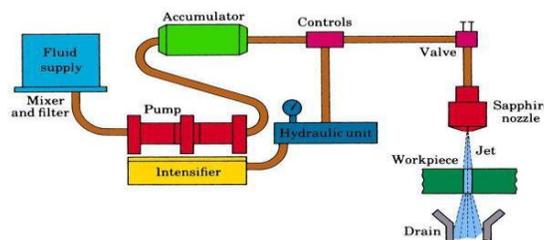


Fig. 1 Working Process of Abrasive Water Jet Machining

## II. LITERATURE REVIEW

Heriyanto et.al [1], suggested a novel composite based on glass from local waste materials. To manufacture polymeric marble, such as stone composite, the glass powder filler is analyzed and blended with proprietary resin. Superior mechanical efficiency and minimum water absorption are validated by the prototypes. The statistical study for cutting 2 lay-up configurations of multidirectional CFRP laminates under various AWJM conditions are analyzed by M. El-Hofy et.al

  
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YEAR :							
NUMBER :							
	Title of paper	Name of the author/s	Department of the teacher	Name of journal	Year of publication	ISSN number	Link to the recognition in UGC enlistment of the Journal
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1.	Synthesis and spectroscopic investigations on Pr <sup>3+</sup> doped LiPbB <sub>5</sub> O <sub>9</sub> phosphor : A blue converting red phosphor for white LED's	T. Raguraman B. Deva Prasada Raju Y.C.Ratnakaram	Physics	Optik : International Journal of Light and Electron Optics	2021	0030-4026	Not Given
2.	Role of TeO <sub>2</sub> concentration with the BaF <sub>2</sub> and Bi <sub>2</sub> O <sub>3</sub> on structural and emission properties of Nd <sup>3+</sup> doped fluorophosphates glasses for 1.058 um emission	M. Kumar Y.C.Ratnakaram	Physics	Optical Materials	2021	0925-3467	18731252
3.	Effect of HO <sup>3+</sup> ion concentration on structure and spectroscopic properties of LiPbB <sub>5</sub> O <sub>9</sub> ; Ho <sup>3+</sup> phosphor	T. Raghuraman, R. P. Vijayalakshmi and Y.C. Ratnakaram	Physics	J. Mol. Structure	2020	0020-2860	18728014
4.	Morphology driven enhanced photocatalytic activity of CuO/BiO nano composites	A. Sudharani K. Sunil Kumar M. Ramanadha Y.C.Ratnakaram R.P.Vijayalakshmi	Physics	Mat. Chem. Physics	2020	0254-0584	18793312
5.	Influence of alkali and alkaline earths on structural and luminescence properties of Sm <sup>3+</sup> doped lithium fluoro phosphate glass and different (Na, Mg, K, Ca and Sr) glass ceramics	M. Kumar Y.C.Ratnakaram	Physics	J. Non-Cryst. Solids	2021	0022-3093	18734812
	<b>Prof.K.T.Ramakrishna Reddy:-</b>						
6.	Phase controllable synthesis of CuS nanoparticles by chemical co-precipitation method: Effect of copper precursors on the properties of CuS	BabuPejjai, MuniramaiahReddivari, Tulasi Ramakrishna Reddy Kotte	Physics	Materials Chemistry and Physics	2020	0254-0584	<a href="https://doi.org/10.1016/j.matchemphys.2019.122030">https://doi.org/10.1016/j.matchemphys.2019.122030</a>
7.	Effect of heat treatment in sulfur on structural, optical and electrical properties of thermally evaporated In <sub>2</sub> S <sub>3</sub> thin films	M.S. Tivano, I.A. Svito, S. Rasool, K. Saritha, K.T. Ramakrishna Reddy, V. F. Gremenok	Physics	Solar Energy	2021	0038-092X	<a href="https://doi.org/10.1016/j.solener.2021.04.057">https://doi.org/10.1016/j.solener.2021.04.057</a>

	<b>Prof.S.Vijaya Bhaskara Rao:-</b>						
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9.	Low-latitude mesospheric signatures observed during the 2017 sudden stratospheric warming using the fuke meteor radar and ERA-5.	S Eswaraiah, KondapalliNiranjana Kumar, Yong Ha Kim, G VenkataChalapathi, Wonseok Lee, Guoying Jiang, Chunxiao Yan, Guotao Yang, M VenkatRatnam, P Vishnu Prasanth, S. VijayaBhaskaraRao, K Thyagarajan	Physics	<u>Journalof Atmospheric andSolar Terrestrial Physics</u>	2020	1364-6826	<a href="https://doi.org/10.1016/j.jastp.2020.105352">https://doi.org/10.1016/j.jastp.2020.105352</a>
10.	Study of mixing ratios of SO2 in a tropical rural environment in south India.	Kavutharapu, Renuka, Gadhavi, Harish, Achuthan, Jayaraman, S. VijayaBhaskaraRao, Lal, Shyam. (2020)	Physics	Journal of Earth System Science.	2020	0973-774X	<a href="https://doi.org/10.1007/s12040-020-1366-4">https://doi.org/10.1007/s12040-020-1366-4</a>
11.	Interannual variability of atmospheric gravity waves in the Martian thermosphere: Effects of the 2018 planet- encircling dust event.	V Leelavathi, N VenkateswaraRao, S. VijayaBhaskaraRao	Physics	Journal of Geophysical Research: Planets	2020	2169-9100	<a href="https://doi.org/10.1029/2020JE006649">https://doi.org/10.1029/2020JE006649</a>
12.	Meteor Radar Estimations of Gravity Wave Momentum Fluxes: Evaluation Using Simulations and Observations Over Three Tropical Locations.	Maniyattu, Pramitha, Kishore Kumar, Karanam, Madineni, VenkatRatnam, S. VijayaBhaskaraRao,Geetha Ramkumar	Physics	Journal of Geophysical Research: Space Physics.	2020	21699402	<a href="https://doi.org/10.1029/2019JA026510">https://doi.org/10.1029/2019JA026510</a>
13.	Solar radiometer sensing of multi-year aerosol features over a tropical urban station: direct-Sun and inversion products,	KattaVijayakumar, Panuganti C. S. Devara, Sunil M. Sonbawne, David M. Giles, Brent N. HolbenSarangam, S. VijayaBhaskaraRao and Chalicheemalapalli K. Jayasankar	Physics	Atmos. Meas. Tech.,	2020	1867-131381	<a href="https://doi.org/10.5194/amt-13-5569-2020">https://doi.org/10.5194/amt-13-5569-2020</a>

14.	Sensitivity of Initial and Boundary Conditions on the Simulation of Track and Intensity of Extratropical Cyclone 'Gong' over North Atlantic.	P. K. Pradhan, D. Hari Prasad, D. Srinivas, S. VijayaBhaskaraRao, Guvvala. Rambabu	Physics	<i>Journal of Earth System Science,</i>	2020	0973-774X	<a href="https://doi.org/10.1007/s12040-020-01546-2(0123456789).,-volV)(012345678).9,-(volV)">https://doi.org/10.1007/s12040-020-01546-2(0123456789).,-volV)(012345678).9,-(volV)</a>
15.	Long- term changes in land surface temperature due to land use land cover over a mega city in south India, The journal of India,	Rambabu. G., Prasad. P., Raman, M.R. Ratnam, M.V., S. VijayaBhaskaraRao.	Physics	The Journal of Indian Geophysical Union,	2020	0257-7968	
16.	Stratospheric Quasi Biennial Oscillation Modulations of Migrating Diurnal Tide in the Mesosphere and Lower Thermosphere Over the Low and Equatorial Latitudes,	M. Pramitha <sup>1</sup> , K. Kishore Kumar, M. VenkaRatnam, M. Praveen, and S. VijayaBhaskaraRao	Physics	JGR Space Physics	2021	2169-9402	<a href="https://doi.org/10.1029/2020JA028970">https://doi.org/10.1029/2020JA028970</a>
17.	Quasi-2-Day Wave in Low- Latitude Atmospheric Winds as Viewed From the Ground and Space During January, March, 2020,	Maosheng He, Jorge L. Chau, Jeffrey M. Forbes, Xiaoil Zhang, Christoph R. Englert, Brian J. Harding, Thomas J. Immel, LourivaldoM.Lima, S. VijayaBhaskaraRao, M. VenkaRatnam, Guozhu Li, John M. HardlanderKenneth D. Marr, and Jonathan J. Makela	Physics	Geophysical Research Letters	2021	1944-8007	<a href="https://doi.org/10.1029/2021GL093466">https://doi.org/10.1029/2021GL093466</a>
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18	Santosh Kumar, V.K.Mariswamy, A.Kumar, A.Kandasami, A.Nimmala, S.V.S.Nageswara Rao, V.Rajagopal Reddy and S.Krishnaveni	An Ion Irradiation Effects on the Characteristics of Ru/Pt/n-GaN Schottky Barrier Diodes	Semiconductor	2020	0	40	Sri Venkateswara University
19	P.R. Sekhar Reddy, V. Janardhanam, Kyu-Hwan Shim, Sung-Nam Lee , A.Ashok Kumar, V. Rajagopal Reddy, and Chel-Jong Choi	Temperature dependent Schottky barrier characteristics of Al/n-type Si Schottky barrier diode with Au-Cu phthalocyanine interlayer	Thin Solid Films	2020	1	192	Sri Venkateswara University

20	M.SivaPratap Reddy, Herie Park and V.Rajagopal Reddy	Effect of Temperature on the electrical and current transport properties of Au/Nd <sub>2</sub> O <sub>3</sub> /n-GaN metal/interlayer/semiconductor (MIS) junction	Applied Physics A: Materials Science and Processing	2021	2	149	Sri Venkateswara University
21.	V.Rajagopal Reddy, C.Venkata Prasad, V.Janardhana and Chel-Jong Choi	Electrical and carrier transport properties of Ti/ $\alpha$ -amylase polymer interlayer	Journal of Materials Science: Materials in Electronics	2021	0	75	Sri Venkateswara University
22.	Siva Pratap Reddy Mallem, MallikarjunaKoduru, Kuppm Chandrasekhar, S.V.PrabhakarVattikuti Ravi Manne, V.Rajagopal Reddy and Jung-Hee Lee	Potato Chip-Like 0D Interconnected ZnCo <sub>2</sub> O <sub>4</sub> Nanoparticles for High Performance Supercapacitors	Crystals	2021	5	37	Sri Venkateswara University
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24.	Enhanced solar driven hydrogen evolution rate by integrating dual co-catalysts (MoS <sub>2</sub> , SeS <sub>2</sub> ) on CdS nanorods	Ramanadha Mangiri a, K. Sunil kumar a, K. Subramanyam b,*, A. Sudharani a, D. Amaranatha Reddy c,*, R.P. Vijayalakshmi a,*	Physics	Materials Science & Engineering B	2021May	0921-5107	<a href="https://doi.org/10.1016/j.colco m.2021.100437">https://doi.org/10.1016/j.colco m.2021.100437</a>
25.	Boosting solar driven hydrogen evolution rate of CdS nanorods adorned with MoS <sub>2</sub> and SnS <sub>2</sub> nanostructures	Ramanadha Mangiri a, K. Sunil kumar a, K. Subramanyam b, Y.C. Ratnakaram a, A. Sudharani a, D.	Physics	Colloids and Surfaces A: Physicochemical and Engineering Aspects	2021May	0927-7757.	
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28.	Surfactant assisted morphological transformation of rod-like ZnCo <sub>2</sub> O <sub>4</sub> into hexagonal-like structures for high-performance supercapacitors	K. Prasad, G.Rajasekhara Reddy, B. Deva Prasad Raju	Physics	Indian Journal of Science and Technology	2021	0974-5645	<a href="https://doi.org/10.17485/IJST/v14i7.2002">10.17485/IJST/v14i7.2002</a>
29.	Photoluminescence, radiative shielding properties of Sm <sup>3+</sup> ions doped fluoroborosilicate glasses for visible (reddish-orange) display and radiation shielding applications	Megala Rajesh, Esra Kavaz, B. Deva Prasad Raju	Physics	Materials Research Bulletin	2021	0025-5408	<a href="https://doi.org/10.1016/j.materresbull.2021.111383">10.1016/j.materresbull.2021.111383</a>
30.	Photoluminescence investigations of Eu <sup>3+</sup> doped LiPbB <sub>5</sub> O <sub>9</sub> as a red-emitting phosphor for warm W-LED applications	T Raghu Raman, B Deva Prasad Raju and Y C Ratnakaram	Physics	Indian Journal of Physics	2021	0973-1458	10.1007/s12648-021-02089-y
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33.	An Exponential Model Fitted to Month Wise Rainfall	Sendil V.N., Venkatramana Reddy S., and Sarojamma B.	Physics	Studies in Indian Place Names (UGC Care Journal)	2020	2394-3114	
34.	Regression models for wind speed data	K.Geetha, S.Venkatramana Reddy, B. Sarojamma and P.Venkata Ramana Moorthy.	Physics	International Journal of Multidisciplinary Education Research (UGC Care Journal)	2020	2277-7881	DOI: <a href="http://ijmer.in/issues/volume9/volume9-issue7(7).aspx">http://ijmer.in/issues/volume9/volume9-issue7(7).aspx</a>
35.	Synthesis and properties of (Fe, Ni)-doped zinc sulfide nanopowders	Sreenivasulu B., Venkatramana Reddy S. and Swapna P.	Physics	Journal of Materials Science, Materials in Electronics	2020	1573-482X	DOI: <a href="https://doi.org/10.1007/s10854-020-03796-8">https://doi.org/10.1007/s10854-020-03796-8</a>
36.	Regression models for intraday atmospheric data	Venkata Ramana Moorthy P., Sarojamma B., and	Physics	International Journal of Research and Analytical Reviews (IJRAR)	2020	2348-1269	DOI: <a href="http://doi.org/10.1729/Iou">http://doi.org/10.1729/Iou</a>

		Venkatramana Reddy S					rna1.24189
37.	ARIMA models for intraday atmospheric data	VenkataRamanaMoorthy P., Sarojamma B., and Venkatramana Reddy S.	Physics	InternationalJournal of Analytical and Experimental Modal Analysis	2020	0886-9367	DOI:18.0002.IJEMA.2020.V1218.200001.015685900333
38.	Percentile Regression models for rainfall data in India,	Sendil V.N., Venkatramana Reddy S., and Sarojamma B.:	Physics	International Journal of Analytical and Experimental Modal Analysis	2020	0886-9367	DOI:18.0002.IJEMA.2020.V12112.200001.015685901815
39.	Magnetic Properties of (Mn, Al) co-doped SnO <sub>2</sub> nanopowders: Synthesis and Characterization	Venkateswara Reddy P., Venkatramana Reddy S. and Sreenivasulu B	Physics	Journal of Materials Science: Materials in Electronics	2021	1573-482X	DOI: 10.1007/s10854-020-05069-w
40.	Exponential Piece wise Regression for rainfall data, Conference Series	Anil Kumar K., Sendil V.N., Venkatramana Reddy S. and Sarojamma B.	Physics	Conference Series: Materials Science and Engineering	2021	1757-899X	doi:10.1088/1757-899X/1070/1/012026
	<b>Dr.B.Hemalatha Rudramadevi:-</b>						
41.	Structural, magnetic and dielectric properties of Cobalt doped GdFeO <sub>3</sub> Orth ferrites	C. Sai Vandana, B HemalathaRudramadevi	Physics	Materials Research Express	2020	2053-1591	<a href="https://orcid.org/0000-0002-7108-5887">https://orcid.org/0000-0002-7108-5887</a>
42.	Structural and photoluminescence properties of a novel green emitting Tb <sup>3+</sup> doped Ba <sub>3</sub> La <sub>2</sub> (BO <sub>3</sub> ) <sub>4</sub> phosphor	M.Peddaiah,P.Ankoji , B.HemalathaRudramadevi	Physics	Materialstoday: proceedings	2020	2214-7853	<a href="https://doi.org/10.1016/j.matpr.2020.07.345">https://doi.org/10.1016/j.matpr.2020.07.345</a>
43.	Tunable white light emission from Dy <sup>3+</sup> /Eu <sup>3+</sup> doped LaAlO <sub>3</sub> nanophosphors via hydrothermal	P. Ankoji and B. H. Rudramadevi	Physics	Materials Science & Engineering B	2021	0921-5107	<a href="https://doi.org/10.1016/j.mseb.2020.114883">https://doi.org/10.1016/j.mseb.2020.114883</a>
44.	Structural and an orange-red emission studies of Sm <sup>3+</sup> doped Ba <sub>3</sub> La <sub>2</sub> (BO <sub>3</sub> ) <sub>4</sub> phosphor for solid state lighting application	M. Peddaiah, C. Salma, B. HemalathaRudramadevi	Physics	Optik	2021	0030-4026	<a href="https://doi.org/10.1016/j.ijleo.2021.166695">https://doi.org/10.1016/j.ijleo.2021.166695</a>

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Original research article

# Synthesis and spectroscopic investigations on Pr<sup>3+</sup>-doped LiPbB<sub>5</sub>O<sub>9</sub> phosphor: A blue converting red phosphor for white LEDs

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## ARTICLE INFO

## Keywords:

Solid-state reaction  
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Diffuse-reflectance spectra  
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Red emission

## ABSTRACT

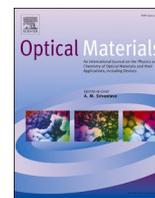
In this study, various concentrations of Pr<sup>3+</sup> doped LiPbB<sub>5</sub>O<sub>9</sub> phosphors were synthesized via solid state reaction technique. For the prepared phosphors, X-ray diffraction (XRD), Fourier transform infrared spectroscopy (FTIR), scanning electron microscopy (SEM), thermogravimetric study (TG-DSC), diffuse reflectance spectroscopy (DRS) and photoluminescence (PL) characterizations were performed. Crystallinity nature of LiPbB<sub>5</sub>O<sub>9</sub>:Pr<sup>3+</sup> phosphor was studied by XRD analysis. Morphology of the prepared phosphors was investigated by SEM studies. Various functional groups present in LiPbB<sub>5</sub>O<sub>9</sub>:Pr<sup>3+</sup> phosphor were identified through FTIR analysis. Variation in weight of the prepared phosphor with the temperature (endo- and exothermic temperatures) was studied by TG-DSC studies. Optical energy band gaps for different concentrations of Pr<sup>3+</sup> were obtained from DRS studies. Photoluminescence (excitation and emission) spectra were investigated at λ<sub>emi</sub> = 609 nm and λ<sub>exc</sub> = 443 nm, respectively. From energy transfer studies, it was identified that the energy transfer between Pr<sup>3+</sup> ions in LiPbB<sub>5</sub>O<sub>9</sub> phosphor was ascribed to dipole-dipole interaction. Lifetime decay curves of <sup>1</sup>D<sub>2</sub> level were studied at λ<sub>emi</sub> = 609 nm and λ<sub>exc</sub> = 443 nm wavelengths. CIE colour coordinates of LiPbB<sub>5</sub>O<sub>9</sub>:Pr<sup>3+</sup> phosphors were calculated from the emission data. From all these studies, it can be mentioned that LiPbB<sub>5</sub>O<sub>9</sub>:0.05Pr<sup>3+</sup> phosphor may be utilized for the blue light converting red phosphor in white LED applications.

## 1. Introduction

Now-a-days, much attempts have been carried out to develop the new materials for fabrication of W-LEDs. White LEDs are considered as next generation light source. W-LEDs find applications in field-emission displays, display panels and solid state lighting (SSL). White light emitting diodes have many superior qualities over fluorescent and incandescent lamps, like small volume, long lifetime energy serving, toxic free and eco-friendly [1]. Mainly there are two methods to produce white light from LEDs. 1. Mixing of yellow phosphor with blue LED and 2. Mixing of blue LEDs with red and green-emitting phosphor. Y<sub>3</sub>Al<sub>5</sub>O<sub>12</sub>:Ce<sup>3+</sup> is the most popular commercial yellow phosphor. The drawbacks of this commercial YAG:Ce phosphor is, as the operating temperature is increased its conversion efficiency decreases and it suffers from the unwanted colour balance [2]. These drawbacks can be rectified by introducing a separate red emitting source. White light can be achieved by the combination of phosphor and near UV-LED chip. So, phosphors play

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# Role of TeO<sub>2</sub> coordination with the BaF<sub>2</sub> and Bi<sub>2</sub>O<sub>3</sub> on structural and emission properties in Nd<sup>3+</sup> doped fluoro phosphate glasses for NIR 1.058 μm laser emission

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## ARTICLE INFO

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Barium and bismuth fluoro phosphate glasses  
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## ABSTRACT

Fluoro phosphate glasses with different contents of barium and bismuth (8, 11, 14, 17 and 20 mol %) doped with Nd<sup>3+</sup> were prepared by melt quenching technique. Importance of these modifier ions on structural transformation were carried out using XRD, FTIR, FT-Raman and <sup>31</sup>P MAS NMR characterizations. <sup>31</sup>P MAS NMR spectra revealed that structural modifications due to Bi<sub>2</sub>O<sub>3</sub> are more when compared with BaF<sub>2</sub> in this fluoro phosphate glass matrix. Three phenomenological Judd-Ofelt (J-O) parameters Ω<sub>λ</sub> (λ = 2, 4, 6) have been derived from the absorption spectra of Nd<sup>3+</sup> doped barium and bismuth fluoro phosphate glasses. From the Judd-Ofelt parameters, transition probabilities (A), branching ratios (β) of certain transitions and radiative lifetimes of certain excited states of Nd<sup>3+</sup> are extracted and reported. From the emission spectra, emission cross sections (σ<sub>e</sub>), band gains (σ<sub>e</sub> × Δλ<sub>eff</sub>) and optical gain parameters (σ<sub>e</sub> × τ<sub>R</sub>) were reckoned for the observed emission bands in these phosphate glasses. It is observed that barium glass resulted higher laser spectroscopic parameters (σ<sub>e</sub>, σ<sub>e</sub> × Δλ<sub>eff</sub>, σ<sub>e</sub> × τ<sub>R</sub>) which are crucial characteristics for exploring promising laser applications. Impact of Ba<sup>2+</sup> and Bi<sup>3+</sup> on luminescent properties of Nd<sup>3+</sup> doped fluoro phosphate glasses has been examined in search of solid state gain medium for laser emitting NIR light around 1.058 μm for photonic applications.

## 1. Introduction

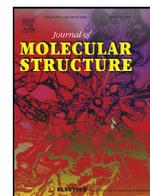
Nd<sup>3+</sup> doped glasses have several advantages in medicine and telecommunications, especially as a laser amplifier around eye-safe regions 1.06 and 0.97 μm [1–3]. Studies on fluoro phosphate and fluoride glasses doped with Nd<sup>3+</sup> ions have been interesting area to the many researchers for further extensive studies [4–10]. Their intrinsic physical properties, like high transparency and low phonon energy in comparison with pure oxides are important to get desirable material for several photonic applications. Fluoro phosphate glasses doped with Nd<sup>3+</sup> can yield rather shorter pulses relative to pure phosphate host. In addition Nd<sup>3+</sup> emission at 1.06 μm can be accomplished with the aid of laser diode by pumping effectively and also the optical properties of Nd<sup>3+</sup> ions rely on glass host and active ion environment [11].

TeO<sub>2</sub> is known as conditional glass former i.e. with the coordination of alkali earth metals or heavy metal oxides strengthen the glass forming ability. Hence these glasses find promising optical properties besides mechanical and electrical properties like high densities, high non-linear behaviour, low phonon energy, resistance against devitrification,

stability for long durations enduring moisture, operable as ultra fast switches for optical devices moreover wide transparency in the IR range [12–17]. These characteristics of tellurium based glasses which find reliable hosts for many applications as IR domes, modulators, optical fibres, non linear optical fibres and laser windows. Various studies are available to enhance the spectroscopic, electrical and mechanical properties of tellurite glasses by incorporation of other oxides with heavy metal oxides like PbO, Bi<sub>2</sub>O<sub>3</sub>, TiO<sub>2</sub>, or Nb<sub>2</sub>O<sub>5</sub>. Incorporation of Bi<sub>2</sub>O<sub>3</sub> is expected to enhance the infrared transmission of TeO<sub>2</sub> glasses to a greater extent, because frequencies of some fundamental modes of vibrations associated with Bi<sub>2</sub>O<sub>3</sub> structural group located in the same region of vibrations of TeO<sub>4</sub> structural groups. Addition of Bi<sub>2</sub>O<sub>3</sub> content to phosphate glass matrix exhibit NIR emission centers. Dehydration of glasses takes place while they are in synthesis and hence special operation is required for phosphate glass [18]. Bismuth phosphate glasses proven useful laser glass host among the investigated glasses for the Nd<sup>3+</sup> ion, remarkably for high peak power laser and high energy outputs. These glass lasers are advantageous for fusion energy research as they perform remarkable energy-storing potential and extraction

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# Effect of Ho<sup>3+</sup> ion concentration on structure and spectroscopic properties of LiPbB<sub>5</sub>O<sub>9</sub>:Ho<sup>3+</sup> phosphor

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## ABSTRACT

Lithium lead borate (LiPbB<sub>5</sub>O<sub>9</sub>:Ho<sup>3+</sup>) phosphors doped with distinct concentrations of Ho<sup>3+</sup> ions were prepared by solid state reaction technique. Structural characteristics were studied from X-ray diffraction (XRD), Fourier transform infrared spectroscopy (FTIR) and FT-Raman characterizations. Spectroscopic properties were studied from UV-Vis-NIR and photoluminescence (PL) spectra. From XRD investigations, crystallite sizes were calculated from Debye-Scherrer (D-S) and William-Hall (W-H) methods. Optical energy band gaps were calculated by using Tauc's relation for direct and indirect allowed transitions. The emission spectra of LiPbB<sub>5</sub>O<sub>9</sub>:Ho<sup>3+</sup> phosphors were recorded by monitoring the excitation wavelength at  $\lambda_{exc} = 397$  nm. Lifetime decay curves of <sup>5</sup>S<sub>2</sub> energy level of Ho<sup>3+</sup> ion were studied for distinct concentrations of Ho<sup>3+</sup> ions. Energy transfer mechanism was investigated for LiPbB<sub>5</sub>O<sub>9</sub>:Ho<sup>3+</sup> phosphor. Concentration quenching was observed at 0.08 mol% of Ho<sup>3+</sup> concentration among various concentrations. CIE color coordinates were computed and they showed the greenish-yellow region for various Ho<sup>3+</sup> concentrations. The present, LiPbB<sub>5</sub>O<sub>9</sub>:0.08Ho<sup>3+</sup> phosphor may be useful for the greenish-yellow emitting phosphor applications.

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## 1. Introduction

In the present days, there is much need for high efficient displays and lamps with lower power consumption. This requirement urged the scientists to develop high performance phosphors with desirable qualities. Phosphors are used in various situations like solid state lighting (SSL) devices, solar cells, display devices, bio-imaging and temperature sensors, etc. So, there is much need for production of high performance phosphors by selecting suitable host and activator ion [1]. In SSL technology, rare earth (RE<sup>3+</sup>) ions doped oxide phosphors have gained much importance for the production of white light emitting diodes (W-LEDs). One of the ways of producing the white light emission is blending of blue, red and green emitting phosphors in right proportion [2]. Another way is excitation of tri-color (blue, green and red) phosphors with a blue UV chip. Among the three phosphors, if any one of the phosphor shows the low efficiency then total luminescence will be decreased, which intern leads to lower color rendering index (CRI) and high coordinate color temperature (CCT) for white LED [3]. It is necessary to choose a proper host to accommodate proper rare earth ions. Among various hosts, borates are very much useful and

they exhibit interesting characteristics like lower phonon energies and high rare earth (RE<sup>3+</sup>) ion solubility etc. Addition of lead oxide (PbO) reduces the phonon energy of the phosphor compounds. Lower phonon energy can prevent the non-radiative energy loss of excited RE<sup>3+</sup> dopants [4].

Normally, RE<sup>3+</sup> ions are used as activators in phosphors. For RE<sup>3+</sup> ions, 4f-4f transitions are parity forbidden and Laporte selection rule is not allowed. However, mixed non-centrosymmetric electronic states with opposite parity ligands lead to parity allowed transitions. Such combination lead to the emission of narrow bands from RE<sup>3+</sup> ions due to their shielding of 4f electrons by larger radial 5s<sup>2</sup>5p<sup>6</sup> sub-shells. Among the rare earth activators, holmium (Ho<sup>3+</sup>) ion is an important ion because of its lasing action in visible and IR regions. The Ho<sup>3+</sup> ion's low lying meta-stable states are very useful for efficient lasing transitions [5]. Ho<sup>3+</sup> ions doped phosphors find applications in field emission displays (FEDs), security printing, lighting industry and distinct medical related applications [6]. Crystals doped with Ho<sup>3+</sup> ions show a strong emission around 540 nm with the excitation of UV-radiation. Also, Ho<sup>3+</sup> doped phosphors are not explored much as other RE<sup>3+</sup> ions like, Sm<sup>3+</sup>, Eu<sup>3+</sup>, Dy<sup>3+</sup> etc. [7].

In Ho<sup>3+</sup> ion, the intermediate energy levels like <sup>5</sup>I<sub>7</sub> and <sup>5</sup>I<sub>6</sub> are very much useful to achieve population inversion with longer lifetimes. The transition, <sup>5</sup>I<sub>7</sub> → <sup>5</sup>H<sub>8</sub> of Ho<sup>3+</sup> ion corresponds to 2 μm emission is used in optical fiber communications, gas sensors and

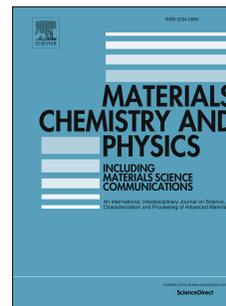
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# Journal Pre-proof

Morphology Driven Enhanced photocatalytic activity of CuO/BiOI Nanocomposites

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### Abstract

The development of novel highly efficient semiconductor metal oxide catalysts for enhanced photocatalytic dye degradation had of great significance. Herein, we report the synthesis of novel and highly efficient CuO/BiOI nanocomposite (0, 10, 20, 30, 40 wt % of CuO) semiconductor photocatalysts by a facile hydrothermal method. High crystallinity of tetragonal structure had observed from XRD studies. From SEM and TEM studies flower like morphology had observed upto 30% of CuO in CuO/BiOI nanocomposite and for 40% of CuO nanoflower like morphology slightly diminishes. EDAX and XPS spectra depict the presence of Bi, O, I, Cu only no other impurities had observed. Stretching and bending vibrational modes had observed from FTIR analysis. Bandgap decreases gradually upto 30% of CuO in CuO/BiOI nanocomposite and slightly increases for 40% of CuO in CuO/BiOI nanocomposite. Decrease in peak intensity due to charge carriers were observed from Photoluminescence studies Photocatalytic activity had estimated by the degradation of methyl orange (MO) solution under visible light irradiation. The flower-like morphology of 30% CuO in CuO/BiOI nanocomposite showed the high absorption ability to facilitate the generation of charge carriers as well as active oxygen species.

**Keywords:** CuO/BiOI, nanoflower, degradation of methyl orange, visible light, photocatalytic activity.

## Morphology Driven Enhanced photocatalytic activity of CuO/BiOI Nanocomposites

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### Abstract

The development of novel highly efficient semiconductor metal oxide catalysts for enhanced photocatalytic dye degradation had of great significance. Herein, we report the synthesis of novel and highly efficient CuO/BiOI nanocomposite (0, 10, 20, 30, 40 wt % of CuO) semiconductor photocatalysts by a facile hydrothermal method. High crystallinity of tetragonal structure had observed from XRD studies. From SEM and TEM studies flower like morphology had observed upto 30% of CuO in CuO/BiOI nanocomposite and for 40% of CuO nanoflower like morphology slightly diminishes. EDAX and XPS spectra depict the presence of Bi, O, I, Cu only no other impurities had observed. Stretching and bending vibrational modes had observed from FTIR analysis. Bandgap decreases gradually upto 30% of CuO in CuO/BiOI nanocomposite and slightly increases for 40% of CuO in CuO/BiOI nanocomposite. Decrease in peak intensity due to charge carriers were observed from Photoluminescence studies Photocatalytic activity had estimated by the degradation of methyl orange (MO) solution under visible light irradiation. The flower-like morphology of 30% CuO in CuO/BiOI nanocomposite showed the high absorption ability to facilitate the generation of charge carriers as well as active oxygen species.

**Keywords:** CuO/BiOI, nanoflower, degradation of methyl orange, visible light, photocatalytic activity.



# Influence of alkali and alkaline earths on structural and luminescence properties of $\text{Sm}^{3+}$ doped lithium fluoro phosphate glass and different (Na, Mg, K, Ca and Sr) glass ceramics

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## ARTICLE INFO

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## ABSTRACT

Transparent glass ceramics comprising of  $\text{BiPO}_4$  nanocrystals in bismuth phosphate glass ceramics ( $59.5\text{P}_2\text{O}_5+15\text{Bi}_2\text{O}_3+10\text{BaF}_2+10\text{AF}+05\text{TeO}_2+0.5\text{Sm}_2\text{O}_3$  where AF= alkali and alkaline earth fluorides) doped with  $\text{Sm}^{3+}$  ions were synthesized by typical melt quenching route. On the basis of data obtained from differential thermal analysis (DTA), prepared samples were analyzed for their thermal stability. Further powder X-Ray diffraction (PXRD) analysis has been done for all the samples to confirm the crystalline phase of  $\text{BiPO}_4$  and short-range order i.e., isotropic. Validations of various structural units were done with the help of FTIR. Spectral intensities were obtained using Judd-Ofelt (JO) theory for various absorption bands of  $\text{Sm}^{3+}$  ions using least square fit method for all the studied glass and glass ceramics. Various optical parameters of  $\text{Sm}^{3+}$  doped lithium phosphate glass and various glass ceramics were obtained from emission and absorption spectra studied in the present work. These optical parameters include JO intensity parameters ( $\Omega_2, \Omega_4$  and  $\Omega_6$ ), radiative transition probabilities ( $A_{ed}$ ), branching ratios ( $\beta$ ), emission cross sections ( $\sigma_e$ ), absorption cross sections ( $\Sigma$ ), gain bandwidths and optical gains ( $\sigma_e \times \Delta\lambda_{\text{eff}}$  and  $\sigma_e \times \tau_R$  respectively). Influence of alkali and alkaline earths metals on radiation properties of various excited levels of  $\text{Sm}^{3+}$  has been investigated. In relation to the other glass networks and ceramics,  $\text{SrF}_2$  glass ceramics studied in the present work exhibited productive properties and could be useful in development of optical devices for visible laser applications.

## 1. Introduction

Rare earth ions as a dopants play pivotal role in glasses and glass ceramic systems. Particularly for the past few decades this sphere has drawn much attention in view of many advantages for extensive applications in photonics, optical and optoelectronic telecommunications. [1–4]. Of late rare earth doped glass ceramics and glasses not only confined to optical applications in infrared regions but also enhancing interest as visible lighting devices. Therefore, trivalent ions like  $\text{Tb}^{3+}$ ,  $\text{Eu}^{3+}$ ,  $\text{Sm}^{3+}$  and  $\text{Dy}^{3+}$  ions are becoming increasing interest. Among different phosphate hosts, alkali or alkaline earth incorporated vitreous matrices have excellent nature of transparency for the Ultra Violet (UV) light [5–7]. In recently alkali and alkaline earth based hosts with glass formers/mixed glass formers like telluro phosphates, borotellurite, borosilicates shows increasing interest [8–10]. Telluro phosphates yield exceptional luminescence properties because of the local structure or

vicinity of dopant RE ions and become beneficial sites for cations upon addition of second network former. It has been proven that  $\text{Bi}^{3+}$  ions are adaptable activators and sensitizing ions when co existent with conditional glass former tellurium. Moreover, tellurite glasses propose low phonon energy, high rare earth solubility, high refractive index of linear and non-linear medium, low melting temperature and better chemical stabilization with thermal and mechanical constancy. Alkali/alkaline earth metals have been proven to be the improvement for optical and physical properties in glass systems favoring feasibility of efficient host selection [11,12]. Oxy fluoride glass (OFG) ceramics and glass matrices as a host deemed to be appropriate for rare earths by dint of high transparency and resists non-radiative relaxation owing to multi-phonon relaxation [13,14]. At the same time OFG ceramics offer superior properties such as chemical and physical as well as thermal among various vitreous materials than mere oxide or fluorides. Combination of alkaline earth modifiers improves the ability of ceramic

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## Phase controllable synthesis of CuS nanoparticles by chemical co-precipitation method: Effect of copper precursors on the properties of CuS



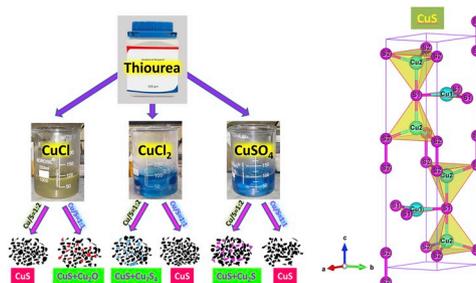
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### HIGHLIGHTS

- CuS NPs were synthesized from CuCl + CH<sub>4</sub>N<sub>2</sub>S by chemical co-precipitation method.
- Effect of copper precursors and Cu/S ratio on properties of CuS NPs was studied.
- Copper precursor type and Cu/S mole ratio played decisive roles on phases of CuS.
- CuS NPs showed excitonic absorption and localized surface plasmon resonance.

### GRAPHICAL ABSTRACT



### ARTICLE INFO

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Chemical co-precipitation method  
Effect of copper precursors  
Cu/S mole ratio

### ABSTRACT

The studies focusing on the synthesis of CuS nanoparticles (NPs) by Chemical Co-Precipitation method (CCP) along with detailed growth mechanism are limited. In addition, the synthesis of CuS NPs in water solvent is highly encouraged as water is served as the best eco-friendly solvent. In the present report, taking the advantage of Cu<sup>+1</sup> oxidation in the aqueous medium, CuS NPs were synthesized using CuCl and thiourea (Tu) via CCP in presence of naturally abundant water solvent under open atmosphere. In addition, the effect of different copper precursors (such as CuCl, CuCl<sub>2</sub>, and CuSO<sub>4</sub> in combination with thiourea) and the mole ratio of Cu/S on the properties of CuS NPs were also investigated. XRD analysis showed the single-phase CuS for the combination of CuCl + Tu at Cu/S = 1:2 and CuCl<sub>2</sub> (or CuSO<sub>4</sub>) + Tu at Cu/S = 1:1. For other growth conditions, copper-rich composition with mixed phases was observed. XPS analysis showed both +1 and +2 oxidation states for copper in CuS NPs synthesized from CuCl and Tu at Cu/S = 1:2. The CuS NPs showed broad absorptions in the UV-Vis and NIR regions due to excitonic absorption and localized surface plasmon resonance (LSPR). The optical band gap energy of CuS NPs was varied in the range of 2.05–2.34 eV, depending on the type of copper precursor and Cu/S mole ratio used. The synthesized CuS NPs have potential applications in the visible solar light-driven dye degradation.

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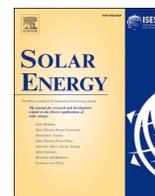
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## Effect of heat treatment in sulfur on structural, optical and electrical properties of thermally evaporated In<sub>2</sub>S<sub>3</sub> thin films

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### ABSTRACT

Crystallinity, optical band gap, resistivity and photoresponse of thermally evaporated In<sub>2</sub>S<sub>3</sub> thin films deposited at a temperature of 350 °C and further annealed in sulfur vapour at different temperature range of 200–300 °C is investigated. It is observed that with an increase of annealing temperature, predominantly β-In<sub>2</sub>S<sub>3</sub> phase is formed and the optical band gap for indirect allowed transitions increases from 1.6 eV to 2.0 eV and for direct allowed transitions from 2.3 eV to 2.7 eV. The electrophysical properties indicate that the activation mechanism of conductivity with an activation energy in the range of 0.5–0.73 eV, which is typical for the presence of indium vacancies in the β-In<sub>2</sub>S<sub>3</sub> crystal structure and for the replacement of sulfur by oxygen atoms. It is also noted that sulfur annealing at temperatures of 250–300 °C leads to an increase in the conductivity and photosensitivity of films, which is suitable for photovoltaic applications.

### 1. Introduction

Indium sulfide (In<sub>2</sub>S<sub>3</sub>) is one of the potential materials used in advanced solar cells, as buffer/window layer in Cu(In,Ga)Se<sub>2</sub>, Cu<sub>2</sub>ZnSnS<sub>4</sub> and Sb<sub>2</sub>S<sub>3</sub> based thin film solar cells (Spiering et al., 2016; Lee and Yang, 2021; Lugo-Loredo et al., 2014; Shi et al., 2021), as an electron transport layer (ETL) in perovskite solar cells (Yang et al., 2019; Hou et al., 2017) and as a photosensitizer in sensitized solar cells (Yang et al., 2015; Zhang et al., 2014) due to its high stability at room temperature, transparency in a wide wavelength range, less toxicity of its constituent elements and also photosensitive nature. The record conversion efficiency of 18.2% was achieved using thermally evaporated In<sub>2</sub>S<sub>3</sub> films as buffer layer in Cu(In,Ga)Se<sub>2</sub>-based thin film solar cells (Spiering et al., 2016), which is close to 22.6% efficiency achieved using toxic CdS as buffer layer in these cells (Jackson et al., 2016). Shi et al. (Shi et al., 2021) was also able to achieve improved conversion efficiency of Sb<sub>2</sub>S<sub>3</sub>-based solar cell by introducing In<sub>2</sub>S<sub>3</sub> as buffer layer between TiO<sub>2</sub> and Sb<sub>2</sub>S<sub>3</sub> layers that can reduce the charge recombination and enhanced the electron lifetime. Further, In<sub>2</sub>S<sub>3</sub> is used as a photo-anode in photoelectrochemical (PEC) cells for hydrogen production (Wang et al., 2020). Moreover, it can be used in Li-ion batteries (Gu

and Wang, 2014), gas sensor (Souissi et al., 2018; Souissi et al., 2019; Souissi et al., 2020; Souissi et al., 2020) and biosensor (Nagesh et al., 2001; Li et al., 2020) applications.

Indium sulfide has three different structural forms: α-In<sub>2</sub>S<sub>3</sub> (defective cubic), β-In<sub>2</sub>S<sub>3</sub> (defective tetragonal) and γ-In<sub>2</sub>S<sub>3</sub> (layered hexagonal) (Lee et al., 2008; Pistor et al., 2016). Crystalline β-In<sub>2</sub>S<sub>3</sub> is an n-type semiconductor with direct band gap energy varies from 1.8 eV to 2.4 eV depending on its composition and deposition conditions (Sanz et al., 2013; Bouabid et al., 2004; Ji et al., 2015; Nehra et al., 2015). It is the most stable compound at room temperature (Pistor et al., 2016).

The α-modification of In<sub>2</sub>S<sub>3</sub> is usually stable at temperatures above 420 °C. However, in the case when higher annealing rates or deficiency of S atoms prevail during the synthesis process, it is possible to obtain samples of α-In<sub>2</sub>S<sub>3</sub> phase that are stable even at room temperature (Sandoval-Paz et al., 2005). A high-temperature trigonal γ-In<sub>2</sub>S<sub>3</sub> modification is stable at temperatures above 754 °C. Nevertheless, the researchers showed that the addition of 5 at. % As or Sb or other elements of V-group leads to the stabilization of γ-In<sub>2</sub>S<sub>3</sub> phase at room temperature (Diehl et al., 1976; Choe et al., 2001).

Defect characteristics of In<sub>2</sub>S<sub>3</sub> structure violate the periodicity of the crystal lattice potential that leads to the appearance of allowed local

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Article

# Interaction of a Low-Pressure System, an Offshore Trough, and Mid-Tropospheric Dry Air Intrusion: The Kerala Flood of August 2018

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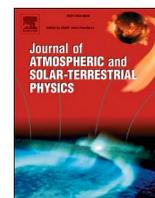


**Abstract:** The present study examines the Kerala Flood Event (KFE, 15–16 August 2018, in India) that occurred along the west coast of India and resulted in ~400 mm of rainfall in one day. The KFE was unique in comparison to previous floods in India, not only due to the rainfall duration and amount, but also due to the fact that the dams failed to mitigate the flood, which made it the worst in history. The main goal of this study is to analyze and elucidate the KFE based on meteorological and hydrological parameters. A propagating low-pressure system (LPS) from the Bay of Bengal (BoB) caused the streak of plenty of rainfall over Kerala, the west coast, central India, and the BoB. Additionally, the upper-tropospheric anti-cyclonic system over the Middle East region inhibited a northward advancement of LPS. On the western coast of India, a non-propagating (with diurnal fluctuations) offshore trough was observed over the west coast (from Kerala to Gujarat state). Therefore, a synergic interaction between LPS, an intrusion of dry air in the middle-troposphere, and the offshore trough was the main reason for KFE. However, after around ten days, rainfall saturated the dam capacities; thus, the released water, along with the amount of precipitation on the day of the event, was one of the other possible reasons which worsened the flood over Kerala.

**Keywords:** Kerala Flood Event; off-shore trough; low-pressure systems

## 1. Introduction

The quantity and availability of surface precipitation play important roles not only in hydrometeorology, but also in water resource management. Be it irrigation, agriculture, controlling floods, coping with droughts, or administering a freshwater supply, the timely assessment of events is vital to answering critical questions, such as when, where, and how much will it rain. Over the Indian subcontinent, the northward propagation of the monsoon and surface rainfall amounts are governed by remote teleconnections and internal dynamics of the monsoon itself [1]. During the summer monsoon, extreme flood events have significant social, economic, ecological, environmental, hydrological, and health impacts on regional and local communities. Therefore, the sudden kick-off of a natural disaster requires a detailed prioritization list of flood forecasts, assessments of the damages, risks, and improved management of floods. July and August are the rainiest months in India, and bring moderate to plenty of rainfall and sometimes floods over various parts of India. Recently, the state of Kerala (in India) witnessed the worst flooding of the century, which occurred from 15 to 16 August in 2018. The flood destroyed thousands of houses, leading to about 500 deaths, inundated water in cities and villages,



## Research Paper

# Low-latitude mesospheric signatures observed during the 2017 sudden stratospheric warming using the fuke meteor radar and ERA-5

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## ARTICLE INFO

## Keywords:

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## ABSTRACT

The signature of the low-latitude mesosphere response to the February 2017 minor sudden stratosphere warming (SSW) was detected using the observations of a meteor radar at Fuke (19.5°N, 109.1°E) a low-latitude station in China and ERA-5 data. Radar detected the zonal wind reversal in the mesosphere three days before the SSW event, whereas the ERA-5 does not reproduce the mesospheric wind response at low-latitudes during the 2017 SSW and large discrepancies are found between the mesospheric zonal winds derived from the Fuke radar and ERA-5. The quasi oscillatory pattern was noted in the meridional winds before the SSW event, afterward, the northward winds are significant. We observed the existence of 20–28-day planetary waves (PWs) in the Fuke meteor radar measured mesospheric zonal winds before the SSW and the 2–12-days period PWs before and after the SSW in the meridional winds. The zonal structure and periodicity of the PWs have been verified with the other meteor radar at the Indian tropical station Tirupati (13.63°N, 79.4°E). However, ERA-5 does not capture the PW activity in the mesosphere as radar. The similarities and dissimilarities among the different techniques have been discussed. Therefore, the present study re-emphasizes the strong response of the low-latitude mesosphere to the 2017 minor SSW in a manner similar to the major SSW event.

## 1. Introduction

Sudden stratospheric warming (SSW) is one of the most remarkable and radical phenomena in the atmosphere, primarily occur in the boreal winter, when the polar vortex distorts and can even break down (Shi et al., 2017). Recently updated research on the SSWs has decisively shown the strong connection between the SSWs and widespread changes all through the Earth's atmosphere (Pedatella et al., 2018). These SSW events can affect the atmospheric chemistry, temperatures, winds, from the surface to the thermosphere and even across both the hemispheres. The occurrence of the SSW event was first noticed by Scherhag (1952)

utilizing the radiosonde observations of the stratosphere temperatures over Berlin. In successive studies, the comprehensive physical and chemical mechanisms that reinforce the SSW were revealed (e.g., Matsuno, 1971; Schoeberl and Hartmann, 1991). In brief, SSW occurs as a result of the interaction between vertically propagating planetary waves (PWs) and the mean flow in the stratosphere. The theoretical study by Liu and Roble (2002) described that the development of the PWs with wavenumber 1&2 ( $k = 1, 2$ ) in the lower atmosphere could be the superseding phenomenon for the SSW occurrence. Though it was believed that the source of the PWs causing the SSW exists in the troposphere (Matsuno, 1971; Alexander and Shepherd, 2010), still the debate is

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# Geophysical Research Letters



## RESEARCH LETTER

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### Key Points:

- The quasi-2-day waves (Q2DW) wind field at 80–200 km altitude is delineated from combining ground and space data in the low-latitude region (+/−15°)
- Zonal wavenumber components  $s = +2$  and  $s = +3$  are the dominant ones in our observations, and their wave periods evolve differently with time
- The quasi-2-day waves  $s = +3$  exhibits an excellent quantitative agreement between two datasets at 95–100 km, serving as a validation of the ICON-MIGHTI winds

### Supporting Information:

Supporting Information may be found in the online version of this article.

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## Quasi-2-Day Wave in Low-Latitude Atmospheric Winds as Viewed From the Ground and Space During January–March, 2020

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**Abstract** Horizontal winds from four low-latitude ( $\pm 15^\circ$ ) specular meteor radars (SMRs) and the Michelson Interferometer for Global High-resolution Thermospheric Imaging (MIGHTI) instrument on the ICON satellite, are combined to investigate quasi-2-day waves (Q2DWs) in early 2020. SMRs cover 80–100 km altitude whereas MIGHTI covers 95–300 km. Q2DWs are the largest dynamical feature of the summertime middle atmosphere. At the overlapping altitudes, comparisons between the derived Q2DWs exhibit excellent agreement. The SMR sensor array analyses show that the dominant zonal wavenumbers are  $s = +2$  and  $+3$ , and help resolve ambiguities in MIGHTI results. We present the first Q2DW depiction for  $s = +2$  and  $s = +3$  between 95 and 200 km, and show that their amplitudes are almost invariant between 80 and 100 km. Above 106 km, Q2DW amplitudes and phases present structures that might result from the superposition of Q2DWs and their aliased secondary waves.

**Plain Language Summary** In the mesosphere and lower-thermosphere, quasi-2-day waves are spectacular planetary-scale oscillations. Almost all relevant observational studies are based on ground-based single-station or single-satellite methods and therefore cannot determine the zonal wavenumber unambiguously. In the current work, we employ a series of multi-station methods on winds measured by four longitudinally separated low-latitude ground-based radars. These methods help us to determine two dominant zonal wavenumbers at 80–100 km altitude. These results are used to complement satellite measurements. The agreement between datasets is extraordinary, allowing us to extend the characteristics of the waves to higher altitudes using satellite measurements.

## 1. Introduction

Quasi-two-day waves (Q2DWs) in the mesosphere have been the subject of numerous observational and theoretical investigations (e.g., Pancheva et al., 2018, and references therein) since their first discovery in specular meteor radar (SMR) winds (Müller, 1972). Q2DWs are generally thought to be the atmospheric manifestation of the gravest westward-propagating Rossby-gravity normal mode with zonal wavenumber  $s = 3$  (Salby, 1981; Salby & Roper, 1980), amplified or perhaps even initiated by the mesospheric easterly jet instability (Plumb, 1983; Pfister, 1985; Randel, 1994), which admits zonal wavenumbers of  $s = 2$  through 4. Q2DWs with  $s = 2, 3$ , and 4 are common features of space-based observational studies (e.g., Gu et al., 2013; Huang et al., 2013; Lieberman, 1999; Tunbridge et al., 2011).

Being the largest dynamical feature of the summertime middle atmosphere, Q2DWs play a significant role in atmosphere-ionosphere coupling. Although earlier works have suggested that Q2DWs could drive



# Study of mixing ratios of SO<sub>2</sub> in a tropical rural environment in south India

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Sulphur dioxide is a toxic pollutant in the atmosphere emitted from natural sources and human activities. Normally, SO<sub>2</sub> has a life-time of about 2 days in the atmosphere and is not transported to long distances from its source region. However, under favourable circumstances such as low humidity or high wind speed, it can travel intercontinental distances from the point of emission. In this article, we have analysed the surface mixing-ratio of SO<sub>2</sub> measured over the time period from January 2010 to April 2012 at a rural region in south India. It is found that SO<sub>2</sub> mixing-ratio is very low over this region with an annual mean value in the range of 0.21–0.24 ppbv. OMI satellite estimates an annual mean value of 0.5 Dobson Units (DU) over the same location and period. However, during January to May relatively higher concentrations of SO<sub>2</sub> are observed, mainly coming from power plants located in southern and eastern India as indicated by higher SO<sub>2</sub>/NO<sub>2</sub> ratios of greater than 0.5. In one instance, on June 20th, 2011, it is found that the OMI SO<sub>2</sub> value was a factor of 13 higher than 2011 annual mean at Gadanki. Using the FLEXible PARTicle dispersion model (FLEXPART) and satellite data, it is found that the observed higher SO<sub>2</sub> value on 20th June was due to intercontinental transport of SO<sub>2</sub> from Nabro volcanic eruption. Using the FLEXPART model with ECLIPSE-v5 emission inventory, the observed seasonal variation of SO<sub>2</sub> could be well reproduced; however, the mixing ratios are found to be overestimated. CAMS (Copernicus Atmosphere Monitoring Service) SO<sub>2</sub> reanalysis values available through its implementation in the ECMWF Integrated Forecasting System are a factor of 7.8 higher than observations, possibly due to incorrect vertical profile used in the model.

**Keywords.** SO<sub>2</sub>; FLEXPART; NO<sub>2</sub>; India; CAMS reanalysis.

## 1. Introduction

SO<sub>2</sub> is a toxic pollutant in the atmosphere. An excess SO<sub>2</sub> amount in the atmosphere can cause respiratory and cardiovascular diseases and damage to buildings (Finlayson-Pitts and Pitts 2000 and references therein). SO<sub>2</sub> reacts with OH radical and forms H<sub>2</sub>SO<sub>4</sub> droplets, high amount of which

causes acid rain. The sulphate aerosols are scattering type of aerosols and affect the climate (Charlson *et al.* 1990). These aerosols have negative radiative forcing in the atmosphere and counter the global warming by greenhouse gases and black carbon (Charlson *et al.* 1991; Kiehl and Briegleb 1993). SO<sub>2</sub> has a lifetime of about two days to two weeks in the troposphere (von Glasow

## Key Points:

- Gravity wave (GW) perturbations in the Martian thermosphere are studied using Ar density profiles measured by Neutral Gas and Ion Mass Spectrometer/Mars Atmosphere and Volatile Evolution
- Daytime GW amplitudes are enhanced and horizontal wavelengths are reduced during the 2018 planet-encircling dust event
- GW amplitudes, in general, anti-correlate with the background temperatures, except during the lower atmospheric dust event

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## Interannual Variability of Atmospheric Gravity Waves in the Martian Thermosphere: Effects of the 2018 Planet-Encircling Dust Event

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**Abstract** We study the interannual variability of atmospheric gravity waves (GWs) in the Martian thermosphere and their relation to the background temperatures using Ar densities measured by Neutral Gas and Ion Mass Spectrometer/Mars Atmosphere and Volatile Evolution (MAVEN). The amplitudes and wavelengths of the GWs are extracted from the neutral density perturbations in the inbound segment of the MAVEN orbit. The GW amplitudes predominantly lie between 5% and 10% and are mostly less than 30% of the background densities. The horizontal wavelengths are between 50 km and 300 km with peak wavelengths of 100–130 km. GW amplitudes show a significant diurnal variation with larger amplitudes during nighttime and smaller amplitudes during daytime. In addition, the GW amplitudes negatively correlate with the background temperatures indicating the role of convective instability in the saturation of the GWs. Most importantly, the GW amplitudes are larger and the wavelengths are smaller when there was a planet-encircling dust event in the Mars' lower atmosphere during 2018. As a result, the typical diurnal variation of GW amplitudes is not apparent. During the lower atmospheric dust event, the GW amplitudes do not show any significant correlation with the background temperatures. It is proposed that the PEDE-2018 led to changes in the circulation of the mesosphere and lower thermosphere, so that the modified circulation enhanced the upward propagation/reduced the filtering of GWs leading to their enhancement in the upper thermosphere.

**Plain Language Summary** Small-scale wave-like structures, known as atmospheric gravity waves (GWs), are omnipresent in the Martian upper atmosphere. In the present study, these GWs are extracted from the neutral densities measured by a mass spectrometer on Mars Atmosphere and Volatile Evolution spacecraft. These waves constitute up to 30% of the background densities and have horizontal scales of 50–300 km. In addition, these waves have a strong diurnal variation with larger amplitudes during nighttime than during daytime. Furthermore, the wave amplitudes are weaker when the upper atmosphere is warmer and vice versa. The most important finding of the present study is that the amplitudes of the GWs are stronger during the lower atmospheric dust event in 2018. Previous studies have shown that the dust event resulted in significant heating of the thermosphere. Our finding is, therefore, in contradiction to the existing understanding of weaker GWs in a warmer thermosphere. The enhancement in GW amplitudes is explained by considering their enhanced propagation in the background flow that is modified by the lower atmospheric dust event. The waves subsequently propagate to upper altitudes without losing much of their energy and hence are able to maintain larger amplitudes, even though the background atmosphere is warmer.

### 1. Introduction

Understanding the structure and dynamics of the Martian thermosphere (100–220 km) is extremely important as this region, in particular the upper thermosphere, acts as a buffer zone between the reservoir of atmospheric species down below and the exosphere above from where the gaseous escape happens (e.g., Bougher, Cravens, et al., 2015). From this view point, the exobase acts as a lid on top of the thermosphere and the gaseous escape is regulated by the amount of energy, particles, and fields (both electric and magnetic) that reach the upper thermosphere. Thermospheric neutral densities, in general, decrease exponentially with an increase in altitude. Superimposed on this, there are perturbations of various scales that are due to forcings from above and below. Forcings from below include the planetary waves, thermal tides, and gravity

# JGR Space Physics

## RESEARCH ARTICLE

10.1029/2019JA026510

### Key Points:

- Evaluation of meteor wind radars operating at low and equatorial latitudes in estimating the MLT region gravity wave momentum fluxes
- Three-dimensional wind simulations with specified mean, tidal, planetary, and gravity wave amplitudes
- Climatology of zonal and meridional gravity wave momentum fluxes in the MLT region over low and equatorial latitudes

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## Meteor Radar Estimations of Gravity Wave Momentum Fluxes: Evaluation Using Simulations and Observations Over Three Tropical Locations

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**Abstract** Meteor radars are widely used to study gravity wave (GW) variances and their momentum fluxes at the altitudes where meteor counts are sufficient to yield good statistical fits to the data. These radars provide hourly zonal and meridional wind observations round the clock in 80- to 100-km height domain. However, the capability of meteor radars in estimating GW momentum fluxes should be evaluated before they can be used for any research applications. In this regard, the present study evaluates the meteor radar observations of GW momentum fluxes obtained from Thumba (8.5°N, 77°E; 2006–2015), Kototabang (0.2°S, 100.3°E; 2002–2017), and Tirupati (13.63°N, 79.4°E; 2013–2018) using three-dimensional wind field simulations, which include specified tidal, planetary and GW fields. A modified composite day analysis is adopted to estimate the GW momentum fluxes, which also accounts for the tidal and planetary wave contributions. The results showed that the retrieved and specified GW momentum fluxes agree very well over Tirupati followed by Thumba and Kototabang. It is noted that the agreement between the retrieved and simulated fields depend on the number of meteor detections used in the analysis. After evaluating the meteor radar retrieved GW momentum fluxes by employing simulations, their interannual variability and climatologies over the three observational locations are constructed. The significance of the present study lies in evaluating the capability of three meteor radars located in equatorial and low-latitudes in estimating GW momentum fluxes by employing three-dimensional wind field simulations with specified mean winds, tidal, planetary, and GW fields.

### 1. Introduction

Importance of gravity waves (GWs), which can alter the structure, energetics and dynamics of the middle atmosphere by transferring energy and momentum from troposphere to the mesosphere, has been well recognized (Fritts, 1984; Fritts & Rastogi, 1985; Holton, 1982; Houghton, 1978; Lindzen, 1981; Matsuno, 1982). Departure of the mesosphere and lower thermosphere from the radiative equilibrium is attributed to the mean meridional circulation with rising motion in the summer hemisphere and sinking motion in the winter hemisphere, and this meridional circulation sustains due to the momentum transferred by the gravity waves (Vincent & Reid, 1983). Investigations on GW activity in the middle atmosphere are thus essential for the explaining the mean meridional circulation in the mesosphere, cold summer mesopause, warm winter mesopause, equatorial mesospheric/stratospheric semiannual and quasibiennial oscillations, and wind reversal in the lower thermosphere (Antonita et al., 2008; Baldwin et al., 2001; Garcia & Solomon, 1985; Holton, 1982; Placke et al., 2011; Yiğit & Medvedev, 2015; Vincent & Reid, 1983). GWs can influence the occurrence of Polar stratospheric clouds which in turn affect the ozone destruction, indirectly (Innis & Klekociuk, 2006). These waves can influence propagation of tides and planetary waves in the middle atmosphere (Yiğit & Medvedev, 2016, 2017). Thus, determination of gravity wave variances and momentum fluxes is important for the understanding of middle atmospheric dynamics and energetics (Placke et al., 2011; Vincent & Reid, 1983). The myriad role played by GW in the middle atmosphere makes them essential part of modelling of the middle atmosphere at different altitudes. Owing to their smaller scales, these waves are parameterized in global models. The importance of parameterization of GW effects including their sources in global models has been well recognized by the middle atmospheric research community (de Wit et al., 2015; Espy et al., 2006; Fritts & Alexander, 2003; Geller et al., 2013). Further, using the vertical derivative



# Solar radiometer sensing of multi-year aerosol features over a tropical urban station: direct-Sun and inversion products

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**Abstract.** The AEROSOL ROBOTIC NETWORK (AERONET) is the most developed ground-based network for aerosol remote sensing and has been playing a significant role not only in monitoring air quality for protecting human health but also in assessing the radiative budget of our planet Earth. In this paper, we report the direct-Sun and inversion products, comprising of spectral variation of aerosol optical depth (AOD), associated Ångström exponent (AE), fine- and coarse-mode aerosol fractions, aerosol size distribution (ASD), refractive index (RI), asymmetry parameter (AP), single scattering albedo (SSA), aerosol radiative forcing (ARF) and columnar concentration of gas constituents such as water vapor (H<sub>2</sub>O), obtained from a Cimel Sun–sky radiometer, functioning in Pune, India, under the AERONET program since October 2004. These long-term measurements carried out from 2005 to 2015 could serve as an urban aerosol optical long-term average or climatology. The AOD long-term variations at all wavelengths, considered in the study, exhibited an increasing trend, implying year-to-year enhancement in aerosol loading. The mean seasonal variations in AOD from cloud-free days indicated greater values during the monsoon season, revealing dominance of hygroscopic aerosol particles over the station. Contribution by different aerosol types to AOD has also been deduced and discussed, and dominance of a mixed type of aerosols (44.85 %) found, followed by combination of biomass burning and urban industrial aerosols (22.57 %)

compared to other types of aerosols during the study period. The long-term datasets, derived aerosol and trace gas products play a significant role in understanding aerosol climate forcing, trends and evaluation of regional air pollution and validation of aerosol transport models over the study region.

## 1 Introduction

Atmospheric aerosol concentration and optical properties are one of the largest sources of uncertainty in current assessments and predictions of global climatic change (Hansen et al., 2000; IPCC, 2001). Changes in the aerosol content of the atmosphere constitute a major forcing mechanism by affecting the radiative balance of the climate system (Crutzen and Andreae, 1990; Charlson et al., 1992). A thorough understanding of regionally dependent chemical and optical properties of aerosols (e.g., aerosol optical thickness, size distribution) and their spatial (both horizontal and vertical) and temporal distribution is required for accurate evaluation of aerosol effects in the climate system (Hsu et al., 2000). Systematic observational evidence is required to study the highly variable characteristics of atmospheric aerosols in time and space (IPCC, 2007). Added, long-term measurements of key aerosol optical properties are urgently needed to better understand the climate changes (Wang et al., 2001; Streets et



# Sensitivity to initial conditions on the simulation of extratropical cyclone ‘Gong’ formed over North Atlantic

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The role of initial conditions (ICs) in the simulation of severe winter storm ‘Gong’ formed over North Atlantic is studied. The life cycle of Gong started at 1800 UTC of 16–0600 UTC of 22 January, 2013, with CSLP of 972 hPa. The gusty wind ( $\sim 33 \text{ ms}^{-1}$ ) and torrential rainfall of  $\sim 90 \text{ mm d}^{-1}$  recorded over several major cities of the Iberian peninsula. Five numerical experiments were performed with the WRF model by initializing at 0600 UTC of 16, 1800 UTC of 16, 0600 UTC of 17, 1800 UTC of 17, and 0600 UTC of 18 January, 2013. Our results suggest that significant differences are seen among the experiments, particularly with the ICs of 0600 UTC 17 January, 2013, which represent the quick movement of Gong with a slight underestimation of intensity. The experiment with IC 0600 UTC on 18 January, 2013 produced the best simulation as compared to the observations. The simulated track, intensity, wind flow, and rainfall were well agreeing with the observations. The 12-h average track errors were ranging from 95 to 332 km with 24-, 36-, 48-, 60-, and 72-h lead time. The Q-vectors of Gong with the WRF model with 24-h lead time produced minimum errors.

**Keywords.** Extratropical cyclone; cyclogenesis; initial and boundary conditions; WRF model.

## 1. Introduction

Extratropical cyclones (ETCs) over North Atlantic (NA) Ocean, which are mostly originated above  $30^\circ\text{N}$  during the winter season and their frequent landfall would have devastating effects on the European economy, especially when those storms pass through the continent. In winter, the ETCs are the major cause of hazardous weather due to the gusty winds, rain, and snowfall cause losses of about €3.5 billion per year across Europe (Barredo 2010). The frequency of ETCs is expected to increase under

climate change (Leckebusch and Ulbrich 2004; Ulbrich *et al.* 2009; Schwierz *et al.* 2010; Donat *et al.* 2011). The tracks of ETCs are associated with the temperature gradients between the warm (cold) over subtropical (Polar) region (Oort 1971; Trenberth and Stepaniak 2003). The primary atmospheric energy transfer from the mid-latitudes towards Polar regions is due to the ETCs. The socio-economic devastation because of the rapid deepening of the ETCs clutches the second position after the tropical cyclones because of its asymmetric nature and has translational velocities that can vary

# Long-term changes in land surface temperature due to land use land cover over a mega city in south India

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## ABSTRACT

It is well known that one of the major causes of global climate change is urbanization and industrialization. The necessity of converting vegetation area into residential and commercial areas and their allied developments in the way of rapid urbanization, may change the surface albedo that could increase the Land Surface Temperature (LST). The main objective of the present study is to evaluate the impact of landscape structure on the diversity of LST over one of the fastest growing urban region Hyderabad, located in Rangareddy district of Telangana state in southern India. Study has been carried out during the period of 1995 - 2018, using four Landsat Images (two Landsat - 5 Thematic Mapper and two Landsat OLI-TIRS 8). Land Use Land Cover (LULC) mapping and LST are derived by using pre-processed landscape data. Interestingly, urban region LST is found less than that observed in the outskirts during entire study period. Land cover classification showed that the built-up areas, barren land and vegetation increased by 2.34%, 9.28% and 18.01%, respectively, while the forest area and water bodies are decreased by 28.79% and 1.21% respectively, over the period of 24 years between 1995 and 2018. Maximum LST for the total area increased by approximately 4°C and the minimum temperature increased by approximately 3.5°C between 1995 and 2018. The negative correlation has been observed between Normalized Difference Vegetation Index (NDVI) and Normalized Difference Water Index (NDWI) with LST with low temperatures, but Normalized Difference Built-up Index (NDBI), has positive correlation with high temperatures. This study also provides a quantitative approach in exploring the relationship between several index and temperature.

**Keywords:** Land Use Land Cover (LULC), Land Surface Temperature (LST), Normalized Difference Vegetation Index (NDVI), Normalized Difference Built-up Index (NDBI), Normalized Difference Water Index (NDWI), Arc GIS.

## INTRODUCTION

Rapid urbanization has led to continuous decline in greenery in most of the cities. Due to population growth and urban sprawl, the vegetation landscape is undergoing unwanted changes. The major reduction in the forest and agricultural lands, and an increase in barren land and impermeable surfaces due to huge built-up areas, are the main reasons for the observed changes in Land Use Land Cover (LULC) (Kumar et al., 2012). Landscape architecture incorporates human and natural components and their spatial pattern (Dissanayake et al., 2019). In the day time, buildings and non-vegetative surface, such as bare soil, can trap the incoming solar radiation (Staniec and Nowak, 2016; Weng et al., 2004), and then re-radiate during the night time, due to the absence of solar insolation (Arsiso et al., 2018). At present, urban areas suffer from the most critical problem in loss of vegetation areas, thereby increase in surface temperatures due to uncontrolled transport, evaporation, and the growth of hard ground surfaces (Buyadi et al., 2013; Hussain et al., 2014; Kant et al., 2009; Kumar et al., 2012). The regional and global impact of changes in terrestrial ecosystems, due to human activities through change in LULC, can be clearly monitored using the thermal infrared (TIR) remote sensing energy, which is emitted directly from the land surface (Faqe Ibrahim, 2017).

The Normalized Difference Vegetation Index (NDVI) is the most commonly used vegetation index for monitoring vegetation and identify different vegetation cover worldwide. However, in an area with low plant cover (urban areas), soil

and climate have a significant impact on NDVI and its relationships with vegetation (Huete and Jackson, 1987). It is imperative to quickly and accurately describe the water-coverage area in order to dynamically monitor water resources and planning water conservation. The most commonly used method for water characteristic extraction, is the Normalized Difference Water Index (NDWI) proposed by Mcfeeters (1996). The NDWI produces negative values for vegetation and soil and positive values for water bodies. The Normalized Difference Built-up Index (NDBI) is an effective indexing mechanism used to automatically mapping urban built-up areas on Thematic Mapper (TM) images. The built-up area appends all impervious surfaces, including houses, industries, roads, etc. This method takes upper hand of the spatial spectral responses of built-up areas and other land covers. Remote Sensing (RS) and Geographical Information System (GIS) techniques are used to detect the land-use changes and its impact on the land surface temperature (Buyadi et al., 2013).

In an earlier study, Rao (1972) introduced a thermal infrared remote sensing-based LST-estimation method. Later, Lombardo, (1985) developed this concept by developing a computational model for remote sensing-based LST measurements. Since then, various researchers have performed several qualitative studies using different satellite data sets (AVHRR/NOVAA/ASTER/Landsat(TM/ETM+)/MODIS TIR data set) and some of them reviewed and suggested a satellite view of the LST's assessment and its relationship to

# JGR Space Physics

## RESEARCH ARTICLE

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### Key Points:

- Response of diurnal tide in the mesosphere-lower thermosphere (MLT) to the stratospheric quasi-biennial oscillation (SQBO) is investigated over three locations using meteor radar observation and Whole Atmosphere Community Climate Model (WACCM) simulations
- The monthly mean tidal variability in the MLT region is highly correlated with stratospheric winds at 20–40 hPa pressure level
- Stratospheric QBO modulation of tidal variability in the MLT imposes the QBO signature in the equatorial electrojet

### Supporting Information:

Supporting Information may be found in the online version of this article.

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## Stratospheric Quasi Biennial Oscillation Modulations of Migrating Diurnal Tide in the Mesosphere and Lower Thermosphere Over the Low and Equatorial Latitudes

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**Abstract** Horizontal wind measurements using meteor radars located at Thumba (8.5°N, 77°E; 2006–2015) Kototabang (0.2°S, 100.3°E; 2002–2017) and Tirupati (13.63°N, 79.4°E; 2013–2017) in the mesosphere-lower thermosphere (MLT) and Specified Dynamics Whole Atmosphere Community Climate Model (SD-WACCM) simulations are employed for investigating the diurnal tide variability at quasi-biennial scales. The model simulations are evaluated using the meteor radar observations at three tropical locations. WACCM simulations could reproduce the seasonal evolution of diurnal tides very well over Thumba and Tirupati but there are small discrepancies over Kototabang. In order to investigate the modulation of the diurnal tide amplitudes in the MLT region by the stratospheric quasi-biennial oscillation (SQBO), deseasonalized perturbations of diurnal tides and stratospheric winds are analyzed. A very good correspondence is found between meridional diurnal tide perturbation amplitudes and the SQBO with positive tidal perturbations during the eastward phase of SQBO and negative perturbations during the westward phase over Thumba and Tirupati. SQBO modulations of diurnal tides at global scales exhibits a positive correlation between the meridional diurnal tide perturbation with SQBO winds at 20 hPa and a negative correlation with SQBO winds at 70 hPa within  $\pm 40^\circ$  latitude, except over the equator. It is also noted that the equatorial electrojet strength, is modulated by the SQBO over the Thumba, which is a dip equatorial location. The significance of present study lies in evaluating WACCM simulations at tropical locations using meteor radar measurements and in investigating the SQBO modulations of diurnal tides at global scales.

**Plain Language Summary** Atmospheric tides are global scale oscillations having periods that are harmonics of solar day (24-, 12-, 8-h, etc.) and play a significant role in coupling lower and middle/upper atmosphere. Tides are generated in the troposphere/stratosphere and propagate upwards. In order to conserve the momentum, the amplitude of tides increases with altitude in response to decreasing density with altitude. Among many atmospheric waves present in the mesosphere-lower thermosphere (MLT), diurnal tides (24-h period) have the largest amplitudes over the low-latitudes and thus play a key role in shaping the structure and dynamics of this region. Even though tides are well represented in numerical models, time-to-time evaluation of these models against observations from several ground-based measurements is needed to employ them in day-to-day research applications. In the present study, SD-WACCM model simulations of mean winds and diurnal tides in the MLT region are evaluated using meteor radar observations over three tropical locations [Thumba (8.5°N, 77°) Kototabang (0.2°S, 100.3°E) and Tirupati (13.63°N, 79.4°E)]. There exists a long-period oscillation in the stratosphere known as stratospheric quasi-biennial oscillation (SQBO), which is believed to modulate the amplitude of diurnal tides at interannual scales. The present study also investigates the relationship between SQBO and the tidal variability in the MLT region. The results show significant correlation between the SQBO phase and the deseasonalized diurnal tide amplitudes in the MLT region. Diurnal tide amplitudes are relatively larger during the eastward phase as compared to the westward phase of the SQBO. It is also noted that the strength of the equatorial electrojet is also modulated by the SQBO. The WACCM simulations could reproduce this feature very well. The model simulations are further employed to study the response of diurnal tide amplitude to the phase of the SQBO at global scales. The results show that the SQBO phase influences the diurnal tide amplitude in the latitude belt of 40°N–40°S except at the equator. Thus, the

# Ar Ion Irradiation Effects on the Characteristics of Ru|Pt|*n*-GaN Schottky Barrier Diodes

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**Abstract**—The present study reports the effects of 650-keV Ar<sup>2+</sup> ion irradiation on the structural, optical, and device characteristics of Ru|Pt|*n*-GaN Schottky barrier diodes (SBDs). Ion irradiation induces the broadening of the GaN X-ray diffraction peaks due to induced structural deformities. The photoluminescence spectroscopy intensity decreases with the increase in the fluence of ions. The recombination of charge carriers induced by the geometrical distortions, and the formation of defects states, shifts the peak positions to shorter wavelengths. The electrical characteristics of these devices exhibit significant changes due to modification at the interface and charge transport properties after Ar<sup>2+</sup> ion irradiation. The charge-transport properties are affected by these deformities at higher fluences and attributed to the contributions of various current conduction mechanisms, including defect-assisted tunnelling and generation–recombination (G–R) currents along with thermionic emission.

**Keywords:** GaN SBDs, electrical parameters, ion irradiation, current conduction mechanisms

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## 1. INTRODUCTION

Over the last few decades, GaN has become one of the fascinating compound semiconductor material for researchers in the field of device-fabrication technology due to its unique properties like large and direct energy bandgap, high melting point, high chemical resistance, and good thermal conductivity [1–4]. These properties make GaN a potential material of modern electronic devices for various applications such as amplifiers, dynamic switches, detectors, lasers, solar cells, transistors for terahertz plasma applications, diodes, including the devices that are reliable in radiation-rich environments [1–3, 5–9]. Low-energy ion irradiation is an effective technique for customizing materials and devices containing semiconductors. These ions, however, introduce electrically active defects that modify the properties of semiconductor material and thus alter the characteristics of the devices fabricated on it [6, 10–14]. Another advantage of low-energy ion irradiation is to test the reliability of the semiconductor devices under exposure to radiation at higher altitudes, e.g., for military

and space applications [9, 15–17] and their response in radiation environments at high energy physics experiments/accelerator facilities [18–22].

Therefore, studies of the influence of energetic ions on semiconductors and their device properties are primary research areas. In this context, we report the 650-keV Ar<sup>2+</sup> ion-irradiation effects on the structural, optical, and electrical properties of Ru|Pt|*n*-GaN Schottky barrier diodes (SBDs) for various fluences to understand the current transport mechanism for its applications in different fields.

## 2. EXPERIMENTAL

In the present work, Ru(30 nm)|Pt(20 nm)|*n*-GaN SBDs were fabricated using a 2- $\mu$ m thick *n*-GaN on the Al<sub>2</sub>O<sub>3</sub> (*C*-plane) substrate. The comprehensive process of fabrication of Ru|Pt|*n*-GaN SBDs is described in detail in [23]. The Ru|Pt|*n*-GaN SBDs were irradiated by 650-keV Ar<sup>2+</sup> ions using the low-energy ion-beam facility (LEIBF) housed at IUAC, New Delhi, India [24]. During irradiation, the beam



# Temperature dependent Schottky barrier characteristics of Al/n-type Si Schottky barrier diode with Au–Cu phthalocyanine interlayer

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## ARTICLE INFO

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## ABSTRACT

The Al/n-type Si Schottky barrier diodes (SBDs) were prepared with Au-Cu phthalocyanine (Au-CuPc) interlayers with different Au and CuPc compositional ratios, probed their temperature dependent current-voltage ( $I$ - $V$ ) and low frequency noise properties. The Schottky barrier properties like barrier height and the ideality factor are strongly temperature dependent, implying the existence of Schottky barrier inhomogeneities. The barrier inhomogeneities was elucidated using thermionic emission theory based on the assumption of Gaussian distribution of the barrier heights. Further, a divergence in the barrier heights evaluated from the  $I$ - $V$  characteristics and Norde's method indicates a deviation of the Al/Au–CuPc/n-type Si SBDs behavior from thermionic emission. The Richardson plot evaluated with the Gaussian distribution of barrier heights method yielded Richardson constant values close to theoretical Richardson constant of n-type Si. The room temperature current noise power spectral density ( $S_I$ ) of the Al/Au–CuPc/n-type Si SBDs having various Au and CuPc concentrations showed a reciprocal of frequency ( $1/f$ ) $^\gamma$  behavior having  $\gamma$  values near to unity. The decrease in  $S_I$  and  $\gamma$  with increasing Au concentration in Au-CuPc interlayers was indicative of lessening barrier inhomogeneity. This was also correlated with the decrease in the value of standard deviation derived using temperature dependent  $I$ - $V$  characteristics. Further investigations revealed that origins of  $1/f$  noise could be associated with the fluctuations of barrier height and carrier mobility for Al/Au–CuPc/n-type Si SBDs with lower and higher Au compositions in Au-CuPc interlayers, respectively.

## 1. Introduction

The metal-semiconductor junctions termed as the Schottky barrier diodes (SBDs) forms the basis of the numerous simple and complex electronic devices. Owing to its importance in the electronics industry, the SBDs have been studied extensively. For an ideal SBD, the barrier height relies on the metal Fermi level and on the metal-semiconductor contact interface properties [1]. Hence, for a particular semiconductor, the possibility to alter the barrier height is limited. Nevertheless, the barrier height formed in the metal/semiconductor interface can be modified by inserting an interlayer and is an added advantage compared to conventional p-n junction [1]. The intention to modify and control the barrier height can be achieved using an organic semiconducting or insulating interlayer and to determine the characteristic parameters of the metal-interlayer-semiconductor devices. Organic

semiconductors promises mechanical flexibility and large-area processing at ambient environments at lower cost and possesses outstanding possibility for commercial applications like logic circuits, sensors, solar cells and displays [2–4]. The integration of organic materials with inorganic semiconductor as interlayer between metal and semiconductor has considered much attention and can be a good substitute towards creation of high-performance devices utilizing the merits of organic and inorganic semiconductors [5,6].

Organic polymers have been broadly examined and studied for their implementations into electronic and optoelectronic devices [7–9]. However, they suffered inferior device performance because of its non-homogeneity, poor thermal and mechanical stabilities. Recently, several ways are employed in the preparation of organic polymer composite films so as to step up the applications of organic-based semiconductors and enhance their performance. Composites consisting of

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# Effect of Temperature on the Electrical and Current Transport Properties of Au/Nd<sub>2</sub>O<sub>3</sub>/n-GaN Metal/Interlayer/Semiconductor (MIS) Junction

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## Abstract

The Au/Nd<sub>2</sub>O<sub>3</sub>/n-type GaN metal/interlayer/semiconductor (MIS) junctions were fabricated with high-*k* rare-earth oxide interlayer and explored its electrical properties in the wide temperature range of 150–400 K. An anomalous decrease in barrier height and an increase in the ideality factor with a decrease in the temperature were observed. The anomalous barrier height and ideality factor are ascribed to a role of barrier inhomogeneities at the interface of MIS junction assuming a double Gaussian distribution of barrier heights in the temperature ranges of 150–225 K and 225–400 K. Double Gaussian distribution giving mean barrier heights of 0.84 eV and 1.23 eV and standard deviations of 0.0085 V and 0.0187 V for the two temperature regions. A modified conventional energy plot gives mean barrier height ( $\bar{\Phi}_{bo}$ ) and Richardson constant ( $A^*$ ) as 0. eV and  $13.44 \text{ Acm}^{-2} \text{ K}^{-2}$  (150–225 K) and 1.23 eV and  $22.85 \text{ Acm}^{-2} \text{ K}^{-2}$  (250–400 K), respectively. The estimated  $A^*$  value in the temperature range of 250–400 K was closely matched with the theoretical value of n-type GaN. Moreover, results express that the obtained interface state density of the MIS junction decreases with increasing temperature. Results explained that the reverse current conduction governed by Poole–Frenkel emission at the temperature range of 150–225 K and Schottky emission at 250–400 K, respectively.

**Keywords** Rare-earth oxide · Nd<sub>2</sub>O<sub>3</sub> interlayer · n-GaN; inhomogeneities · Electrical properties · Current conduction mechanism

## 1 Introduction

Gallium nitride (GaN) was gorgeous semiconductor material for the fabrication of light-emitting diodes, Schottky-barrier photodetectors, solar-blind Schottky photodiodes, metal–semiconductor field effect transistors (MSFETs), heterostructure field effect transistors (HFETs) and high

electron mobility transistors (HEMTs) [1–6] because of its outstanding thermal and electrical properties. High quality ohmic and Schottky contacts play an important role in the device fabrication. But, the Schottky-based GaN HEMTs are grieved by huge gate leakage current that can affect the device recital, reliability, and stability of the devices. In order to reduce the leakage current, there was a potential way, wherein, the insertion of a thin interlayer or insulating layer in between the metal and semiconductor interface was one of the best approaches. Therefore, the detailed investigations were needed to obtain high Schottky barrier height and low leakage current of the Schottky junction with an interlayer or insulating layer on GaN and it is a scientific challenge. Concurrently, it is very important to understand the carrier transport of metal/semiconductor (M/S) interface. A room-temperature measurement solely does not give exact conduction characteristics or the nature of the barrier formation at the M/S interface. Hence, the wide temperature ranges of I-V

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# Electrical and carrier transport properties of Ti/ $\alpha$ -amylase/p-InP MPS junction with a $\alpha$ -amylase polymer interlayer

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## ABSTRACT

This paper demonstrates the electrical and current transport properties of prepared Ti/ $\alpha$ -amylase/p-InP metal/polymer/semiconductor (MPS) junction by current–voltage ( $I$ – $V$ ) approach. The microstructure of the fabricated MPS junction is confirmed by transmission electron microscopy (TEM) measurement. The MPS junction exhibited a good rectification nature over the Ti/p-InP metal/semiconductor (MS) junction. The derived barrier height (BH) of MPS junction (0.78 eV) is higher than the MS junction (0.70 eV), that indicates the BH is influenced by the polymer layer. The BH is extracted by the  $I$ – $V$ ,  $Z(V)$ – $V_d$  plot, Cheung's function,  $\alpha(V)$ – $V$  plot, Norde method and  $\Psi_s$ – $V$  plot and found the values are comparable with one another, which indicates their steadiness and validity. The estimated interface state density ( $N_{SS}$ ) of the MPS junction is less than the MS junction, suggesting that the  $\alpha$ -amylase layer decreased the  $N_{SS}$  value. The forward  $\log(I)$ – $\log(V)$  plot of the MS and MPS junctions reveals the ohmic nature at lower-bias region and space-charge-limited conduction at higher-bias region. Results reveal that the reverse leakage current conduction mechanism of the MS and MPS junctions is governed by Poole–Frenkel emission in lower-bias region, whereas, at higher bias region, Schottky emission is dominant current conduction mechanism. These exploration results establish that the  $\alpha$ -amylase polymer layer is potential for use in organic–inorganic devices.

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## Article

# Potato Chip-Like 0D Interconnected ZnCo<sub>2</sub>O<sub>4</sub> Nanoparticles for High-Performance Supercapacitors

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**Abstract:** Zinc cobaltite (ZnCo<sub>2</sub>O<sub>4</sub>) is an emerging electrode material for supercapacitors due to its rich redox reactions involving multiple oxidation states and different ions. In the present work, potato chip-like 0D interconnected ZnCo<sub>2</sub>O<sub>4</sub> nanoparticles (PIZCON) were prepared using a solvothermal approach. The prepared material was characterized using various analytical methods, including X-ray powder diffraction and scanning electron microscopy. The possible formation mechanism of PIZCON was proposed. The PIZCON electrode material was systematically characterized for supercapacitor application. The areal capacitance of PIZCON was 14.52 mF cm<sup>-2</sup> at 10 μA cm<sup>-2</sup> of current density, and retention of initial capacitance was 95% at 250 μA cm<sup>-2</sup> following 3000 continuous charge/discharge cycles. The attained measures of electrochemical performance indicate that PIZCON is an excellent supercapacitor electrode material.

**Keywords:** ZnCo<sub>2</sub>O<sub>4</sub>; electrode material; areal capacitance; supercapacitors



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## 1. Introduction

Accumulation and energy storage are significant challenges for the further development of various modern devices, such as hand-held devices, hybrid electric vehicles, solar panels, memory backup systems, and defibrillators [1–3]. To overcome this energy problem, scientists have designed and developed novel energy storage devices (batteries and supercapacitors) [4]. Currently, supercapacitors are the most popular energy storage device due to their exceptional electrochemical characteristics, such as high-power density, fast charge–discharge process, low cost, long life cycle, and low environmental impact [5–7]. Supercapacitors store energy based on two operating mechanisms: electric double-layer capacitors (EDLCs) and pseudocapacitors [8–10]. In the former, the charge is stored electrostatically at the electrode–electrolyte interface, and in the latter, the redox reaction is responsible for charge storage [11]. Carbon with various dimensions (0D, 1D, 2D, and 3D) is used as the electrode material for EDLCs. The lower capacitance of carbon-based materials hinders practical applications [12–14]. Transition metal oxides/sulfides/hydroxides and conducting polymers are used as electrode materials for pseudocapacitors [15–17]. In particular, transition metal oxides with spinel structure (TMOSS) (ternary form) exhibit excellent electrochemical characteristics as an electrode material for supercapacitors [18]. Among the TMOSS, zinc cobaltite (ZnCo<sub>2</sub>O<sub>4</sub>) is a potential electrode material for pseudocapacitors due to its high theoretical capacitance, multiple oxidation states, and excellent electrochemical properties [19–22].

## REFINEMENT ANALYSIS, PHOTOLUMINESCENCE AND MAGNETIC PROPERTIES OF $Zn_{1-x}Mn_xO$ ( $x = 0.00, 0.01, 0.02, 0.03$ & $0.04$ ) NANOPARTICLES SYNTHESIZED BY COMBUSTION TECHNIQUE

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$Zn_{1-x}Mn_xO$  ( $x = 0.0, 0.01, 0.02, 0.03$  &  $0.04$ ) nanoparticles were fabricated through a simple combustion method and their structural, morphological, chemical, optical, photoluminescence and magnetic properties were systematically analyzed. X-ray diffraction (XRD) and Rietveld refinement (RR) analysis studies divulged that, the synthesized nanoparticles exhibited the hexagonal structure without any impurity phase. Morphology studies revealed that the synthesized nanoparticles were nearly spherical in shape with uniform size distribution. A clear Blue shift was recognized in the ZnO nanoparticles when doped with Mn ions. The photoluminescence (PL) spectra of all the synthesized nanoparticles exhibited the same emissions and PL intensity diminished with increase in Mn doping concentration. All the synthesized nanoparticles exhibited room temperature ferromagnetism (RTFM) and  $Zn_{1-x}Mn_xO(x=0.02)$  nanoparticles displayed better ferromagnetic property than other compositions. The captive properties of the ZnO: Mn nanoparticles may more useful for optoelectronic and spintronic applications.

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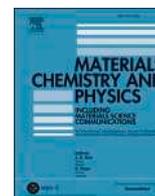
*Keywords:* Zinc oxide, Photoluminescence, Ferromagnetism, Spintronics, Optoelectronics

### 1. Introduction

Currently, researchers have perceived that in several semiconductor crystals substituting of transition metal in host affix local magnetic moments to the system. The doped materials are entitled as dilute magnetic semiconductors (DMS) [1]. Theoretical explorations imply that the semiconductor with direct band gap is the most probable candidate for spintronic devices [2]. ZnO is an n-type II-VI semiconductor with characteristic features such as direct energy band gap of 3.37eV, large binding energy 60meV in addition to wurtzite structure at room temperature [3]. Properties of ZnO nanoparticles can be tailored by dopants and doping concentration [4]. The foremost challenge for the practical applications of DMS is the achievement of ferromagnetism (FM) at room temperature. Transition metal (TM) doped ZnO is one of the best auspicious DMS candidates as it is anticipated to be RTFM (Room Temperature Ferromagnetism). The most propitious property of DMS is that, the substitution of TM in semiconductors does not influence the crystal structure but dramatically switches its dielectric, magnetic and electrical/optical properties, i.e. RTFM is observed in TM doped ZnO [5-6]. The doped TMs are irregularly assigned to substitution lattice sites and ferromagnetic aligned via an indirect magnetic coupling [7]. The TM doped ZnO would be proper for a number of devices such as magnetic devices with gain, spin transistors operated at very low power for mobile applications, optical emitter with encoded information [8]. Some of the reports argued that the RTFM of TM doped metal oxides strongly depends on the metal oxide host system, size, defects, size, type of dopant and concentration [9]. Venkatesem et al. [10] observed the high magnetic moment in Co doped ZnO films. Stable FM ordering observed from carrier mediated exchange interactions for several TM doped ZnO DMS [11]. Among them, Mn doped ZnO would show FM above room temperature and may be applied to shortwave magneto optical devices [12]. Paramagnetism was observed in ZnO: Mn films

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## Morphology driven enhanced photocatalytic activity of CuO/BiOI nanocomposites

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### HIGHLIGHTS

- CuO/BiOI composite nanostructures were fabricated by a facile hydrothermal method.
- CuO/BiOI nanocomposites have photocatalytic activity than BiOI due to elevated morphology.
- Morphology driven 30% CuO/BiOI nanocomposite exhibited enhanced photocatalytic activity.
- Rate of separation efficiency of charge carriers has been boosted.
- The mechanism of enhanced photocatalytic activity was proposed.

### ARTICLE INFO

#### Keywords:

CuO/BiOI  
Nanoflower  
Degradation of methyl orange  
Visible light  
Photocatalytic activity

### ABSTRACT

The development of novel highly efficient semiconductor metal oxide catalysts for enhanced photocatalytic dye degradation had of great significance. Herein, we report the synthesis of novel and highly efficient CuO/BiOI nanocomposite (0, 10, 20, 30, 40 wt % of CuO) semiconductor photocatalysts by a facile hydrothermal method. High crystallinity of tetragonal structure had observed from XRD studies. From SEM and TEM studies flower like morphology had observed up to 30% of CuO in CuO/BiOI nanocomposite and for 40% of CuO nanoflower like morphology slightly diminishes. EDAX and XPS spectra depict the presence of Bi, O, I, Cu only no other impurities had observed. Stretching and bending vibrational modes had observed from FTIR analysis. Bandgap decreases gradually upto 30% of CuO in CuO/BiOI nanocomposite and slightly increases for 40% of CuO in CuO/BiOI nanocomposite. Decrease in peak intensity due to charge carriers were observed from Photoluminescence studies Photocatalytic activity had estimated by the degradation of methyl orange (MO) solution under visible light irradiation. The flower-like morphology of 30% CuO in CuO/BiOI nanocomposite showed the high absorption ability to facilitate the generation of charge carriers as well as active oxygen species.

### 1. Introduction

In recent era, environmental pollution has become a serious issue due to the exponential development of industries and the population which threatens the humanity. To resolute this, the world was moving towards to reduce the contaminants in air and water. Different techniques were developed to reduce pollutants in the environment and water such as adsorption [1,2], filtration [3,4], UV irradiation [5], biodegradation [6], chemical oxidation [7], active oxidation process [8, 9], catalytic oxidation [10], solvent extraction [11,12], photocatalytic degradation [13,14]. Among all these, photodegradation provides an oxidation/reduction process for the removal of dyes through less energy

consumption.

Semiconductor photocatalysts have attracted worldwide attention for their ability to solve energy and environmental problems. The photocatalyst developed upto now has a wide bandgap and absorbs light in the ultraviolet region that exhibits moderate performance due to the high recombination rate of photogenerated electron pairs. Therefore, its practical appliance is low. Nevertheless, photocatalyst composed of a narrow bandgap can achieve a better response to visible light and effective separation of electron pairs [15]. Therefore, in recent years, there has been a boom in the fabrication of visible light driven semiconductors to improve the photocatalytic performance by energy conversion.

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# Enhanced magnetization and dielectric properties of Ca doped BiFeO<sub>3</sub>: Er nanoparticles by sol–gel technique

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## ARTICLE INFO

### Keywords:

BFO  
Ca doped BFO: Er nanoparticles  
Magnetization  
Dielectric properties

## ABSTRACT

Here in, we synthesized pure BiFeO<sub>3</sub> (BFO) and Bi<sub>0.8-x</sub>Ca<sub>x</sub>Er<sub>0.2</sub>FeO<sub>3</sub> (x = 0.0, 0.05, 0.1, and 0.15 at.%) nanoparticles using sol–gel technique and investigated their optical, magnetic, and electrical properties. X-ray diffraction studies reveals structural transformation in BFO from the rhombohedral structure to orthorhombic, without forming any defect phases, with the doping of Er or Ca/Er into BFO. EDX analysis confirms the presence of doped elements (Er and Ca) along with the Bi, Fe and O elements corresponding to BFO host material. TEM images indicate the significant reduction in particle size with increasing the Ca dopant concentration. Further, the band gap of pure BFO nanoparticles (2.30 eV) decreases notably to a minimum of 1.81 eV for Ca and Er co-doped BFO nanoparticles. All samples exhibited the ferromagnetic behavior, Bi<sub>0.8-x</sub>Ca<sub>x</sub>Er<sub>0.2</sub>FeO<sub>3</sub> (x = 0.05 at.%) nanoparticles yielded 2.9 times higher saturation magnetization compared to BFO nanoparticles. In addition, the conductivity increases by 11.8 times for Bi<sub>0.8-x</sub>Ca<sub>x</sub>Er<sub>0.2</sub>FeO<sub>3</sub> (x = 0.05 at.%) nanoparticles compared to BFO nanoparticles.

## 1. Introduction

Multiferroic materials that exhibit simultaneously more than one ferroic properties such as ferroelectricity, ferromagnetism, and ferroelasticity in a single compound, gained extensive research interest owing to their wide range of intriguing applications like electronic memory devices, sensors, photocatalytic activity, and hydrogen production [1–6]. The complex oxide perovskites with ABO<sub>3</sub> stoichiometry are the common multiferroic materials (A = Y, Ho, La, Gd, Nd, Eu, Bi, Ba & Sr and B = Fe, Mn, Co, Cr, Ni, Pb & Ti) [7–13]. Among them, BiFeO<sub>3</sub> (BFO) garnered a special attention because of its ability to exhibit multiferroic properties at room temperature. At room temperature, BFO is in rhombohedrally distorted perovskite structure with R3c space group. It has high ferroelectric Curie temperature, T<sub>C</sub> = 830 °C, and antiferromagnetic Neel temperature, T<sub>N</sub> = 370 °C. Bulk BFO possesses a G-type antiferromagnetic ordering with low ferromagnetism due to the spiral spin structure with a wavelength of 62 nm [14–16]. The cross coupling of magnetic and ferroic orders induces a magnetoelectric effect in multiferroic materials, which is captivating for new fascinating electric and magnetic devices [17–18]. Though BFO is a lead free eco-friendly multiferroic material, it suffers major setbacks in the form of high

leakage current and oxygen vacancies arises from the bismuth volatilization [19–21]. To reduce leakage current and to enhance the magnetic and dielectric properties of BFO, it is to be doped with various metal ions. The doped BFO materials have more efficient results than BFO [22–25]. BFO multiferroic properties can be enhanced by doping A- site, B- site and AB site with rare earth (RE), alkali earth (AE) and transition metal (TM) ions [26–30]. A- site doping is a popularly employed method for the enhancement of magnetic and dielectric properties of BFO [31].

Several research groups have reported the enriched multiferroic properties of BFO through chemical substitution of isovalent RE (Ce, Tb, Eu, Gd, Dy, La, Er and Sm) ions with oxidation state of '+3' or aliovalent (Ba, Ca, Sr, etc) ions with '+2' oxidation state into the A-site (Bi-site) of BFO [32]. RE ions have high magnetic moment and their substitution into BFO arouse the coupling between magnetically active 4f electrons of RE and Fe<sup>3+</sup> ions. On the other hand, the doping of aliovalent ions like Ca<sup>2+</sup> ions leads to the formation of oxygen vacancies that may influence the multiferroic properties. So far, majority of the studies explored the influence of individual-type i.e., either isovalent or aliovalent ions doping on the structural, electrical and magnetic properties of BFO, while a few reports are available on co-doping of isovalent and aliovalent ions into BFO. The co-doping of isovalent and aliovalent ions into

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# Colloids and Surfaces A: Physicochemical and Engineering Aspects

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## Enhanced solar driven hydrogen evolution rate by integrating dual co-catalysts ( $\text{MoS}_2$ , $\text{SeS}_2$ ) on CdS nanorods

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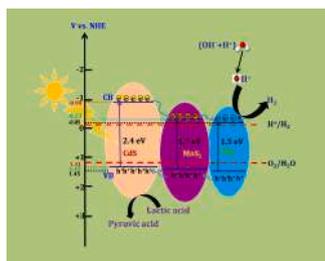
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### GRAPHICAL ABSTRACT

Scheme: Proposed photocatalytic  $\text{H}_2$  production mechanism using CdS/ $\text{MoS}_2$ - $\text{SeS}_2$  nanocomposite.



### ARTICLE INFO

#### Keywords:

CdS/ $\text{MoS}_2$ - $\text{SeS}_2$  nanocomposites  
Solar driven hydrogen  
Co-catalysts  
Photocatalytic hydrogen

### ABSTRACT

Design and development of inexpensive novel nanostructures is a notable pathway to enhance photocatalytic hydrogen evolution to subsidize the future energy demand. For the first time, we are reporting on the  $\text{MoS}_2$ - $\text{SeS}_2$  dual co-catalysts decorated CdS nanorods for efficient photocatalytic water splitting hydrogen production under the simulated sunlight irradiation. Comprehensive structural analyses demonstrated that  $\text{MoS}_2$ - $\text{SeS}_2$  nanostructures decorated on CdS possess structure as that of pristine CdS nanorods. Room temperature photoluminescence spectra showed the reduction of luminescence intensity in the presence of  $\text{MoS}_2$ - $\text{SeS}_2$  dual co-catalysts on CdS host matrix. We obtained a better hydrogen evolution rate ( $168.93 \text{ mmol g}^{-1} \text{ h}^{-1}$ ) through CdS/ $\text{MoS}_2$ - $\text{SeS}_2$  nanocomposites. The present composite also possess long durability and high stability by producing a large surface area, more trapping sites, huge number of charge carriers, efficient charge carrier transportation, and less recombination of charge carriers. Present composite hydrogen evolution rate is 67 times greater than that of hydrogen evolution rate (HER) of pristine CdS nanorods. We intensely trust that, the present composite CdS/ $\text{MoS}_2$ - $\text{SeS}_2$  nanocomposite is the potential candidate for hydrogen production under the solar light harvesting phenomenon.

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## Boosting solar driven hydrogen evolution rate of CdS nanorods adorned with MoS<sub>2</sub> and SnS<sub>2</sub> nanostructures

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### ARTICLE INFO

#### Keywords:

Photocatalytic hydrogen  
CdS/SnS<sub>2</sub>-MoS<sub>2</sub>  
Visible light harvesting  
Efficient charge transfer rate

### ABSTRACT

Hierarchical 1-D CdS nanorods adorned with MoS<sub>2</sub>-SnS<sub>2</sub> nanocomposites were developed by a simple solvothermal method at nano-regime. In the present work, we noticed a tremendous enhancement in H<sub>2</sub> evolution by loading MoS<sub>2</sub>-SnS<sub>2</sub> nanostructures on 1D-CdS nanorods under the solar light irradiation. Notably, for the CdS/MoS<sub>2</sub>-SnS<sub>2</sub> (6 wt%) nanocomposites, the hydrogen production rate reached to 185.36 mmol. h<sup>-1</sup>. g<sup>-1</sup>, this is much higher than that of pristine CdS (2.5 mmol. h<sup>-1</sup>. g<sup>-1</sup>) and 6 wt% of MoS<sub>2</sub> loaded CdS nanorods (123 mmol. h<sup>-1</sup>. g<sup>-1</sup>). The efficient photocatalytic performance in MoS<sub>2</sub>-SnS<sub>2</sub> loaded CdS nanorods could be due to high light harvesting capability, bifurcation of electron-hole pairs, trapping sites, active catalytic zones, migration of charge carriers towards the surface of a semiconductor, and suitable energy levels. We strongly believe that the current design plan on the synthesis of MoS<sub>2</sub>-SnS<sub>2</sub> loaded CdS nanorods and its efficiency for catalytic performance towards hydrogen evolution is an inherent alternative route for sustainable energy production.

### 1. Introduction

Nowadays, non-renewable energy resources are abnormally quenching due to the drastic enhancement of population, rapid industrialization, and upheaval of contemporary technologies [1,2]. In this perception, green and efficient renewable energy sources are urgently needed to provide the alternative fuel intended for sustainable development [3–5]. Among the many non-renewable energy resources, solar energy is one of the most promising and reliable energy resources, owing to its continuous supply/abundant nature [6–10]. Particularly utilization of solar energy and produce high energy density fuels (hydrogen) is an attractive way to capture and utilize the abundant solar energy [11–13]. Among the developed techniques to produce hydrogen photocatalysis water splitting is one of the ideal and cost-effective techniques [14–16]. To this end several semiconductor photocatalysts such as metal oxides, metal nitrides, metal sulphides, metal selenides, polymer based photocatalysts, metal free photocatalysts (C<sub>3</sub>N<sub>4</sub>) nanostructures were developed and verified it for photocatalytic hydrogen production [17–19]. Among the developed photocatalysts transition metal sulfide-based semiconductors have attracted much attention due

to their suitable band gap for visible light harvesting capability, suitable water reduction potentials and excellent chemical, electrical, and optical properties [20].

Amid the horde of transition metal and sulfide-based semiconductors, CdS has been recognized as one of the promising photocatalysts for H<sub>2</sub> production due to its optimum bandgap (2.4 eV) and suitability of absorbing visible light. The intensification of the photocatalytic activity and the stability of the CdS for the H<sub>2</sub> production are obtained by preparing CdS with different morphologies. For further enhancing of hydrogen evolution rate, hybridizing with other semiconductors like polymers or materials of the large surface area on to host matrix is a worthy approach [21,22]. According to previous studies, suitable co-catalysts are essential for increasing the hydrogen evolution rate of the CdS photocatalysts. Generally, there are two main reasons for integrating the co-catalysts onto the host lattice for high H<sub>2</sub> production in CdS nanostructures. These are electron acceptors; electrons are extracted from photoexcited semiconductors and significantly contribute to the catalytic reaction. Given this, recently several noble metal-free promoters have explored to increase photocatalytic hydrogen generation, such as transition metals (Co, Mo, Ni, and W) and their

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Original research article

# Synthesis and spectroscopic investigations on Pr<sup>3+</sup>-doped LiPbB<sub>5</sub>O<sub>9</sub> phosphor: A blue converting red phosphor for white LEDs

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## ARTICLE INFO

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## ABSTRACT

In this study, various concentrations of Pr<sup>3+</sup> doped LiPbB<sub>5</sub>O<sub>9</sub> phosphors were synthesized via solid state reaction technique. For the prepared phosphors, X-ray diffraction (XRD), Fourier transform infrared spectroscopy (FTIR), scanning electron microscopy (SEM), thermogravimetric study (TG-DSC), diffuse reflectance spectroscopy (DRS) and photoluminescence (PL) characterizations were performed. Crystallinity nature of LiPbB<sub>5</sub>O<sub>9</sub>:Pr<sup>3+</sup> phosphor was studied by XRD analysis. Morphology of the prepared phosphors was investigated by SEM studies. Various functional groups present in LiPbB<sub>5</sub>O<sub>9</sub>:Pr<sup>3+</sup> phosphor were identified through FTIR analysis. Variation in weight of the prepared phosphor with the temperature (endo- and exothermic temperatures) was studied by TG-DSC studies. Optical energy band gaps for different concentrations of Pr<sup>3+</sup> were obtained from DRS studies. Photoluminescence (excitation and emission) spectra were investigated at λ<sub>emi</sub> = 609 nm and λ<sub>exc</sub> = 443 nm, respectively. From energy transfer studies, it was identified that the energy transfer between Pr<sup>3+</sup> ions in LiPbB<sub>5</sub>O<sub>9</sub> phosphor was ascribed to dipole-dipole interaction. Lifetime decay curves of <sup>1</sup>D<sub>2</sub> level were studied at λ<sub>emi</sub> = 609 nm and λ<sub>exc</sub> = 443 nm wavelengths. CIE colour coordinates of LiPbB<sub>5</sub>O<sub>9</sub>:Pr<sup>3+</sup> phosphors were calculated from the emission data. From all these studies, it can be mentioned that LiPbB<sub>5</sub>O<sub>9</sub>:0.05Pr<sup>3+</sup> phosphor may be utilized for the blue light converting red phosphor in white LED applications.

## 1. Introduction

Now-a-days, much attempts have been carried out to develop the new materials for fabrication of W-LEDs. White LEDs are considered as next generation light source. W-LEDs find applications in field-emission displays, display panels and solid state lighting (SSL). White light emitting diodes have many superior qualities over fluorescent and incandescent lamps, like small volume, long lifetime energy serving, toxic free and eco-friendly [1]. Mainly there are two methods to produce white light from LEDs. 1. Mixing of yellow phosphor with blue LED and 2. Mixing of blue LEDs with red and green-emitting phosphor. Y<sub>3</sub>Al<sub>5</sub>O<sub>12</sub>:Ce<sup>3+</sup> is the most popular commercial yellow phosphor. The drawbacks of this commercial YAG:Ce phosphor is, as the operating temperature is increased its conversion efficiency decreases and it suffers from the unwanted colour balance [2]. These drawbacks can be rectified by introducing a separate red emitting source. White light can be achieved by the combination of phosphor and near UV-LED chip. So, phosphors play

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# Surfactant assisted morphological transformation of rod-like $\text{ZnCo}_2\text{O}_4$ into hexagonal-like structures for high-performance supercapacitors

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## Abstract

**Objectives:** To develop the microstructures of rod-shaped  $\text{ZnCo}_2\text{O}_4$  (ZCO-Urea) and hexagonal-shaped  $\text{ZnCo}_2\text{O}_4$  (ZCO- $\text{NH}_4\text{F}$ ) through the change of surfactants such as urea and  $\text{NH}_4\text{F}$  in the reaction and to investigate the physicochemical and electrochemical properties for high-performance supercapacitors. **Methods:** The structural and morphological characteristics of two prepared samples were analyzed through X-ray diffraction analysis (XRD), Scanning electron microscope (SEM) analysis, and Transmission electron microscope (TEM) analysis, respectively. The electrochemical performance was evaluated using Cyclic voltammetry (CV), Galvanostatic charge-discharge (GCD), and Electrochemical impedance spectroscopy (EIS) analysis. **Findings:** The crystalline nature and phase purity of the as prepared samples were confirmed from XRD, and the structural parameters such as lattice parameter ( $a$ ), microstrain ( $\epsilon$ ), dislocation density ( $\delta$ ), cell volume ( $v$ ), and average crystalline size ( $D$ ) for both the samples were determined. The SEM and TEM analysis revealed morphological characteristics of the samples. The electrochemical analysis of ZCO-Urea and ZCO- $\text{NH}_4\text{F}$  electrodes were tested for supercapacitor application in 1M of aqueous KOH electrolyte and exhibit an areal capacitance of  $31 \text{ mF cm}^{-2}$ , and  $41.43 \text{ mF cm}^{-2}$ , respectively, obtained at a current density of  $10 \mu\text{A cm}^{-2}$ . And also showed outstanding cyclic stability over 1000 charge-discharge cycles. **Applications:** The simple and inexpensive method of synthesized surfactant-assisted morphological transformation of ZCO microstructures will introduce new directions in this emerging energy field.

**Keywords:**  $\text{ZnCo}_2\text{O}_4$ ; Urea;  $\text{NH}_4\text{F}$ ; areal capacitance; supercapacitors

## 1 Introduction

As the non-renewable energy resources such as fossil fuels become rarer and the increasing demand for energy to meet current energy requirements leads to an intense search for alternative energy sources and the use of energy devices. This is further



# Photoluminescence, radiative shielding properties of $\text{Sm}^{3+}$ ions doped fluoroborosilicate glasses for visible (reddish-orange) display and radiation shielding applications

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## ABSTRACT

The various concentrations of trivalent samarium ions activated  $\text{SiO}_2 + \text{B}_2\text{O}_3 + \text{Na}_2\text{CO}_3 + \text{NaF} + \text{CaF}_2$  (SBNC) glasses have been prepared with the conventional melt quenching method. Various physical parameters like density, refractive index, thickness, etc were evaluated/calculated for prepared glasses. The synthesized glasses were subject to analysis through FTIR, absorption, photoluminescence excitation, emission and fluorescence decay measurements. Judd-Oflet parameters ( $\Omega_2$ ,  $\Omega_4$  and  $\Omega_6$ ) were estimated for all investigated SBNC $\text{Sm}$  glasses and calculated various radiative parameters. The fluorescence emission spectra consist of four sharp peaks centered at 564 nm ( $^4\text{G}_{5/2} \rightarrow ^6\text{H}_{5/2}$ ), 600 nm ( $^4\text{G}_{5/2} \rightarrow ^6\text{H}_{7/2}$ ), 660 nm ( $^4\text{G}_{5/2} \rightarrow ^6\text{H}_{9/2}$ ), and 710 nm ( $^4\text{G}_{5/2} \rightarrow ^6\text{H}_{11/2}$ ). The glass doped with 0.5 mol %  $\text{Sm}^{3+}$  ions (SBNC $\text{Sm}05$ ) has the highest emission intensity for  $^4\text{G}_{5/2} \rightarrow ^6\text{H}_{7/2}$  transition (600 nm (orange)). The characteristic fluorescence emission parameters were calculated. The SBNC $\text{Sm}05$  glass attains the higher values of stimulated emission cross-section ( $\sigma_{\text{emi}} = 11.23 \times 10^{-20} \text{ cm}^2$ ), the gain bandwidth ( $\sigma_{\text{emi}} \times \Delta\lambda_{\text{eff}} = 16.22 \times 10^{-25} \text{ cm}^3$ ) and optical gain parameter ( $\sigma_{\text{emi}} \times \tau_{\text{R}} = 19.85 \times 10^{-25} \text{ cm}^2\text{s}$ ). The lifetime of excited of  $\text{Sm}^{3+}$  ions ( $^4\text{G}_{5/2}$ ) was estimated using the least square fitting method. The CIE chromaticity coordinate values of investigated glasses confirmed the emitted radiation fall in the visible reddish-orange region of the EM spectrum. Moreover, the shielding capacity of SBNC $\text{Sm}$  glasses against gamma photons and fast neutrons were extensively evaluated using Py-MLBUF online software. The results clearly shows that the different concentrations of  $\text{Sm}^{3+}$  ions into SBNC glasses improved both shielding and optical properties. The obtained values suggested that the SBNC $\text{Sm}05$  and SBNC $\text{Sm}20$  glasses can be used as a potential candidate in photonic device applications and radiation shielding applications.

## 1. Introduction

In recent years, scientist were very fascinated in the field of luminescence exhibited by the materials activated with rare earths (RE) and transition metal (TM) ions due to their wide applications in up-converters, hole burning high-density memories, light-emitting diode (LEDs), modern telecommunication (optical fiber amplifiers, waveguide lasers, optical luminescence solar energy concentrators [1–8]). The host material's structural changes highly influences the emission transition bandwidths and luminescence quantum efficiency of the doped RE ions. So, for the design and development of novel optical materials, it is necessary to choose a host material with excellent luminescence efficiency properties. The materials with lesser phonon energy are highly

accessed in the development of commercial lasers and fiber amplifiers [9–11]. The low phonon energy host materials will give higher radiative emission efficiencies due to decrease in non-radiative losses. The glasses activated using  $\text{RE}^{3+}$  ions mainly used in various applications like solid-state lasers, medicine, military, day-to-day lightening, and modern communications systems [12–16].

Among the glass host materials, the borosilicate glasses are excellent host materials for RE ions doping because of their high transparency in optical window, low thermal coefficient, good mechanical strength as well as RE ion solubility, higher corrosion resistance, and high softening temperature, thermal stability along with higher chemical durability and moisture resistance. Moreover, the borosilicate glasses possess higher phonon energy ( $\sim 1300$  to  $1500 \text{ cm}^{-1}$ ), promoting higher non-

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# Photoluminescence investigations of $\text{Eu}^{3+}$ -doped $\text{LiPbB}_5\text{O}_9$ as a red emitting phosphor for warm W-LED applications

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**Abstract:**  $\text{LiPbB}_5\text{O}_9:\text{Eu}^{3+}$  phosphors were synthesized via solid-state reaction technique and studied various properties. For the prepared  $\text{LiPbB}_5\text{O}_9:\text{Eu}^{3+}$  phosphors, structural and spectroscopic characterizations were performed. Crystallinity nature of  $\text{LiPbB}_5\text{O}_9:\text{Eu}^{3+}$  phosphors was investigated from X-ray diffraction (XRD) analysis. Functional group investigations and maximum phonon energies of  $\text{LiPbB}_5\text{O}_9:\text{Eu}^{3+}$  phosphor were studied via Fourier transform infrared spectroscopy (FTIR) analysis. The thermogravimetric (TG-DSC) analysis for  $\text{LiPbB}_5\text{O}_9:0.07\text{Eu}^{3+}$  phosphor precursor was carried out in  $\text{N}_2$  atmosphere up to 800 °C. From the TG-DSC analysis, weight loss of the precursor with temperature and endothermic temperatures was studied. The optical band gaps of  $\text{LiPbB}_5\text{O}_9:\text{xEu}^{3+}$  phosphors for distinct  $\text{Eu}^{3+}$  ions concentrations were found using diffuse reflectance spectra (DRS) analysis. Excitation spectra of  $\text{LiPbB}_5\text{O}_9:\text{Eu}^{3+}$  phosphors were recorded at monitoring emission  $\lambda_{\text{emi}} = 614$  nm wavelength, and emission spectra were recorded by monitoring excitation wavelength  $\lambda_{\text{exc}} = 393$  nm. Energy transfer analysis of  $\text{LiPbB}_5\text{O}_9:\text{Eu}^{3+}$  phosphor was studied with the Blasse and Dexter theories. Fluorescence lifetime decay curves of  $^5\text{D}_0$  level of  $\text{Eu}^{3+}$  ions were analyzed at the above-mentioned excitation and emission wavelengths. From the emission spectral data, the CIE color coordinates and correlated color temperatures (CCT) were estimated. From the above investigations, it can be mentioned that  $\text{LiPbB}_5\text{O}_9:\text{Eu}^{3+}$  phosphors find significant applications in white light emitting diodes as a red emitting phosphor.

**Keywords:** Phosphor; Phonon sideband; Photoluminescence; Energy transfer; CIE diagram

## 1. Introduction

At present, energy has become an essential commodity and the need for energy is increasing in all the sectors of society. Production of high efficiency light source and white light emitting diodes (W-LEDs) created research hotspot. Solid-state lighting (SSL) technology covers the production of light by LEDs, organic LEDs and light emitting polymers. At present, SSL technology emerges as a substitute to the fluorescent, incandescent lamps and highly intense discharge tubes. Nearly 20% of energy can be saved using the SSL technology. SSL technology has many advantages like compactness, high efficiency, environmental friendliness and longer lifetime. In SSL technology, W-LEDs play the vital role [1, 2].

Nowadays white LED is produced by mixing GaN or InGaN blue LEDs ( $\lambda_{\text{em}} \sim 450\text{--}470$  nm) with the

$\text{Y}_3\text{Al}_5\text{O}_{12}:\text{Ce}^{3+}$  yellow emitting phosphor. In this combination, a part of blue wavelength is absorbed by YAG:Ce phosphor and converts it to longer wavelength via down conversion to emit white light [3]. In this method, main drawbacks are high coordinate color temperature (CCT > 6000 K) and low color rendering index (CRI < 80), which might be avoided by using the other techniques. By mixing the near-UV-LED chip (380–420 nm) with the tricolor phosphors, white light could be generated [2]. Blue/green/red emitting tricolor phosphor layer is coated on the output surface near-UV InGaN-based LED to get white light. Today the available commercial phosphors for tricolor (RBG) emission are, for green emission  $\text{ZnS}:\text{Cu}^+$ ,  $\text{Al}^{3+}$ , for blue emission  $\text{BaMgAl}_{10}\text{O}_{17}:\text{Cu}^{2+}$  and for red emission  $\text{Y}_2\text{O}_3:\text{Eu}^{3+}$ . By comparing the above commercial three phosphors, red phosphor has lower efficiency and poor stability. So, to improve overall efficiency of W-LEDs, an efficient red emitting phosphor is much needed [4]. There are two basic requirements for an efficient red emitting phosphor. 1. The host or phosphor activator must show strong absorption in near-UV region. 2. The phosphor

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# REVIEW ON HEALTH HAZARDS AND IT'S EFFECTS ON HUMAN BY USING MOBILE CELLULAR PHONES

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**Abstract :** In today's fast-moving and globalised world it is nearly inconceivable to assume our day-to-day life without mobile-phones. It is one of the most effective innovations of the 20th century, which has ended up a helpful implies of communication. The development in the utilize of cellular phone has raised the concerns around the conceivable interaction between the electromagnetic fields (EMF) radiation and the natural impacts on human tissues, especially the brain and the human resistant framework. The impact of normal use of mobile phone has raised worry about the potential health hazards. It is reported, that people who talk on the phone for several hours a day are 50% more likely to develop brain cancer and degeneration of cells. The cause for this is the radio waves formed by mobile phones. It is measured, that every minute the human mind receives about 220 electromagnetic impulses, which are not essentially harmful, but which definitely affect the brain in cases of prolonged impact. In this paper we aim to provide review of some studies which investigated the possible effects of cell phone radiation on human tissues. This review will provide answers for public concern about the hazard of using cell phone.

**Keywords:** Mobile phone, Radiowaves, Brain cancer, Electro Magentic radiations, Risk assessment.

## I. INTRODUCTION

New technologies are evolving in day to day life to assist human being. Mobile usage is currently the fastest rising communication system in the telecommunication industry. Due to increased number of users using the mobile phone, the anxiety is now focused towards electromagnetic radiations emitted by the mobile phones itself. Electromagnetic emission can be classify into ionizing and non-ionizing radiation. Ionizing radiation is the emission with high energy which is able to take away tight bonds between electrons and atoms resulting in tissue damage while non-ionizing radiation is the radiation that has sufficient energy to vibrate the atoms and molecule but do not remove the electrons in the molecule. This radiation mainly occurs at low frequency range. Mobile phone is designed with low power transceiver to transmit voice and data to base station is located at few kilometres. The radiation of mobile phones can cause problems like headaches, severe pain in ear, blurring of vision, memory loss, itching, burning sensations, feeling asleep, hypersensitivity exhaustion have been observed when using mobile phone. The quantity of RF generated by cell phone is typically depends on the number of base stations around the area, the cell phone network traffic, and on how far the cell phone from base stations[1]. The quantity of the power which sent from a base station could vary from cell phone to another one even within the same area, depends on the interfering from obstacles such as buildings and trees [2]. The hazard of coverage to electromagnetic field was first highlighted and publicized in the late 1970s by Colorado study [3] that linked magnetic filed exposure from power lines to the possible development of child leukaemia.

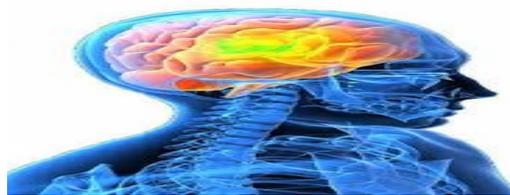


Figure1:Brain affected by EMF exposure

Current studies report two types of brain cancer may occur Glioma and Acoustic neuroma. The figure(1) shows the brain affected due to the Electro Magenetic exposure. The mobile phones usage influence our nervous system. It is the down reality, that nowadays a lot of people, especially youth, experience lack of human contact, and they try to compensate it by mobile-phone communication, which is not an adequate substitute for personal intercourse. Youth is not an easy period of life, and at that time a young person is especially vulnerable. The real world seems to fade in comparison with hours-long chats and hundreds of messages. These aspects cause psychological trouble, as people start to feel tight in face-to-face communication. There is definite risk for pregnant women and their children, so they are sturdily recommended to reduce usage of cell phones. Some studies give information about harmful effects of cell phones on the male reproductive system, so men must not carry phones in the pockets of their trousers.

# Synthesis and Luminescence Properties of Chemically Synthesized ZnS Nanopowders

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## Abstract:

Pure and Cu-doped ZnS nanopowders are synthesized successfully with chemical method. XRD displays the synthesized powder have cubic structure and crystallites size is to be 2-3 nm. These results were confirmed by transmission electron microscopy (TEM), which tune with the XRD results. SEM and TEM micro graphs of ZnS nanopowders were in sphere-shaped nature. The chemical composition is found in pure and doped ZnS nanopowders using EDAX spectra. UV-Vis spectra appearance the absorption peak between 310-320 nm. Photo luminescence studies reveal harsh emission crests at 439 nm, 450 nm and 466 nm with declining intensity for pure and doped powders.

**Keywords:** ZnS nanopowders, XRD, SEM with EDAX, Absorption spectra, PL and HR-TEM.

## 1. Introduction:

Dilute magnetic semiconductors (DMSs) are important in research field to find their innovative properties and control the spin and charge carrier concentration [1], these are used in MRI contrast imaging, drug delivery, biomedical imaging and protein separation [2–5]. Zinc sulfide exists as II–VI composite semiconductor of band gap 3.67 eV with binding energy 40 meV. ZnS semiconducting substance used in lasers, sensors and displays [6–8]. Pronounced improvement had been attained in gathering magnetic and optical properties by varying different doped ions into ZnS nanopowders. Among these nobbled ions, transition metals (TM) doped ZnS nanopowders has been observed as a hopeful new-fangled discussion of DMS spreading to their greater magnetic and optical assets [9–11]. Cu-doped ZnS nanopowders display green and

## An Exponential Model Fitted to Month Wise Rainfall

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### Abstract

Rainfall plays a major role in crop yield, for cultivation purpose, generation of power, drinking and harvesting purpose, etc. Average Annual rainfall in India is 300-650 millimeters. India is divided into five major divisions; they are 1. Country as Whole, 2. North West India, 3. Central India, 4. South Peninsula and 5. East & North East India. We fitted an Exponential Smoothing model for 5 major regions by taking constants 0.1 to 0.9 values. The best model among them is chosen using Mean Absolute Error.

**Keywords:** Rainfall, Exponential model, Country as Whole, North West India, Central India, South Peninsula, East & North East India.

### 1.Introduction

In India the seasons are divided into four 1. Winter ranges from December to February, 2. Summer in the months of March, April and May, 3. Rainy season from June to September and as post rainy seasons is from October to December, rainfall plays major role for cultivation, drinking water, power generation etc. India gets 70% of its annual rainfall in the rainy season. In India on an average 50% of irrigation based on rainfall only. Generally climatic condition of Andhra Pradesh is hot and humid. The rainy season for Andhra Pradesh starts during June and continuous till September. In this season heavily rains in Andhra Pradesh. Generally Andhra Pradesh is brought by the North East Monsoons around the month of October. In this paper we have divided India into 5 major regions; and for each region we have fitted Exponential model with different constant values.

“Forecasting trends in time series”, was given by Gardner E.S, Jr and McKenzie. E. “Prediction intervals for exponential smoothing state space models”, was given by Hyndman R.J., Kuchlor, A.B., Ord, Jr and Snyder, R.D. The book “Forecasting Methods and Applications” by Makridakis, S., Wheelwright, S.C & Hyndman R.J. “Exponential Smoothing with a Damped Multiplicative Trend” was given by James W. Taylor. In his article the method establish the local growth  $T_t$ , by smoothing successive differences is

$(S_t - S_{t-1})$  of the local level  $S_t$ . The forecast for the growth projection is as follows

$$S_t = \alpha X_t + (1 - \alpha)(S_{t-1} - T_{t-1})$$

$$T_t = \delta(S_t - S_{t-1}) + (1 - \delta)T_{t-1}$$

$$\hat{X}_t(m) = S_t + mT_t$$

where  $X_t$  = actual observation

$$\hat{X}_t(m) = m \text{ step ahead forecast}$$



# Synthesis and properties of (Fe, Ni)-doped zinc sulfide nanopowders

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## Abstract

Pure and (Fe, Ni)-doped ZnS nanopowders have been successfully synthesized by chemical co-precipitation method using Poly Vinyl Pyrrolidone (PVP) as capping agent. Powder X-ray diffraction (XRD) studies reveal that the synthesized powders are in cubic blended structure. The average crystalline size of pure and doped ZnS nanopowder conform around 2–3 nm. In the investigations, Ni is kept constant at 3 mol% and Fe is increased from 1 to 5 mol%. Transition electron microscopy (TEM) is also used to investigate the average size of the nanopowders. TEM results are reasonably in good agreement. SEM micrographs of the (Fe, Ni)-doped nanopowders result in agglomeration with spherical in shape. The EDAX spectra show the chemical composition of dopants is uniform in ZnS. Optical absorption spectra show the absorption edge at 310 nm. Photoluminescence (PL) studies are conducted with excitation wavelength of 306 nm. Pure ZnS exhibits sharp emission peaks at 438 nm, 450 nm and 466 nm. (Fe, Ni)-doped ZnS samples also exhibit the sharp emission peaks at 450 nm and 467 nm with decreasing intensity. The magnetic measurements reveal that 5 mol% Fe- and 3 mol% Ni-doped ZnS nanopowders exhibit a weak ferromagnetic behavior.

## 1 Introduction

Semiconducting materials doped with magnetic materials are known as dilute magnetic semiconductors (DMS) [1]. The authors have a lot of interest in transition and rare-earth dopants and hence in DMS due to their charge and spin controlling features, DMS materials have created a lot of interest in various scientific fields. The semiconducting materials like II–VI and III–V group compounds are popular host materials for transition metals (TM) and rare-earth metals (RE). These materials have found applications in spintronics and other bandgap engineering devices, light emitting diodes, field detectors, lasers, magnetic resonance imaging (MRI) and solar cells [2–7]. II–VI compounds such as CdS, CdSe, ZnS, ZnO and ZnSe are most popular host materials which are doped with transition metals (TM) or rare-earth metals (RE) [8–13]. ZnS is a wide bandgap material (3.72 eV) and a favorable host for transition metals due a

variety of applications. Many have investigated the optical and magnetic properties of ZnS-based DMS nanostructures [14–29]. Some important studies are electrical and magnetic properties of cold compacted Fe-doped ZnS nanoparticles [30, 31]. A gradual increase of magnetization in (Fe, Ni)-doped samples has been observed at room temperature. Sambavisham et al. [32] have reported induced magnetism in Fe-doped ZnS nanoparticles. Pure ZnS nanopowders have exhibited diamagnetic behavior and Fe-doped ZnS samples a superparamagnetic-like behavior with weak ferromagnetism. Eryong et al. [33] have observed the reduction in the intensity of photoluminescent (PL) peaks and superparamagnetism in the Fe-doped ZnS nanopowders. Various studies on PL and magnetic studies of TM-doped ZnS nanostructures are available in the literature. However, room temperature magnetism induced in TM-doped ZnS DMS nanostructures still remains as an enigma. Fe-doped nanopowders are expected to have future applications in solar cells, biomarkers, bandgap engineering devices, lasers and nanoelectromechanical systems (NEMS) [34–40].

Pure and (Fe, Ni)-doped ZnS nanostructured materials have been synthesized by using chemical co-precipitation method. XRD results show that all the synthesized samples are in cubic blended structure. The average crystalline sizes of pure and (Fe, Ni)-doped ZnS nanoparticles are found to be around 2–3 nm. These results have been confirmed by the

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# REGRESSION MODELS FOR INTRADAY ATMOSPHERIC DATA

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## ABSTRACT

Now a days atmospheric studies plays a vital role in forecasting atmospheric variables like rainfall, temperature, wind speed, humidity, sunset and sunrise etc. For forecasts any variable we are using regression models. There are several regression models and some of them are simple regression model, multiple linear regression model, polynomial regression model, Poisson regression model, negative binomial regression model, etc. In this paper we use wind speed as dependent variable and precipitation, visibility and time as independent variables for 5 years intraday data. For the data we fitted general multiple regression model, Negative Binomial regression model and Poisson Regression model for estimation of parameters and we used ordinary least squares method and maximum likelihood method. Root mean square error (RMSE) criteria is used to choose the best model among three models.

**Key words:** wind speed, precipitation, visibility, time, regression model and RMSE.

## 1. INTRODUCTION:

Atmospheric Science forecasting plays major role in human life. There is a vital role in every human life of Atmospheric variables like wind speed, precipitation, visibilities according to time. The data may be several types i.e. cross sectional data, time series data, numerical data, categorical data, etc. In the present paper we are using different regression models to fit wind speed as dependent variable with precipitation, visibility and time as independent variables. Among the various regression models, some of them are Linear Regression model, Polynomial Regression model, Logistic Regression model, Multiple Regression model, stepwise Regression model, Ridge Regression, Lasso Regression, etc. [1,2].

Biswajeet Pradhan studied Remote sensing and GIS-based land slide hazard analysis and cross-validation using multivariate logistic regression model on three test areas in Malaysia[3]. In this paper pre cross validation of multivariate logistic regression model using remote sensing data and GLS for landslide hazard analysis was provided on the Penong and Selangor areas in Malaysia.

T .O. Olatayo, et.al [4], published an article on “Modelling and Estimation of Climatic Variable using Time Series Trigonometric Analysis”. In this paper, they discussed time series trigonometric analysis and estimation methods based on ordinary least square and maximum likelihood. Application and verification of fuzzy algebraic operators to landslide susceptibility mapping given by S.Lee [5]. Comparison of the GIS based land slide susceptibility assessment methods: Multivariate versus bivariate are given by M.L. Suzen, et.al[6].

# ARIMA MODELS FOR INTRADAY ATMOSPHERIC DATA

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**Abstract-**There are six seasons in India and they are Spring, Summer, Mansoon, Autumn, Pre winter and Winter. In this paper we took day wise data of wind speed and temperature for 20 years. By taking wind speed as dependent variable and temperature as independent variable, we perform seven Auto Regressive Integrated Moving Average (ARIMA) models. Here the moving average length 6, integration of length from 1 to 7 and auto regression of length from 1 to 7. For choosing the best model among these 7, we are using stationary R square and Root Mean Square Error (RMSE) criteria. The best model among the 7 models is ARIMA(2,2,7) with stationary R square 0.888 and RMSE 1.756.

**Keywords:** day wise data, wind speed, temperature, RMSE, ARIMA and stationary R square.

## I. INTRODUCTION

Atmosphere plays major role in human life. Atmospheric variables are temperature, pressure, rainfall, wind speed, precipitation, wind gust, visibility etc. Generally wind speed is an atmospheric quantity caused by air moving from higher pressure to lower pressure. It is usually due to changes in temperature. Wind speed generators are used for generation of powers. Wind within the upper portion of planet's atmosphere allows light, chemical elements such as hydrogen to move upto the exogas, then the exogas lower limit is exosphere, the gases reach escape velocities entering outer space without impacting other particles of gas. The steam of changed particles is a solar wind.

Statistical analysis of the relationship among wind speed, pressure and temperature was given by R.D. Wooten[1]. In this paper, he considered to common entities to metrologies of storm are pressure and wind speed. He taken readings from a buoy in the Gulf near a reading estimated using Doppler within a hurricane and identifies the relationship between wind speed and pressure using regression analysis and non response analysis. The non response analysis is used to detect interaction relationship among pressure, wind speed and temperature.

T.O. Olatayo et al [2] used the Time Series Trigonometric Analysis (TSTA) and its estimation using Ordinary least squares and maximum likelihood for the climatic variables such as rainfall, temperature, humidity and evaporation. It is good for model or not, is tested using Co-efficient of determination. Rainfall increases in south western Nigeria was due to periodic changes in evaporation, humidity and temperature. Harvey et al [3] assessing and modelling statistical behaviour of rainfall in north east Brazil. Auto regression integrated moving average modelling for population prediction was given by Olatayo et al. [4]. Method of Trigonometric modelling of seasonal variation demonstrated with multiple sclerosis relapse data was given by Spelman et al. [5], and Hopkins et al [6] has written an article on multiple sclerosis and the local weather in 1955.

## II. METHODOLOGY

There are many regression models in the literature[7,8] for time series atmospheric data and some of them are specified as Simple Linear Regression model, polynomial regression model, Quadratic Regression model, Auto Regression models, Auto Regressive moving average models with different moving averages (q), and Auto regressions (p), Auto regressive integrated moving average models (ARIMA) (p, d, q) with Auto regressive (p), integration (d) and moving average (q), Auto regressive conditional heteroscedasticity(ARCH), Generalized Auto regressive conditional heteroscedasticity(GARCH), Vector Auto regressive models (VAR), etc.

In this paper we are taking different orders of Auto regressive, integration but moving averages is '6' i.e., ARIMA (p, q, 6). The ARIMA models for wind speed data using the following procedure:

## Percentile Regression models for rainfall data in India

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### ABSTRACT

India depends on the rainfall for cultivation and drinking purpose. Average annual rainfall in India is around 300-650 millimeters. The climate seasons of India are winter in January and February, summer season is in the months of March, April and May; June, July, August and September is rainy season and Post monsoon is from October to December. In this paper we divide total area of India into five regions i.e North west India, North Eastern, Central North East India, Penisular India, and West central India. For five regions and All India, we fitted 10 Percentile regression models by taking tau (T) are 0.1, 0.2, 0.3, 0.4, 0.5, 0.6, 0.7, 0.8, 0.9. By choosing the least RMSE value of each division we will tell which model is the best for the data.

Keywords: Rainfall, percentile regression, RMSE.

### I. INTRODUCTION:

Percentile Regression model plays a vital role than the linear regression model. Generally linear regression model explain the relationship between the independent variables related with dependent variable. Regression analysis is a form of predictive modeling technique which investigates the relationship between independent and dependent variables. There are many regression lines according to number of independent variables, shape of the regression line and type of dependent variables. Some of them are Polynomial Regression, Logistic Regression, Ridge Regression, Lasso Regression, Elastic Net Regression, Principle Components Regression, Partial Least Squares Regression, Support Vector Regression, Ordinal Regression, Poisson Regression, Negative Binomial Regression, Quasi Poisson Regression, Cox Regression, Tobit Regression, etc.



# Magnetic properties of (Mn, Al) doped SnO<sub>2</sub> nanoparticles: synthesis and characterization

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## ABSTRACT

Pure and (Mn, Al) co-doped SnO<sub>2</sub> nanoparticles were synthesized using co-precipitation method. Different concentrations of Mn (1, 3, 5 mol%) were doped into SnO<sub>2</sub> at 5 mol% constant concentration of Al. The X-ray diffraction (XRD) studies revealed the formation of single tetragonal rutile-type phase in pure and (Mn, Al) doped SnO<sub>2</sub> nanoparticles. The particle sizes were in the range of 20–30 nm, as calculated from the XRD data. Raman studies revealed that the pure and (Mn, Al) doped SnO<sub>2</sub> nanoparticles have active modes at 150 (B1g), 306 (Eu), 476 (Eg), 625 (A1g) and 776 cm<sup>-1</sup> (B2g) corresponding to tetragonal rutile-type phase SnO<sub>2</sub>. The SEM micrographs show that the surface morphology of samples was formed by non-uniform spherical in shape particles. The chemical composition of samples was analyzed by EDAX spectra analysis. The presence of Sn<sup>4+</sup>, Al<sup>3+</sup>, O<sup>-2</sup> and Mn<sup>2+</sup> ions was confirmed in the prepared samples. The observation of TEM micrographs confirmed the non-uniform spherical shape surface morphology of nanoparticles and their sizes about 20–30 nm. The UV–VIS absorption spectra show absorption edge at ~ 320 nm, whereas the photoluminescence spectra show the emission peaks at 419, 420, 442, 445 and 462 nm under the excitation at 350 nm. The vibrating sample magnetometer shows diamagnetic nature for pure SnO<sub>2</sub> and Ferro magnetism for co-doped SnO<sub>2</sub> samples. The ferromagnetism increased in (Mn, Al) co-doped SnO<sub>2</sub> samples at higher Mn concentrations.

## 1 Introduction

Diluted Magnetic Semiconductors (DMS) doped with transition metals (TM) are suitable materials for spintronics applications. These are examined intensively due to their sole properties and novel

applications at high temperatures (T<sub>c</sub>) [1]. The room temperature ferromagnetism (RTFM) in various TM doped oxides such as SnO<sub>2</sub> [2–4], ZnO [5, 6] and TiO<sub>2</sub> [7, 8] was studied. Among these, Tin dioxide (SnO<sub>2</sub>) is an n-type semiconductor, it has wide band gap (3.6 eV) and pronounced potential in spintronics

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## Exponential piece wise regression for rainfall data

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## Exponential piece wise regression for rainfall data

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**Abstract.** There are several regression models for the rainfall in the literature. Some of them are linear regression model, multiple regression model, piece wise regression model, Poisson regression model, negative binomial regression model, etc. Various piece wise regression models are linear piece wise regression, polynomial piece wise regression, cubic piece wise regression, quadratic piece wise regression, etc. This paper proposes three piece wise regression models using exponential smoothing models, i.e, simple exponential smoothing spline, holt's exponential spline, and damped exponential spline for annual rainfall data from 1970 to 2017 with two knots at 1990 and 2005 with three subdivisions. Symmetric mean average percentage error is used as an accuracy measure for choosing the best model among the proposed three exponential spline models.

**Keywords:** rainfall data, simple exponential smoothing spline, holt's exponential spline and damped exponential spline, Symmetric mean average percentage error.

### 1. Introduction:

In India, the rainy season is generally from June to September, and the annual average rain is recorded between 750 and 1500 millimeters around the region. Usually, rainwater is better than artificial irrigation methods because it does not have added chlorine chemicals. The advantages are that it is good for plants and soil. It reduces runoff pollution, contributes to erosion prevention efforts, and eco-friendly options to keep composts moister. On the other side of the coin are essential created flooding kills thousands around the world every year. Rain causes excessive load on the drainage system.

W.F.Krejowski et al.[1] explains "Radar hydrology: rainfall estimation", the authors used Radar observations of rainfall and discussed their use. Methodological advances are needed in several areas of radar-rainfall estimation of particular importance, advancement in rainfall estimates using polarimetric radar observations, estimates of the error structure of rainfall rate estimates, and validation of radar rainfall algorithm. J.H.C.Gash[2] studies "An analytical model of rainfall interception by forecasts", the two major factors which control the evaporation of intercepted rainfall area a) amount of time that the canopy spends saturated during rains and the evaporation rate

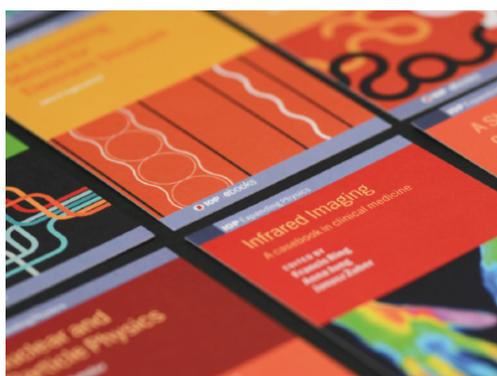


PAPER

# Structural, magnetic and dielectric properties of cobalt doped $\text{GdF}_e\text{O}_3$ orthoferrites

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## PAPER

Structural, magnetic and dielectric properties of cobalt doped  $\text{GdFeO}_3$  orthoferritesRECEIVED  
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## Abstract

In this present work deals with the structural and magnetoelectric behaviour of Cobalt substituted  $\text{GdFeO}_3$  orthoferrites synthesized by solid state reaction technique. X-ray diffraction and FTIR studies of  $\text{GdCo}_x\text{Fe}_{1-x}\text{O}_3$  ( $0 \leq x \leq 0.3$ ) orthoferrites disclosed the orthorhombic  $Pbnm$  structure and Co induced vibrational modes in  $\text{GdFeO}_3$  orthoferrites respectively. Cationic displacements confirmed from the crystallite size calculations and deviations in lattice parameters affected the magnetic and electrical nature of the  $\text{GdCo}_x\text{Fe}_{1-x}\text{O}_3$  ( $0 \leq x \leq 0.3$ ) orthoferrites. Co substitution promoted a drastic improvement in the magnetic nature of Cobalt substituted  $\text{GdFeO}_3$  orthoferrites than that of  $\text{GdFeO}_3$ . Antiferromagnetic  $\text{GdFeO}_3$  has turned out to be strong ferromagnetic material on Co substitution. Higher coercive values 1620.4 Oe and 4035.06 Oe were recorded for  $\text{GdCo}_{0.2}\text{Fe}_{0.8}\text{O}_3$  ferrites whereas for  $\text{GdFeO}_3$  they were seen to be 527.62 Oe and 360.61 Oe at 300K and 150K temperatures respectively. Dielectric studies revealed a decrease in dielectric constant and loss tangent values with frequency at room temperature. AC conductivity is seen to be increasing at higher frequencies and a maximum value is obtained at Co content of  $x = 0.2$ . The significance of cobalt in mutating the structural, magnetic and electrical properties of  $\text{GdCo}_x\text{Fe}_{1-x}\text{O}_3$  ( $0 \leq x \leq 0.3$ ) ferrites is clearly seen by making them useful for high frequency applications.

## Introduction

Rare earth perovskites,  $\text{ReMO}_3$  (e.g. Re = Gd, Eu, Dy etc and M = transition metal ions) were focused for the past several years because of their intriguing magnetic and electrical properties. Magnetic and electrical properties of many rare earth perovskites have been observed, based on the type of rare earth cation, oxygen non-stoichiometry, and aliovalent cationic substitution. It was earlier reported that europium niobate ( $\text{EuNbO}_3$ ) exhibits ferromagnetic nature and due to the presence of oxygen vacancies it gets transformed into a superconductor with a critical temperature about 6 K [1–4]. Among many rare earth perovskites, rare earth orthoferrites with distorted perovskite structure attained importance owing to their notable and unconventional magnetic ground states arised primarily due to challenging interactions among charge, spin and orbital degrees of freedom [5]. The undistorted symmetric structure of these perovskites gets disturbed due to distortion or tilting of  $\text{BO}_6$  octahedra and (iii) differences in cationic site occupancies due to B ions movement within the polyhedra with respect to oxygen octahedra. These distortions cause a misalignment in the magnetic moments according to applied magnetic field direction [6, 7].  $\text{GdFeO}_3$ , in  $Pnma$  space group is a rare earth orthoferrite with orthorhombic structure. In  $\text{GdFeO}_3$ , symmetric structure is distorted by  $\text{FeO}_6$  octahedral tilting. A typical feature of  $\text{GdFeO}_3$  is it shows antiferromagnetic ordering as well as ferroelectric behaviour simultaneously above room temperature due to its mixed ionic and electronic conductivity This peculiar nature of  $\text{GdFeO}_3$  is due to the interactions between Gd 4f spin and Fe 3d spin resulting in diverse magnetic transitions at different temperatures [8–10]. Apart from this electric and magnetic fields can effectively control the ferroelectric polarization and magnetization in  $\text{GdFeO}_3$ . Yusuke Tokunaga *et al* had already proposed that the domain wall in  $\text{GdFeO}_3$  crystal determines the efficiency of their mutual controllability in  $\text{GdFeO}_3$  crystal and has an important



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# Structural and photoluminescence properties of a novel green emitting Tb<sup>3+</sup> doped Ba<sub>3</sub>La<sub>2</sub>(BO<sub>3</sub>)<sub>4</sub> phosphor

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## ABSTRACT

A novel green light emission from rare earth ion Tb<sup>3+</sup> at various concentrations of (0.02, 0.04, 0.06, 0.08 and 0.1 mol) doped in barium lanthanum borate (Ba<sub>3</sub>La<sub>2</sub>(BO<sub>3</sub>)<sub>4</sub>) phosphors have been synthesized by conventional solid state reaction method. The crystal structure, functional and luminescence properties were characterized by XRD, FTIR and Photoluminescence (PL) analyses respectively. Surface morphology and composition of the starting elements of the phosphors were analyzed by FESEM and EDX. From XRD, it was confirmed that an orthorhombic crystal structure for Tb<sup>3+</sup> doped Ba<sub>3</sub>La<sub>2</sub>(BO<sub>3</sub>)<sub>4</sub> phosphors. From FTIR, the energy absorption bands between B-O and B-O-B were identified. From PL study, the emission spectra containing of four emission peaks at 487 nm, 545 nm, 586 nm and 622 nm corresponding to the electronic transitions of <sup>5</sup>D<sub>4</sub> → <sup>7</sup>F<sub>6</sub>, <sup>5</sup>D<sub>4</sub> → <sup>7</sup>F<sub>5</sub>, <sup>5</sup>D<sub>4</sub> → <sup>7</sup>F<sub>4</sub> and <sup>5</sup>D<sub>4</sub> → <sup>7</sup>F<sub>3</sub> were recorded at NUV excitation of 271 nm. A prominent green emission with high intensity of wavelength at 545 nm corresponding to <sup>5</sup>D<sub>4</sub> → <sup>7</sup>F<sub>5</sub> transition was also observed. The CIE colour coordinates of the optimum emission of Ba<sub>3</sub>La<sub>2</sub>-x(BO<sub>3</sub>)<sub>4</sub>:xTb<sup>3+</sup> phosphors were x = 0.2765 and y = 0.6948, which were located in the green region and hence this phosphor might be a potential application in green light emitting display devices.

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## 1. Introduction

For the past two decades, the inorganic phosphor materials doped with rare-earth (RE) elements have drawn attractive attention due to their abundant luminescent emission of colors based on f-f or f-d transitions and potential applications in solid state lighting (SSL) and white light emitting devices (W-LEDs) [1–4]. Also, trivalent rare-earth elements have become the most promising activators of phosphors due to their luminescence characteristics in ultraviolet (UV) and visible region [5]. The phosphors based on rare-earth elements have great research attention due to their sharp emission luminescence properties at a suitable sensitization [6]. W-LEDs are of special interest because of their power saving and eco-friendly nature devices [7]. Moreover, these materials emit white luminescence that shows great advantage by the replacement of conventional light emitting sources such as incandescent and fluorescent lamps with high potential, reliability and long lifetime as well as low energy consumption has enabled W-LEDs to

gain much commercial interest [8]. In general, phosphors are playing much more attention due to mainly on various oxygen containing inorganic compounds such as silicates, aluminates, borates, oxides and alumina-borates. In this context, special emphasis was given to inorganic rare-earth doped phosphors incorporated in the frame work of a suitable host lattice on the account of their diverse contributions to W-LED applications, field emission display (FED), fiber optic communications, opto-electronic devices, solid state lasers, optical fiber amplifiers, etc.

Materials based on borate phosphors are much helpful classes of host materials for luminescence due to their wide applications in lighting fields, large electronic band gap, low synthesis temperature, chemical and environmental stability and high UV region transparency [9]. Since phosphor materials have several applications, variety of borate materials were used as host materials and were doped with different rare-earth ions which have been reported earlier by various researchers [10–12]. We have prepared a novel kind of borate based green emitting phosphor which is activated with Tb<sup>3+</sup> ions with their possible applications for W-LEDs. Since Tb<sup>3+</sup> doped phosphor materials have a strong excitation band in the near ultra violet (NUV) region from 200 to 400 nm and emission around 545 nm due to <sup>5</sup>D<sub>4</sub> → <sup>7</sup>F<sub>5</sub> transition [13]. The most

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# Tunable white light emission from Dy<sup>3+</sup>/Eu<sup>3+</sup> doped LaAlO<sub>3</sub> nanophosphors via hydrothermal method

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White light

## ABSTRACT

A sequence of Dy<sup>3+</sup>/Eu<sup>3+</sup> co-doped LaAlO<sub>3</sub> nanophosphors are synthesized by hydrothermal technique and their phase purity, particle nature and luminescence characteristics are investigated. All the prepared samples possess single-phased perovskite type rhombohedral structure of LaAlO<sub>3</sub> and consist of polygonal natured particles with the mean size of 30 nm. Under the excitation with 351 nm, LaAlO<sub>3</sub>: Dy<sup>3+</sup> nanophosphors shown characteristic emission peaks of Dy<sup>3+</sup> ion and are positioned at 485, 576 and 665 nm. LaAlO<sub>3</sub>: 9 mol% Dy<sup>3+</sup>, y mol% Eu<sup>3+</sup> nanophosphors exhibited emission bands of both Dy<sup>3+</sup> and Eu<sup>3+</sup> ions and are noticed at 485, 576, 590, 620 and 696 nm under 351 nm excitation. It can be perceived that the Dy<sup>3+</sup> integrated luminescence intensity is reduced and the average lifetime of Dy<sup>3+</sup> is decreased with the enhancing Eu<sup>3+</sup> content, which is owing to energy migrates from Dy<sup>3+</sup> ion to Eu<sup>3+</sup> ion. Moreover, CIE coordinate values of LaAlO<sub>3</sub>: 9 mol% Dy<sup>3+</sup>, y mol% Eu<sup>3+</sup> nanophosphors are altered from the bluish-white to white light and ultimately to the orange-white light location with increasing the Eu<sup>3+</sup> ion content. This nature of color adjustable nanophosphors shows the excellent potential advantages in the fields of white light luminescent materials, optoelectronic devices and color displays.

## 1. Introduction

In current decade, there has been a grow in consideration in the synthesis of multicolour emission components because of its wide utilizations in white light emitting diodes (WLEDs), color displays, optoelectronic devices and medical imaging [1]. Many researchers have been analysed the white light luminescence phosphors employed in WLEDs. One technique for acquiring white light luminescence phosphor is through the energy transmits from the sensitizer to the activator. For instance, Martinez et al. [2] described that the Ce<sup>3+</sup> and Dy<sup>3+</sup> co-doped Al<sub>2</sub>O<sub>3</sub> films Commission International de l'Eclairage (CIE) chromaticity values were approach to the perfect white light coordinate values (0.333, 0.333). Shripathi et al. [3] investigated the luminescent characteristics and energy migration behaviour of Dy<sup>3+</sup> and Tb<sup>3+</sup> co-doped Y<sub>2</sub>O<sub>3</sub> nanophosphors. Another technique to make white light is single rare earth ion doped phosphors, which emits white light itself. Generally, it is fact that single Dy<sup>3+</sup> ions activated luminescent materials and which exhibits two typical emission transitions <sup>4</sup>F<sub>9/2</sub>→<sup>6</sup>H<sub>15/2</sub> (blue) and <sup>4</sup>F<sub>9/2</sub>→<sup>6</sup>H<sub>13/2</sub> (yellow) [4]. However, owing to the insufficient of red color emitter, the color render index of that luminescent compound is extremely low [5]. To alter the red emitted member, a red luminescent

center is introducing into Dy<sup>3+</sup> ions doped photoluminescent materials. The Eu<sup>3+</sup> ion, which gives the orange and pure red emissions owing to its <sup>5</sup>D<sub>0</sub>→<sup>7</sup>F<sub>J</sub> (J = 1, 2, 3, 4 and 5) transitions, is an great activator [6]. Hence, white light develop in excellent features can be attained by co-doping Dy<sup>3+</sup> and Eu<sup>3+</sup> ions into a host material.

Lanthanum aluminate (LaAlO<sub>3</sub>) possesses a perovskite-like structure [7]; it is a significant inorganic material and which has been studied to be superior luminescent host compound due to those material desirable photoluminescence properties, chemical durability and elevated thermal stability [8]. Based on the literature structural and photoluminescence characteristics of Dy<sup>3+</sup> and Eu<sup>3+</sup> co-doped LaAlO<sub>3</sub> nanophosphors were not studied. Usually phosphor materials emission characteristics are rely on host materials crystal structure, particles morphology and size. Hydrothermal technique is an admirable synthesizing way, which can produce nanopowder with high crystallinity and homogeneous morphology [9].

In the current work, LaAlO<sub>3</sub>: Dy<sup>3+</sup>/Eu<sup>3+</sup> nanopowder samples were prepared via hydrothermal technique successfully, and their structural, emission, energy migration and decay lifetime process were characterized in detail.

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Original research article

# Structural and an orange-red emission studies of $\text{Sm}^{3+}$ doped $\text{Ba}_3\text{La}_2(\text{BO}_3)_4$ phosphor for solid state lighting application

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## ABSTRACT

A new kind of host phosphor materials  $\text{Ba}_3\text{La}_2(\text{BO}_3)_4$  doped with  $\text{Sm}^{3+}$  ion, were prepared by solid state reaction method. The crystal structure of synthesized samples is an orthorhombic structure confirmed by XRD study. The FTIR spectra confirmed the band assignments among the borate networks. The thermal stability of the sample was examined by TG-DTA study. FESEM and EDX provide surface morphology and elemental composition of the materials. From DRS analysis we have calculated the energy band gap through Tauc plot method. For PL studies,  $\text{Ba}_3\text{La}_2(\text{BO}_3)_4:\text{Sm}^{3+}$  samples excitation spectra were monitored at 601 nm and the prominent excitation peak was observed at 408 nm. The emission spectra consist of four bands and the highest intense emission peak was observed at 601 nm ( $^4\text{G}_{5/2} \rightarrow ^6\text{H}_{7/2}$ ) due to the intra 4f transition of the  $\text{Sm}^{3+}$  ion. From CIE 1931 Chromaticity, the color coordinates were calculated  $x = 0.5363$ ;  $y = 0.4519$  and these are lying in the orange-red region. Hence this new phosphor sample might be a useful material for an orange-red emission, applicable in solid-state lighting and display devices.

## 1. Introduction

Researchers extensively investigating on the present and future generations of white light emission diodes (W-LEDs), field emission displays (FEDs) and plasma display panels (PDPs) that have been occupied by the inorganic phosphor materials which can have superior characteristics of high luminous efficiency, energy saving, chemical stability and eco-friendly [1,2]. W-LEDs based on phosphor materials and have attractive features as solid-state lighting sources since they can have several advantages over fluorescent and incandescent lamps including cheap cost, high efficiency, energy conservation, high compactness, high thermal stability, good reliability and longer operating life [3–5]. Many research groups have been paid efforts to synthesize red emitting phosphor suitable for LEDs [6]. Among the rare earth elements, trivalent samarium ion ( $\text{Sm}^{3+}$ ) usually emits orange-red light when excited with blue and near ultraviolet and commonly has a elevated emission intensity [7,8].

The luminescent characteristics are varying based on the host material and hence host material selection is most important. The selected host materials that have high crystallinity, thermal stability, chemical stability, low phonon energy and superior transparency in an ultra violet [UV] region are best suitable for luminescent materials [9–11]. Borate based oxide materials could show these characteristics and hence many pioneering researchers have worked on borate based phosphor materials. The present  $\text{Ba}_3\text{La}_2(\text{BO}_3)_4$  material belongs to borate group inorganic phosphor material which have orthorhombic crystal structure with space group  $\text{pcmn}$  (62)

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## اصغر ویلوری - ”وہ جب یاد آئے بہت یاد آئے“

ڈاکٹر محمد امین اللہ

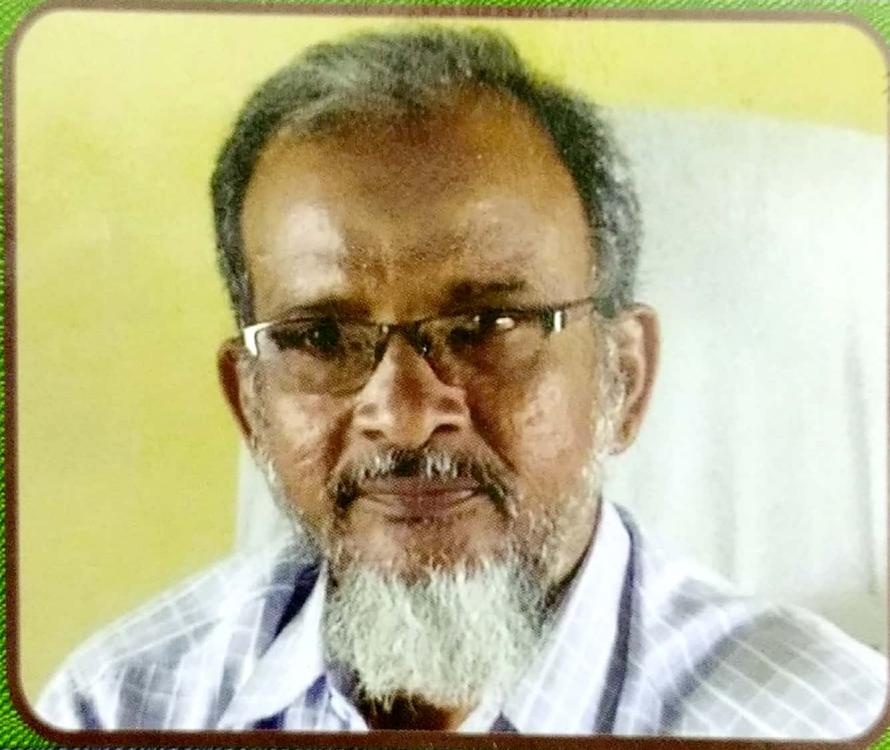
اسٹنٹ پروفیسر شعبہ اردو، جامعہ سری وینکٹیشور، تروپتی، آندھرا پردیش - انڈیا

”وہ جب یاد آئے بہت یاد آئے“ جناب اصغر ویلوری کے غزلیات اور قطعات کا مجموعہ ہے۔ اس سے قبل آپ کے متعدد شعری مجموعے منظر عام پر آچکے ہیں اور اردو دنیا میں داد و تحسین حاصل کر چکے ہیں۔ یوں تو اصغر ویلوری نے دیگر شعری اصناف پر طبع آزمائی کی ہے تاہم رباعی آپ کی صنف خاص ہے۔ رباعی گوئی میں آپ کو کمال حاصل ہے جس کا اعتراف اردو کے نام و راہیوں اور ناقدوں نے کیا ہے۔ جن میں حامدی کاشمیری، شمس الرحمن فاروقی، قمر رئیس، مظہر امام وغیرہ شامل ہیں۔ جنوبی ہند میں بحیثیت رباعی گو شاعر اصغر ویلوری ایک اہم اور معتبر نام ہے۔ اردو شعر و ادب کے حوالے سے ریاست تامل ناڈو کی آپ آن بان اور شان ہیں۔ آپ کا شمار اُس قبیل کے اُدبا اور شعرا میں ہوتا ہے جن کا اردو سے اور اُن کے پیشے سے کوئی تعلق نہیں۔ جو اردو کی روٹی توڑتے نہیں بلکہ اردو کے خدمت گزار ہیں۔ علامہ اقبال، پیشہ سے وکیل اور فلسفہ کے استاذ اردو کے عظیم شاعر۔ فیض احمد فیض، پیشہ سے انگریزی لکچرار اور میجر، مگر اپنے عہد کے سب سے مقبول شاعر۔ فراق گورکھپوری، انگریزی کے پروفیسر اور اردو کے مایا ناز شاعر۔ شمس الرحمن فاروقی اعلیٰ سرکاری افسر اردو کے ادیب و ناقد اصغر ویلوری، ریلوے کے اعلیٰ افسر مگر اردو کے منفرد رباعی گو شاعر۔ اس خصوص میں اصغر ویلوری سے متعلق یہ بات قابل ذکر ہے کہ آپ نے علاقہ تامل ناڈو میں رہ کر اردو شاعری میں کمال حاصل کیا ہے۔ یہ وہ علاقہ ہے جہاں تامل زبان و ادب اور لہجہ کا اثر ہر فرد پر حاوی ہے۔ ایسی سنگلاخ زمین پر اصغر ویلوری نے اردو شاعری کے خوبصورت پودے اُگائے ہیں۔ آپ کا یہ کارنامہ قابل تحسین بھی ہے اور قابل ستائش بھی ہے۔

شہر ویلور جنوبی ہند کی ریاست تامل ناڈو کا ایک تاریخی شہر ہے۔ بیجا پور کی عادل شاہی سلطنتوں کے زوال کے بعد علما و فضلا کے ساتھ ساتھ اُدبا اور شعرا نے بھی ویلور کا رخ کیا۔ یہاں کے سازگار ماحول سے متاثر ہو کر یہیں سکونت اختیار کر لی۔ شہر ویلور میں اردو شعر و ادب کی کافی پذیرائی ہوئی اور یہ سلسلہ آج بھی جاری ہے۔ شہر ویلور سے وابستہ کئی اُدبا و شعرا نے اپنی گراں قدر خدمات سے اردو شعر و ادب کے دامن کو مزین کیا ہے۔ اسی شہر ویلور میں اصغر ویلوری کی پیدائش ۲۹ جولائی ۱۹۳۱ء کو ہوئی۔ آپ کا نام اسماعیل بیگ ہے۔ ابتدائی تعلیم ویلور میں حاصل کی۔ اعلیٰ تعلیم کے لیے ۱۹۴۹ء میں مدراس (چینئی) کا رخ کیا اور یہیں انڈین ریلوے میں آپ کو ملازمت مل گئی۔ آپ ایم۔ اے۔ اور بی۔ ایل۔ کی تعلیم مکمل کی۔ ریلوے میں ایک سینیئر افسر رہے اور بحیثیت ڈویژنل کمرشل مینیجر کے وظیفہ یاب ہوئے۔ ملازمت سے سبکدوشی کے بعد چند سال پیشہ وکالت سے وابستہ رہے۔ تاہم اردو شعر و ادب کی خدمت آپ کا اہم مشغلہ رہا ہے۔ اب آپ کی عمر تقریباً نوے سال کی ہے۔ اب بھی آپ اردو کی اشاعت، تصنیف و تالیف میں مصروف ہیں۔ آپ کے متعدد شعری مجموعے منظر عام پر آچکے ہیں۔ جن کے نام: حروف، نقوش اصغر، کھلے الفاظ رباعیات اصغر، قص قلم، حق نما، مشاہدات اصغر، طرز بیان، عکس زار، سنگ ریزے وغیرہ ہیں۔ اب تک آپ پر چھ کتابیں لکھی گئی ہیں۔ ۲۰۰۲ء میں ڈاکٹر محمد علی اثر نے ’اصغر ویلوری - فن اور شخصیت‘ کے عنوان سے تنقیدی مضامین پر مشتمل ایک کتاب شائع کی۔ ڈاکٹر مناظر عاشق ہرگانوی نے ۲۰۰۵ء میں ’اصغر ویلوری - منفرد رباعی گو‘ کے عنوان سے ایک کتاب ترتیب دی ہے۔ ایک اور کتاب بعنوان ’اصغر ویلوری کی غزلیہ شاعری‘ بھی منظر عام پر آچکی ہے۔ آپ کے دوست جناب فہیم احمد نے آپ کی ۱۱۴ منتخب رباعیات کا انگریزی میں خوبصورت ترجمہ بعنوان Nector of Thoughts سے کیا ہے۔

مجاہدِ اردو

سید ہدایت اللہ



ناشر

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**ORIGINAL RESEARCH PAPER**

**Microbiology**

**DETECTION, OPTIMIZATION AND CHARACTERIZATION OF BACTERIOCIN PRODUCED BY *LACTOBACILLUS FERMENTUM* A STRAIN ISOLATED FROM HOME MADE CURD- INDIAN TRADITIONAL FOOD**

**KEY WORDS:** Bacteriocin, optimization, production, *Lactobacillus fermentum*, traditional food.

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**ABSTRACT**

Lactic acid bacteria display numerous antimicrobial activities mainly due to the production of bacteriocins and antifungal peptides. Bacteriocins are known for anti-microbial properties against various pathogens. The aim of this work is to investigate the effect of growth conditions on the maximum production of bacteriocin by *Lactobacillus fermentum* isolated from home made curd. Bacteriocin produced by *Lactobacillus fermentum*, inhibited the growth of *Salmonella typhimurium*, *Escherichia coli*, *Staphylococcus aureus*, *Enterococcus faecalis* and *Proteus mirabilis*. The exponential phase of the growth was started at 4h from the time of incubation. The stationary phase begins at the 12h from the time of incubation. Maximum bacteriocin production of 12650 AU/mL with more biomass was obtained in presence of glucose. Yeast extract as sole nitrogen source, in MRS broth, stimulated bacteriocin production upto 2400 AU/mL. The maximum bacteriocin production of 12200 AU/mL was obtained with 2 % of NaCl. The optimum pH for bacterial growth and bacteriocin production was identified as pH 5. The highest bacteriocin activity of 7250 AU/ml and maximum growth of 1.90 was recorded at pH 5. Bacteriocin production was found to be highest at 40°C temperature (8100AU/ml). Optimization of bacteriocin production with the modification of environmental growth conditions will greatly benefit efficient commercial applications. The stability of the bacteriocin with respect to pH, temperature, enzyme sensitivity and organic solvents also studied.

**INTRODUCTION**

Recent explorations of the human gut microbiota suggest that perturbations of microbial communities may increase predisposition to different disease phenotypes. Dietary nutrients may be converted into metabolites by intestinal microbes that serve as biologically active molecules affecting regulatory functions in the host. Probiotics may restore the composition of the gut microbiome and introduce beneficial functions to gut microbial communities, resulting in prevention of gut inflammation and other intestinal diseases. Lactic acid bacteria (LAB) are known for the production of antimicrobial compounds, including bacteriocins or bacteriocin-like peptides. Bacteriocins of LAB are defined as ribosomally synthesized proteins usually antagonistic against pathogenic organisms. They are generally low molecular weight proteins that gain entry into target cells by binding to cell surface receptors. Their bactericidal mechanism varies and may include pore formation, degradation of cellular DNA, disruption through specific cleavage of 16S rDNA, and inhibition of peptidoglycan synthesis<sup>1</sup>.

Bacteriocin production does not always correlate with the increase in cell mass or growth rate of the producer strain<sup>2</sup>. Higher bacteriocin levels are often recorded in the absence of growth stimulating nutrients, or at temperatures and pH conditions lower than required for optimal growth<sup>3</sup>. Optimal bacteriocin production is often recorded in medium with limiting concentrations of sugars, nitrogen sources, vitamins and potassium-phosphate, or when the medium pH is regulated<sup>4</sup>. Bacteriocin production changes dramatically upon altering of environmental conditions and optimum production may require a specific combination of environmental parameters. Studies conducted on bacteriocins from other lactic acid bacteria, e.g. pediocin AcH<sup>5</sup>, pediocin PD-1<sup>6</sup>, enterocin 1146<sup>7</sup>, enterocin AS-48<sup>8</sup>, enterocin P<sup>9</sup>, sakP<sup>10</sup> and bacteriocins produced by *Leuconostoc mesenteroides* L124<sup>11</sup> have shown that production is often regulated by growth pH and temperature. In some cases, higher bacteriocin activity has been recorded at sub-optimal growth conditions<sup>12-15</sup>.

Because of the increasing demand for more natural and microbiologically safe food products, there is a need for biopreservation techniques. Bacteriocins have considerable

potential for food preservation, as well as for human therapy as potential supplements or replacements for currently used antibiotics. This study was focused on isolation, screening and characterization of bacteriocin producing *Lactobacillus fermentum* from curd and its inhibitory activity against pathogens with broad inhibition spectra and optimization of nutrients, medium pH and temperature on the activity levels of bacteriocin production and also stability of the bacteriocin under different conditions.

**MATERIALS AND METHODS**

**Isolation, Identification and Screening of bacteriocinogenic *Lactobacillus fermentum***

Curd samples were collected under aseptic conditions in sterile containers for the isolation of *Lactobacillus* strains on MRS agar at 37°C for 48 h. Colonies were taken from the MRS plates, sub cultured and maintained on MRS agar medium<sup>16</sup>.

The isolated *Lactobacillus* strains were identified based on colony morphology, cell morphology and biochemical tests described by Oyeleke and Manga<sup>17</sup>. Identification of the producer strain to species level was done by 16 S r RNA sequence analysis, then sequenced and compared the sequences in GenBank using BLAST, Basic Local Alignment Search Tool and was identified as *Lactobacillus fermentum*.

Culture of *Lactobacillus fermentum* was grown in MRS broth at 37°C for 48 h. After incubation, the bacterial cells were removed by centrifugation at 10,000 x g for 5 min at 4°C. The supernatant was adjusted to pH 6 with 1 N NaOH to eliminate inhibitory activity from acid. The supernatant was used as pretreated extract of *Lactobacillus fermentum* and stored at -20°C until analysis. The different target organisms used to demonstrate antimicrobial activity are *Escherichia coli*, *Enterococcus faecalis*, *Pseudomonas fluorescense*, *Pseudomonas auregenosa*, *Staphylococcus aureus*, *Salmonella typhimurium*, *Proteus mirabilis* and *Bacillus megaterium* and were grown at 37°C for 24 h in luria broth medium.

**Detection of Antimicrobial Activity and assay**

The antimicrobial activity of bacteriocin producing *Lactobacillus fermentum* was studied against enteric pathogens using the agar well diffusion method<sup>18</sup>. Indicator lawns were prepared by spreading 0.5 ml of each target strain

# EVOLUTION AND MOLECULAR EPIDEMIOLOGY OF THE PAPAYA RINGSPOT VIRUS IN THE CUCURBITACEAE FAMILY GROWN IN MULTIPLE LOCALES IN ANDHRA PRADESH, INDIA

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Original Research Article

## ABSTRACT

The present study aimed to understand the evolution and molecular epidemiology of *Papaya ringspot virus* (PRSV-W) in various regions of Andhra Pradesh, India. To screen PRSV-W suspected samples from different cucurbit orchards in different locations of Andhra Pradesh, we employed a Direct antigen coating enzyme linked immune sorbent test (DAC-ELISA) with polyclonal antibodies generated against PRSV. In Papaya ring spot virus was-w cultivated in pumpkin plants, characteristics such dilution endpoint, heat inactivation, and *in vitro* survival were evaluated. The virus was initially characterised using transmission electron microscopy (TEM) and full length coat protein (CP) amplification through Reverse transcription polymerase chain reaction (RT-PCR). To the best of our knowledge, this is the first study from the Andhra Pradesh region of India. The level of variability among PRSV-W isolates in Andhra Pradesh was shown by sequence analyses of PRSV-W isolates. The research also revealed that PRSV-W potentially infect a variety of different plants. The findings of this study show that PRSV has a wide host range, as well as its potential influence on economically significant crops and the development of PRSV resistant cucurbit cultivars.

**Keywords:** *Cucurbitaceae*; *Papaya ringspot virus*; Epidemiology; RT-PCR; TEM.

## INTRODUCTION

Cucurbits are one of the important economic crop plant species and it harbours most of the vegetables, we consume in our day to day life.

Microbial diseases, which bring down the yield of these plants, are a major hurdle to the farmers with great economic loss and the most commonly seen diseases in these plants are viral borne [1]. Almost thirty-two infectious viruses are known to infect



# Influence of Significant Parameters on Cellulase Production by Solid-State Fermentation

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Chapter

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## Abstract

Cellulases become an area of unique attention in bioremediation methods owing to their capability to breakdown cellulose. Development of cost-effective, high titer of attractive enzymes by fungi is a challenge. The overproduction of dynamic enzymes which cut various  $\beta$ -1,4-glycosidic bonds still wreck a challenge and is the key blockage for the cellulosic biomass transformation. Microbes are an eye-catching topic for production of cellulases because of their enormous prospective for production of cellulase, enzyme intricacy, and severe habitation variability. Microbial cellulolytic enzymes are ideal because of their immense advantages in number of industries. In fact, trend for cellulolytic enzymes is undeniably expanding for their use in bioremediation, pharmaceuticals, pulp and paper, waste management, food processing, and so on. Future research is ensuing into enhanced scientific information in addition to the achievement of summit of the rising demands of cellulase and associated enzymes for production of eco-friendly textiles, detergents, bio-pulping, and bio-alcohols. Furthermore, it is opening novel paths for exploitation of a variety of agricultural residues and pollutants as a basis of renewable energy in lieu of throwing away to cause environmental degradation. In years to come, newest knowledge of outstanding cellulolytic enzymes and acceptance of various biotechnological approaches will undoubtedly bring immense vision in the field of green chemistry. Hence, the present book chapter focused on fungal cellulases in bioremediation and factors affecting cellulases production by solid-state fermentation (SSF).



# Influence of Xenobiotics on Fungal Ligninolytic Enzymes

Bioenergy Research: Basic and Advanced Concepts pp 93-117 | Cite as

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Chapter

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## Abstract

White rot fungi (WRF) (belonging to the Basidiomycota family) are considered as the most efficient microorganisms to degrade lignin polymer through secretion of lignin-modifying enzymes such as oxidases (laccase) and peroxidases (lignin peroxidase and manganese peroxidase). Non-specific nature of these LMEs has a wide range of industrial and environmental applications including biodegradation and bioremediation of xenobiotics. Environmental pollution was generally caused by the extensive use of xenobiotics in the ecosystem. Massive studies on bioremediation of pollutants by bacteria and actinomycetes are highly noticed. It was recognized that very fewer research reports have existed on the influence of xenobiotics on the growth of highly environmentally adapted fungi as well as white rot fungi (WRF). Hence, the present book chapter mainly reveals the effect of xenobiotics on growth and secretion or production of LMEs by WRF and their participation in the bioremediation of xenobiotics. This chapter initially revealed the chemical nature of xenobiotics and their toxicity impact on WRF biomass. Furthermore the effect of pesticides such as malathion, lindane, and diuron on white rot fungal (*Pleurotus ostreatus*, *Phanerochaete chrysosporium*, *Ganoderma lucidum*) growth as well as secretion of ligninolytic enzymes and minimization of xenobiotics including PAHs and dyes by the WRF was clearly explained. This chapter provides information about how to reduce the harmful impact of xenobiotics in the environment by using LMEs and improve the applications of enzymatic technology.

## Keywords



# Cultivation of Microalgae: Effects of Nutrient Focus on Biofuels

Microbial Strategies for Techno-economic Biofuel Production pp 85-127 | Cite as

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## Abstract

Several microalgae have potential to produce biofuels, carotenoids, polyunsaturated fatty acids, peptides, and phytosterols. Microalgae are capable of producing biofuels competently as another potential alternate as feedstock and may help to generate extra revenue, when its cultivation is handled scientifically at large-scale. The growth medium components, which is a major part of their cultivation, play a key role to improve its cellular components and mass accumulation. The medium components are varied according to the nature of microalgae, i.e., heterotrophic, autotrophic, and their nature of availability. In this chapter, nutritional factors, suitable compositions of media used for various microalgae cultivation, photosynthesis process, micronutrients requirements, and bioreactors for microalgae are discussed. For enhanced production of biofuels and bioactive compounds, optimized environmental conditions and nutritional factors for effective cultivation of microalgae have been revealed.

## Keywords

Microalgae Photosynthesis Lipid production Cultivation

## Nomenclature



# Microalgae as an Efficient Feedstock Biomass for Biofuel Production

Microbial Strategies for Techno-economic Biofuel Production pp 129-169 | Cite as

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Chapter

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## Abstract

Solar, biomass, and wind are the main renewable energy resources to fulfill the need of modern society. Biofuels include bio-diesel, bio-methane, bio-ethanol, bio-methanol, bio-ethers, and bio-hydrogen. The nonfood feedstocks such as agricultural wastes, municipal wastes, microalgae, and other microbial sources are most suitable to produce biofuels. Microalgae cultivation for biofuel production can utilize the wastewater as substrate, reduces the greenhouse effect (sequestration of CO<sub>2</sub>), and also releases O<sub>2</sub>. By utilizing this technology, one can produce bio-ethanol, bio-methanol, biodiesel, and bio-hydrogen along with oxygen release. Microalgae contemplated as substrates for the generation of bio-diesel together with other sources of biomass, such as lignin-cellulose materials, organic wastes that are characterized by high yielding potential, are not utilized as a source of human food. Various steps involved in the bioprocessing of the valuable products and downstream processing techniques along with their merits and demerits have been revealed in this chapter.

## Keywords

Microalgae Lipid productivity Photobioreactors Circular economy



# Value Added Products from Agriculture, Paper and Food Waste: A Source of Bioenergy Production

Bioenergy Research: Commercial Opportunities & Challenges pp 91-126 | Cite as

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Chapter

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## Abstract

Solid waste generated from food mainly contains various organic compounds such as carbohydrates, lipids, and proteins. These biodegradable wastes mainly released from food, agricultural, household, and hospitality segments. The waste material produced from food is frequently burned or discarded into open areas, which may also become a source of many severe health and environmental problems. The management of waste material generated from food is done by transform into various value-added products, like phytochemicals, food supplements, bioactive materials, dietary fibers, safe to eat and important oils, biofertilizers, biofuels, and single-cell proteins (SCP). Every year, enormous amounts of solid waste (sludge) from the wastewater treatment of paper manufactures have been created. They might be dumped into the landfill if they have heavy metals lower than the standard of the Department of Industrial Work and the Ministry of Industry. Nowadays, the area of landfills is quite limited whereas solid waste has been accumulated. In the case of waste from agriculture biomass, a few of them are mixed with soil or applied as ingredients of the fertilizer. On the other hand, the value of the wastes is fairly low. Hence, the manufacture of value-added products, such as furniture cardboard, and packaging and the agricultural product from solid wastes could be useful. This chapter is mainly focused on the modification of the solid



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## Prophylactic Measures to be Taken by Oral Health Care Professionals During a Pandemic Outbreak of COVID-19

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### ABSTRACT

Many viruses have been posing threat to the world from time to time and recently in this category, a novel coronavirus called COVID-19 (SARS-CoV2) was detected in December 2019 and is causing havoc all over the world. COVID-19 spreading through person-to-person transmission routes including direct transmission, like cough, sneeze, droplet inhalation and contact transmission, like contact with oral, nasal and eye mucous membranes. The operators in oral health care profession expose to great risk of COVID-19 infection due to face-to-face communication and their exposure to fluids from the conjunctiva, oral cavity, nose and also other body fluids, and handling with the sharp instruments. Oral health care professionals (dentists and dental hygienists) play a prime role in preventing the spread of COVID-19. Several dental hospitals and clinics have been completely closed or have been providing minimal treatment for emergency cases. However, prophylactic and emergency treatments are being provided in some countries and a few supporting regular dental treatment. Oral health practitioners are prone to risk as they are hardly prepared for such unexpected global outbreak. Lack of universal protocol or guidelines to control the infection and dental care provision during such a pandemic condition could be of better help. The present study fills in the missing gap with necessary recommendations comprising of preventive steps for disease/infection transmission during dental practice to block the operator-to-patient and vice-versa transmission routes in dental clinics and hospitals.

**Key Words:** COVID-19, Coronavirus, Dental, Precautions, Lockdown, Awareness

### INTRODUCTION

Viruses have always been challenging to mankind with their dynamicity in structure, virulence, prevalence, transmission, and potentiality to claim lives. One among those recently discovered is the Novel Coronavirus 2019. In late December 2019, Wuhan City province of China suffered through a pneumonia outbreak, which kept spreading at an exponential rate to other parts of China and neighbouring countries. Even before it became clear about its aetiology and mode of transmission, it was reported in more than 25 other countries and WHO declared it as a Public Health

Emergency of International Concern on January 30, 2020.<sup>1</sup> Within no time, Covid-19 had spread around 18 countries in which four countries reported human-to-human transmission. On February 26, 2020, the first case of this disease was recorded in the United States, which was not imported from China. As of today, April 10, 2020, COVID-19 has affected around 210 countries and territories all over the globe including, two international conveyances namely, Diamond Princess Cruise harboured at Yokohama, Japan, and Holland America's MS Zaandam Cruise as retrieved from WHO coronavirus disease situation dashboard on April 11, 2020.<sup>2,3</sup>

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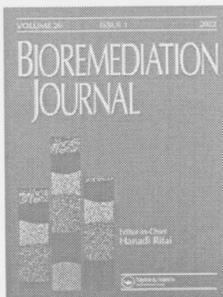
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## Effect of lignocellulosic materials and chlorpyrifos pesticide on secretion of ligninolytic enzymes by the white rot fungus – *Stereum ostrea*

B. S. Shanthi Kumari, Kanderi Dileep Kumar, Narasimha Golla, Suresh Babu Naidu Krishna, K. Sai Geetha, Satyanarayana Swamy Vyshnava & B. Rajasekhar Reddy

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# A rapid microwave-assisted synthesis of silver nanoparticles using *Ziziphus jujuba* Mill fruit extract and their catalytic and antimicrobial properties

- [Kondaiah Seku](#) ,
- [Syed Sulaiman Hussaini](#),
- [Babu Pejjai](#),
- [Maryam Murad Shamal Al Balushi](#),
- [Rajesh Dasari](#),
- [Narasimha Golla](#) &
- [G. Bhagavanth Reddy](#) 

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## Abstract

## Article

# Phytosynthetic Fabrication of Lanthanum Ion-Doped Nickel Oxide Nanoparticles Using *Sesbania grandiflora* Leaf Extract and Their Anti-Microbial Properties

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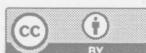
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**Abstract:** Over the past few years, the photogenic fabrication of metal oxide nanoparticles has attracted considerable attention, owing to the simple, eco-friendly, and non-toxic procedure. Herein, we fabricated NiO nanoparticles and altered their optical properties by doping with a rare earth element (lanthanum) using *Sesbania grandiflora* broth for antibacterial applications. The doping of lanthanum with NiO was systematically studied. The optical properties of the prepared nanomaterials were investigated through UV-Vis diffuse reflectance spectra (UV-DRS) analysis, and their structures were studied using X-ray diffraction analysis. The morphological features of the prepared nanomaterials were examined by scanning electron microscopy and transmission electron microscopy, their elemental structure was analyzed by energy-dispersive X-ray spectral analysis, and their oxidation states were analyzed by X-ray photoelectron spectroscopy. Furthermore, the antibacterial action of NiO and La-doped NiO nanoparticles was studied by the zone of inhibition method for Gram-negative and Gram-positive bacterial strains such as *Escherichia coli* and *Bacillus subtilis*. It was evident from the obtained results that the optimized compound NiOLa-04 performed better than the other prepared compounds. To the best of our knowledge, this is the first report on the phytosynthetic fabrication of rare-earth ion Lanthanum (La<sup>3+</sup>)-doped Nickel Oxide (NiO) nanoparticles and their anti-microbial studies.

**Keywords:** *Sesbania grandiflora* leaf extract; green synthesis; NiO nanoparticles; characterization; antibacterial activity

## 1. Introduction

Transition metal oxide nanoparticles (NPs), such as Cu<sub>2</sub>O, MnO<sub>2</sub>, NiO, TiO<sub>2</sub>, Co<sub>3</sub>O<sub>4</sub>, SnO<sub>2</sub>, and Fe<sub>2</sub>O<sub>3</sub>, are excellent candidates for use in electrocatalytic activity as they promote electron-transfer reactions and in medicinal applications. Among these, semiconductor



# Development of carbon-based nanocomposite biosensor platform for the simultaneous detection of catechol and hydroquinone in local tap water

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## ABSTRACT

The significant aspect of this work is to develop a nanocomposite biosensor based on the combination of Fe<sub>3</sub>O<sub>4</sub> nanoparticles (NPs)—multi-walled carbon nanotubes (MWCNTs) (Fe<sub>3</sub>O<sub>4</sub>-MWCNTs), tyrosinase (TYR), and silica sol-gel (SiSG). The obtained material was drop cast on the glassy carbon electrode (GCE) to attain a nanocomposite biosensor (SiSG-TYR/Fe<sub>3</sub>O<sub>4</sub>-MWCNTs/GCE). The surface morphology of Fe<sub>3</sub>O<sub>4</sub>-MWCNTs was characterized by FE-SEM, TEM, and EDS techniques. The analytical performance of the electrochemical biosensor was evaluated by using cyclic voltammetry (CV), differential pulse voltammetry (DPV), and electrochemical impedance spectroscopy (EIS). The SiSG-TYR/Fe<sub>3</sub>O<sub>4</sub>-MWCNTs/GCE was applied as an efficient biosensor for the simultaneous determination of catechol (CC) and hydroquinone (HQ). A good linear relationship was figured out between the peak currents and analyte concentrations from 1.5 to 30 μM and 1.5–40 μM for CC and HQ with detection limits down to the concentrations of 0.055 and 0.057 μM, respectively. Several kinetic parameters such as charge transfer coefficient, the heterogeneous rate constant, and the number of electrons involved were successfully calculated. The developed biosensor exhibited satisfactory repeatability, reproducibility, good stability, and anti-interference performance. The proposed biosensor was efficiently used for the detection of CC and HQ in spiked local tap water with satisfactory results.

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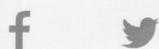
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# Microalgae Potential Feedstock for the Production of Biohydrogen and Bioactive Compounds

Microbial Strategies for Techno-economic Biofuel Production pp 171-206 | Cite as

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Chapter

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## Abstract

Urbanization and industrialization increase the energy demand, and fossil fuels are depleting drastically due to energy consumption by industrial and domestic purposes. There is a need to increase the production of energy by sustainable renewable sources. Marine microalgae are potential sources of biofuels and feedstock for the production of other bioactive compounds. Microalgae can be easily cultured in photobioreactors for the production of several types of biofuels. This chapter describes about the production of biohydrogen through photolysis followed by dark fermentation. Several types of photobioreactors used in the production of biohydrogen, suitability of microalgae as feedstock, and other microorganism used in the dark fermentation are discussed. The end product of biohydrogen after combustion is only water vapor; hence, there is no air pollution. Because of this nature of hydrogen gas, much attention has been paid by several researchers for the production of biohydrogen. Several bioactive compounds produced by microalgae, possibility of scale up, and industrialization have been revealed. Various parameters involved in the process,



## Cost Effective Technologies for Solid Waste and Wastewater Treatment

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### Chapter 3 - Bioremediation approach for treatment of soil contaminated with radiocesium

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#### Abstract

Radioactive cesium contamination of the environment due to nuclear weapons testing, nuclear reactor accidents, and past waste disposal practices at nuclear facilities is a major concern. Much attention is given to <sup>137</sup>Cs because of its  $\gamma$ -radiation, long half-life, and solubility in water. Cs contamination of the soils at Chernobyl and Fukushima was mainly confined to the topsoil layer. Several remediation methods such as physical (soil excavation), chemical extraction, and bioremediation using plants and microorganisms have been proposed. To date, no cost-effective techniques for cleaning the soils contaminated with cesium have been found. Microorganisms play a key role in the transformations of toxic metals and radionuclides in contaminated soils and wastes. In this chapter, we review the potential bioremediation of Cs contamination using microorganisms such as bacteria, fungi, mycorrhizae, and algae and microbial by-products.

Previous

Next

#### Keywords

Radiocesium; Soil contamination; Remediation; Microorganisms; Bacteria; Fungi; Algae

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# Synthesis of *Frankincense* gum stabilized AgNPs by microwave irradiation and their catalytic, antioxidant, and antibacterial properties

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## ARTICLE INFO

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Antibacterial activity

## ABSTRACT

Herein, report the microwave irradiation synthesis of AgNPs using *frankincense* gum (FR) and their antioxidant, catalytic and antibacterial activities. The developed synthetic route for the synthesis of AgNPs is simple, eco-friendly, and economically viable. UV-visible, FTIR, powder XRD, DLS, and TEM techniques have been used for the characterization of synthesized FR@AgNPs. FTIR data demonstrated that the C=O and -OH functional groups of *frankincense* gum were playing an essential role in the reduction and stabilization process of the synthesized FR@AgNPs. TEM and powder XRD measurements were confirmed that FR stabilized FR@AgNPs were well dispersed, spherical, and high crystallinity with a size of  $7 \pm 2$  nm. In the presence of NaBH<sub>4</sub>, the catalytic potential of FR@AgNPs was verified for the reduction of Methyl Orange (MO), Rhodamine-B (Rh-B), and Methyl Red (MR) dyes. AgNPs exhibited significant catalytic efficacy for the degradation of MO, Rh-B, and MR dyes. The AgNPs have shown good antibacterial activity against the *Bacillus subtilis*, *Bacillus series*, *Escherichia coli*, and *Pseudomonas aeruginosa*. The DPPH radical scavenging mechanism was used to test the antioxidant potential of FR@AgNPs at various concentrations.

## 1. Introduction

The Omani *Frankincense* gum (FR) (Arabic: Luban) also called Olibanum is a natural gum obtained from the tree of genus *Boswellia*. There are several species of this genus found in many parts of West Asia, North Africa, and India like *Boswellia sacra*, *B. serrata*, *B. carteri*, *B. thuiifera*, *B. bhaw-dajiana*, etc. The species native to Oman is *Boswellia sacra* [1]. The Dhofar region of Oman produces the highest grade of frankincense from *B. sacra*, known as *Hojari*. In the Sultanate of Oman, FR is used as a traditional folk medicine, as well as incense to ward off the demons of disease and pain. During recent times, several studies are being carried out to validate their medicinal and pharmacological applications [2–4]. The medicinal applications of gum extract have been established through various clinical trials, *in vitro* assays, and animal studies, for the treatment of inflammatory bowel disease, asthma, rheumatoid arthritis, and osteoarthritis [5–7]. The European Medicine Agency has given the status of ‘Orphan Drug’ to gum extract of *B. serrata* for the treatment of peritumoral brain edema [8]. Kathpalia et al. reported [9] improved

therapeutic response of marketed nano emmigel of *B. serrata*, a topical product for in vivo anti-inflammatory and analgesic activity. The antioxidant, immunomodulatory, and anticancer activity of frankincense has been investigated [10–12].

Nanotechnology and nanoscience have emerged as a new discipline revolutionizing the use of metal nanoparticles in diverse fields ranging from mechanical to biomedical [13,14]. The green synthesis of nanoparticles has improved the application of nanoparticles in medicine due to their non-toxicity and improved efficacy as compared to physical and chemical methods [15]. The medicinal plants provide an easy source of phytochemicals for the preparation of biogenic nanoparticles. The resulting nanoparticles capped with the phytochemicals result in remarkably new therapeutic applications as compared to the phytochemicals themselves [16,17].

The emerging prospects of biogenic nanoparticles clubbed with the renewed interest of researchers for the therapeutic [10,18] and pharmacological [19] applications of *Boswellia* species motivated us to undertake the preparation and characterization of biogenic nanoparticles

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**Archives of Virology**  
**OBITUARY Pothur Sreenivasulu (1950-2020)**  
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<b>Abstract:</b>	Plant virology lost an outstanding scientist and a teacher with the passing away of Prof. Pothur Sreenivasulu (from now referred to as Sreenivasulu) on 19 <sup>th</sup> August 2020 in Bangalore, India. We lost a mentor and a most trustworthy friend. Sreenivasulu was known for his pioneering contributions to the characterization of viruses infecting groundnut (peanut), sugarcane, sorghum, rice, banana, pigeonpea and aroid plants; developing tools for their diagnosis based on molecular and serological properties; and establishment of the Virology Department at Sri Venkateswara University (SVU), Tirupati, India. The first three co-authors of this contribution were his students.

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## **OBITUARY**

### **Pothur Sreenivasulu (1950-2020)**

Plant virology lost an outstanding scientist and a teacher with the passing away of Prof. Pothur Sreenivasulu (from now referred to as Sreenivasulu) on 19<sup>th</sup> August 2020 in Bangalore, India. We lost a mentor and a most trustworthy friend. Sreenivasulu was known for his pioneering contributions to the characterization of viruses infecting groundnut (peanut), sugarcane, sorghum, rice, banana, pigeonpea and aroid plants; developing tools for their diagnosis based on molecular and serological properties; and establishment of the Virology Department at Sri Venkateswara University (SVU), Tirupati, India. The first three co-authors of this contribution were his students.

Sreenivasulu was born on 1<sup>st</sup> June 1950. He was a brilliant student throughout his college education, as evidenced by the highest ranks he obtained. He was awarded Konri Venkatagiri and Srimathi Ganjam Venkata Ramanaiiah memorial prizes for obtaining the first rank in his M.Sc. degree (1971-73). He earned a Ph.D degree in plant virology in 1978 from SVU.

Sreenivasulu had spent his entire career at the SVU. He was appointed as a lecturer in the Department of Botany in 1979. Subsequently, sustained efforts by him and Prof. M.V. Nayudu resulted in the establishment of the Department of Virology, first of its kind in India, in 1987. Sreenivasulu became Head of the Department of Virology in 1990. He was the founding coordinator for M.Sc. courses in Biotechnology (1995-96) and Microbiology (2000-05) at SVU. He held such important positions at SVU as Chairman of the Board of Studies of Virology Department, Vice-Principal and Principal of the College of Biological and Earth Sciences. Sreenivasulu was mainly responsible for bringing international recognition to the Virology Department. During his tenure as Principal, he introduced many academic refinements for the welfare of students as well as faculty. He was invited by International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) to participate in all the international meetings connected with virus research. He was one of the main resource persons selected to participate in technology transfer courses organized by ICRISAT. The laboratory manuals prepared by him for the short-term training courses funded by the University Grants Commission (India) and the Department of

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4 Biotechnology (India) are well received by the plant virologists from all over India. Sreenivasulu  
5 spent eighteen months as a Visiting Scientist (1987-88) in Dr. J.W. Demski's laboratory at the  
6 University of Georgia (UG) in Griffin, GA, USA.  
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11 His notable achievements were identification of peanut bud necrosis virus as a distinct  
12 tospovirus; assessment of economic importance and distribution of peanut stripe potyvirus; and  
13 characterization of numerous viruses infecting economically important crops that include rice  
14 tungro virus complex, peanut green mosaic potyvirus, peanut chlorotic leaf streak caulimovirus,  
15 sugarcane streak mosaic poacevirus, cucumber mosaic cucumovirus, cowpea mild mottle  
16 carlavirus, maize stripe tenuivirus, banana bract mosaic potyvirus, pigeonpea sterility mosaic  
17 emaravirus, and nucleorhabdovirus associated with stripe and mosaic diseases of sorghum. He was  
18 instrumental in developing cost-effective and reliable techniques for virus detection and  
19 transferring the technologies to numerous researchers in India. Indeed, his research laid the  
20 foundation for subsequent characterization of economically important groundnut viruses by  
21 scientists at ICRISAT. Sreenivasulu's research findings and the diagnostic tools he developed  
22 facilitated numerous scientists to conduct surveys for viruses, to understand their epidemiology,  
23 and opened opportunities to devise management strategies for viral diseases. The facilities offered  
24 at SVU were not adequate. To accomplish his goals Sreenivasulu had established very fruitful  
25 collaborations with ICRISAT, Indian Institute of Sciences (IISc) in Bangalore, Maharashtra  
26 Hybrid Seed Company in Jalna, University of Delhi-South Campus, and advanced virus  
27 laboratories in USA, UK, and Belgium.  
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44 Sreenivasulu had supervised numerous post-graduate and Ph.D students. The guidance he  
45 provided and the opportunities he gave to investigate challenging problems helped his students to  
46 establish very successful careers in India and abroad. He was held in high esteem by renowned  
47 scientists that include Drs. J.W. Demski (UG), C.W. Kuhn (UG), M.V. Nayudu (SVU), H. S.  
48 Savithri (IISc), and G. Padmanabhan (IISc). Sreenivasulu was a modest, kind-hearted, and very  
49 fair person. His impeccable integrity and commitment to strive for excellence is second to none.  
50 Sreenivasulu published over 120 research articles in many reputed journals, contributed to book  
51 chapters, and to a textbook "Plant Viruses" written by Prof. M. V. Nayudu, published by Tata  
52 McGraw Hill in 2006. In fact, he is a ROLE MODEL and showed clearly how hard work,  
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4 commitment and integrity can lead to the establishment of a successful career for scientists  
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6 working in developing countries.  
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10 Sreenivasulu is survived by his wife Hyma Devi, a daughter Hima Bindu, a son Kodanda  
11 Pani, and four grandchildren. His entire family ably supported him in his career. As in the case of  
12 all FOUR of us, all Sreenivasulu's students, colleagues, and collaborators have fond memories of  
13 their time spent with him.  
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19 Hema Masarapu<sup>1\*</sup>

20 P. Lava Kumar<sup>2</sup>

21 Satyanarayana Tatineni<sup>3</sup>

22 D.V.R. Reddy<sup>4</sup>  
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# dsRNA Molecules From the *Tobacco Mosaic Virus* p126 Gene Counteract TMV-Induced Proteome Changes at an Early Stage of Infection

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Exogenous application of double-stranded RNA (dsRNA) in the tobacco–*Tobacco mosaic virus* (TMV) pathosystem was shown previously to induce resistance against TMV providing an alternative approach to transgenesis. In the present study, we employed proteomics technology to elucidate the effect of TMV on tobacco as well as the effect of exogenous application of TMV p126 dsRNA molecules (dsRNAp126) at an early stage of the tobacco–TMV interaction. The proteome of tobacco leaf at 15 min post inoculation (mpi) in the presence or absence of dsRNAp126 molecules was studied. Thirty-six tobacco proteins were differentially accumulated in TMV-infected vs. healthy tobacco leaf tissue. The identified main differential TMV-responsive proteins were found to be involved in photosynthesis, energy metabolism, stress, and defense responses. Most of the virus-induced changes in the tobacco leaf proteome were not observed in the leaves treated with dsRNAp126 + TMV. The results indicated that the protein changes induced by TMV infection were counteracted by the exogenous application of dsRNAp126 molecules. Moreover, using small RNA sequencing, we showed that the exogenously applied dsRNAp126 was efficiently processed in tobacco as early as 15 min post application (mpa) to produce small interfering RNAs (siRNAs); the dicing pattern was not affected by the presence of TMV. The presence of dsRNAp126 reduced TMV p126 RNA abundance suggesting virus titer reduction *via* a sequence-specific mechanism, since a non-homologous dsRNA did not protect from TMV infection nor affect TMV accumulation.

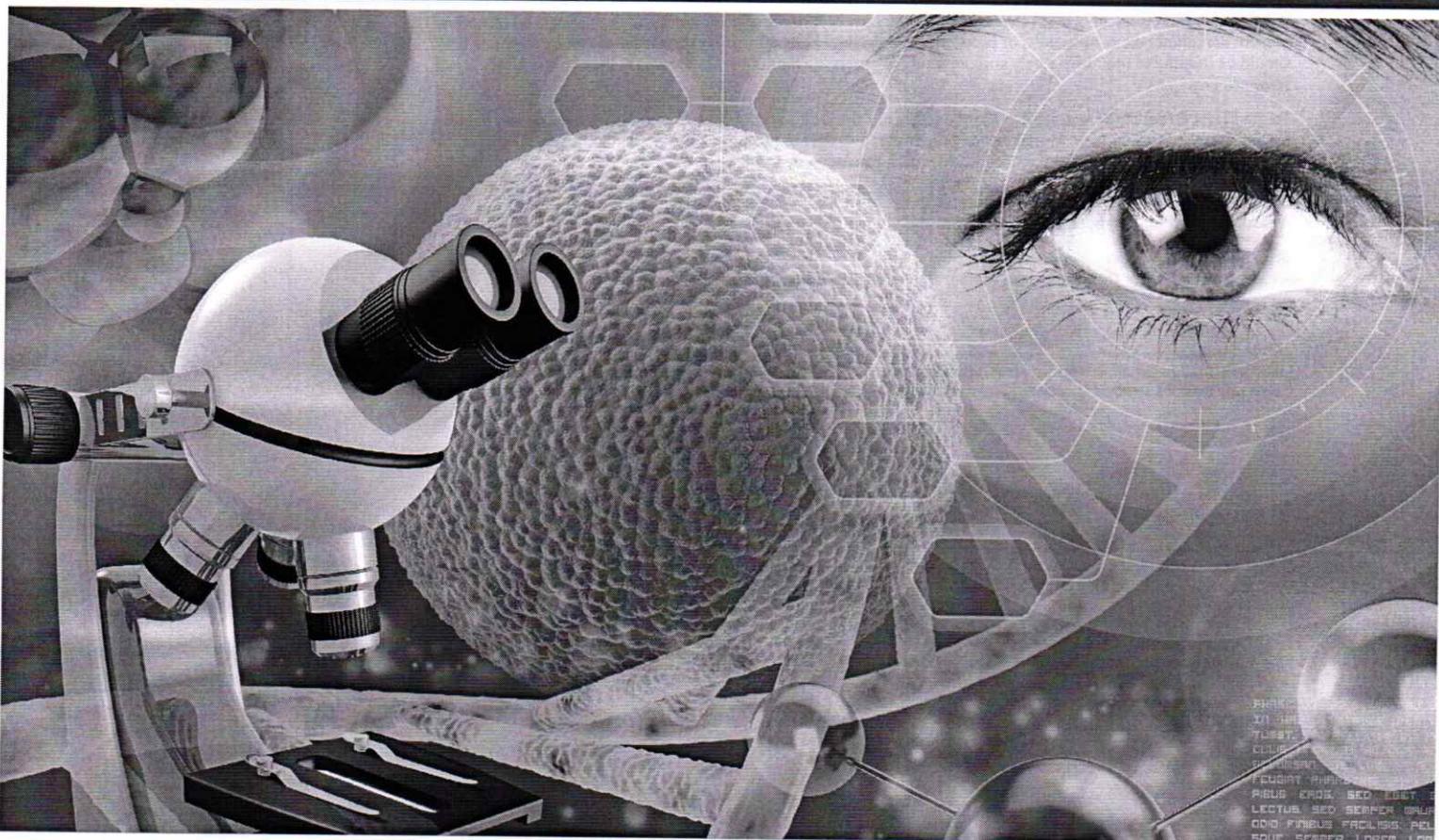
**Keywords:** double-stranded RNA, plant proteomics, RNA interference, silencing suppressor, *Tobacco mosaic virus*, tobacco

## INTRODUCTION

RNA interference (RNAi) plays an important role in plant defense against subcellular pathogens including viruses (Padmanabhan et al., 2009; Wang M. B. et al., 2012). Double-stranded RNA (dsRNA) and stem-loop RNAs are the crucial players in RNAi initiation (Meister and Tuschl, 2004; Brodersen and Voinnet, 2006). The dsRNA-specific nucleases, known as DICER-like proteins

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## Chapter 16

# Recent developments in detection and diagnosis of plant viruses

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### 1 Introduction

Plant viruses cause serious economic losses to several agricultural and horticultural crops around the world. The losses caused by plant viruses are estimated to be more than several billion dollars per year worldwide and are therefore a major threat to global crop production and food security (Hull, 2002; Jones and Naidu, 2019). Plant viruses depend on the cellular machinery and resources of their host plant cells to reproduce, thereby resulting in alteration of normal physiological functions of the plant, which leads to stunted growth, inferior quality, and reduced yield of the plant products (Gergerich and Dolja, 2006). Globalization of agricultural trade and adverse climatic changes facilitated increased movement of the viruses and their vectors through human beings, seed, and other propagative materials. Unlike other plant pathogens, there are no direct methods available to control plant viruses, and current management practices are based on indirect measures such as eradicating the sources of infection (rouging of infected plants, elimination of alternative hosts and vectors), managing cultural practices, and vector control using virus-free planting material, production of virus-resistant plants, and quarantine practices ( Jones and Naidu, 2019). Detection is the process of identifying the presence of the virus, and diagnosis is the distinctive characterization in terms of a species, genus, and family. Plant virus infections are often unmanaged or managed incorrectly due to the difficulties in diagnosis. Hence, rapid detection and diagnostic tools are required to limit the spread of the virus diseases to other plants and minimize crop losses. Diagnostic procedures are also of greater importance to check germplasm at quarantine centers to ensure its safe movement across the countries and for production of healthy plant material (Hesketh et al., 2019). Biological, physical, serological, and molecular properties of the viruses are used to develop various methods for the detection and diagnosis of plant virus diseases (see Table 1).

Conventional diagnostic methods based on biological and physical properties of virus such as symptomatology, bioassay on indicator plants, vector relations, and virusparticle morphology by electron microscopy are cumbersome, time-consuming, and expensive. The recognition of a disease based on the symptoms expressed by virus-affected plants remains the primary diagnostic approach in many cases. But it is often confusing because symptom expression is variable and depends on the stage of infection, plant age, co-infection with other pathogens, and environmental conditions. In addition, plants (especially *in vitro* plantlets) can have asymptomatic infections at certain stages ( Jeong et al., 2014; Abd El-Aziz, 2019; Lava Kumar et al., 2019). Therefore, several sensitive and effective technologies/methods have been developed during the last four decades based on virus protein (e.g., immunosorbent electron microscopy [ISEM], enzyme-linked immunosorbent assay [ELISA]) and nucleic acid (e.g., nucleic acid hybridization, isothermal and thermostable PCRs) for plant virus detection, each with its own advantages and disadvantages (reviewed in Martin et al., 2000; Naidu and Hughes, 2001; Boonham et al., 2014; Fang and Ramasamy, 2015; Yadav and Khurana, 2016; Biswas et al., 2016; Jeong et al., 2014; Pallás et al., 2018; Rajamanickam et al., 2019). Among the several protein-based techniques, ELISA has revolutionized plant pathogen diagnosis with its improved sensitivity and specificity, which is especially useful for testing a large number of samples (Clark and Adams, 1977; Torrance and Jones, 1981), but it is constrained by limited availability of antibodies. The use of ELISA has been well-documented and proved for the detection of several plant viruses in plant material, insect vectors, seeds, and vegetative propagules (covered in Naidu and Hughes, 2001; Jeong et al., 2014; Boonham et al., 2014; Abd El-Aziz, 2019).

Nucleic acid-based techniques are found to be very sensitive, accurate, and effective when compared with serological methods for plant virus detection, especially for

## Pothur Sreenivasulu (1950–2020): a humble virologist who made eminent contributions to virology discipline in India

Hema Masarapu<sup>1</sup> · P. Lava Kumar<sup>2</sup>  · Satyanarayana Tatineni<sup>3</sup> · D. V. R. Reddy<sup>4,5</sup>

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Plant virology lost an outstanding scientist and an eminent teacher with the sudden demise of Prof. Pothur Sreenivasulu (hereafter, Sreenivasulu) on 19th August 2020 in Bangalore. We lost a mentor and a most trustworthy friend. He was known for his pioneering contributions to the characterization of viruses infecting groundnut, sugarcane, sorghum, rice, banana, pigeonpea, vegetable and aroid crop

plants in India, and development of diagnostic tools for their detection based on serological and nucleic acid properties. As a co-founder, he made immense contributions to the Department of Virology's growth at Sri Venkateswara University (SVU), Tirupati, Andhra Pradesh, India. Several of his students have become renowned scientists around the world. The first three co-authors of this contribution were his students, and the last author was his mentor for postdoctoral research.

Sreenivasulu was born in Thagguparthi village in Anantapur District, Andhra Pradesh, on 1st June 1950. He was awarded Konri Venkatagiri and Srimathi Ganjam Venkata Ramanaiah memorial prizes for obtaining the first rank in his M.Sc. degree, indicating his brilliance and interest in higher education. He earned a Ph.D. degree in plant virology in 1978 from SVU under the guidance of Prof. M. V. Nayudu. He was a recipient of the Council of Scientific and Industrial Research (CSIR), New Delhi Junior-, Senior and Postdoctoral Research fellowships (JRF/SRF/PDF).

Sreenivasulu had spent his entire career at the SVU. He was appointed as a lecturer in the Department of Botany in 1979. Subsequently, sustained efforts by him and Prof. M. V. Nayudu resulted in the establishment of the Virology department with University Grants Commission (UGC) recognition to offer M.Sc. and Ph.D. programs at SVU in 1987, first of its kind in India. Prof. Sreenivasulu made significant contributions to the design of the virology course curriculum on par with international standards. It was the first and only department in SVU to offer an interdisciplinary post-graduate (PG) program in a semester system during that time.

Sreenivasulu became a Reader and, in 1994, became a Professor of Virology. He became Head of the Department of Virology (1990–1992; 1994–2005); and served as Chair

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D. V. R. Reddy: Former Principal Virologist.

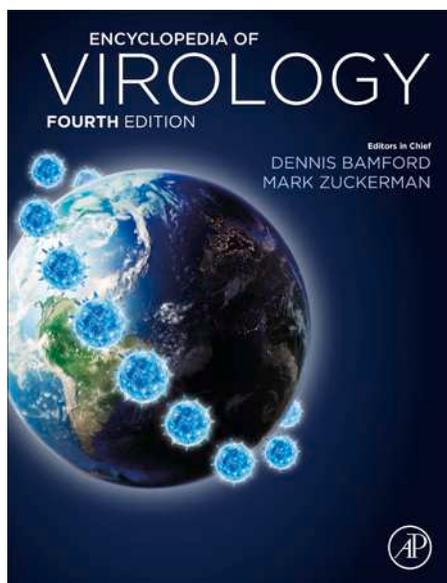
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## Pecluviruses (*Virgaviridae*)

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### Nomenclature

**aa** Amino acid(s)

**AGO** Argonaute 1

**CITE** Cap-independent translation enhancer

**Co-Pro** Protease-cofactor

**CP** Coat protein or capsid protein

**CRP** Cysteine-rich protein

**ELISA** Enzyme-linked immunosorbent assay

**ER** Endoplasmic reticulum

**HC-Pro** Helper component-proteinase

**IRES** Internal ribosome entry site

**kb** Kilobase

**kDa** Kilodalton

**LAMP** Loop-mediated isothermal amplification

**mAbs** monoclonal antibodies

**MP** Movement protein

**NCR** Noncoding regions

**nt** Nucleotide(s)

**OAS** Origin of assembly

**ORF** Open reading frame

**pAbs** Polyclonal antibodies

**PCR** Polymerase chain reaction

**RdRp** RNA-dependent RNA polymerase

**RISC** RNA-induced silencing complex

**RT-qPCR** Reverse transcription quantitative PCR

**satRNA** satellite RNA

**UTR** Untranslated region

**VIGS** Virus-induced gene silencing

**VLPs** Virus-like particles

**VPg** Viral protein genome-linked

**VRC** Virus replication complex

**vRNA** virion RNA

### Glossary

**Forma specialis** An informal rank in a classification, allowed by the International Code of Nomenclature for Algae, Fungi, and Plants, that is applied to a parasite (most frequently a fungus), which is characterized from a physiological standpoint (e.g., by the ability to infect a specific host), but scarcely or not at all from a morphological standpoint.

**Fortuitous hosts of obligate biotrophic**

**Plasmodiophorida** Host on which some primary infections evolve into resting spores without going through the zoosporangial stage.

**Hetero-encapsidation** Partial or full coating of the genome of one virus with the coat protein of a differing

virus. Also termed trans-capsidation or heterologous encapsidation.

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**Archives of Virology**  
**OBITUARY Pothur Sreenivasulu (1950-2020)**  
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<b>Abstract:</b>	Plant virology lost an outstanding scientist and a teacher with the passing away of Prof. Pothur Sreenivasulu (from now referred to as Sreenivasulu) on 19 <sup>th</sup> August 2020 in Bangalore, India. We lost a mentor and a most trustworthy friend. Sreenivasulu was known for his pioneering contributions to the characterization of viruses infecting groundnut (peanut), sugarcane, sorghum, rice, banana, pigeonpea and aroid plants; developing tools for their diagnosis based on molecular and serological properties; and establishment of the Virology Department at Sri Venkateswara University (SVU), Tirupati, India. The first three co-authors of this contribution were his students.

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## OBITUARY

### Pothur Sreenivasulu (1950-2020)

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Sreenivasulu was born on 1<sup>st</sup> June 1950. He was a brilliant student throughout his college education, as evidenced by the highest ranks he obtained. He was awarded Konri Venkatagiri and Srimathi Ganjam Venkata Ramanaiah memorial prizes for obtaining the first rank in his M.Sc. degree (1971-73). He earned a Ph.D degree in plant virology in 1978 from SVU.

Sreenivasulu had spent his entire career at the SVU. He was appointed as a lecturer in the Department of Botany in 1979. Subsequently, sustained efforts by him and Prof. M.V. Nayudu resulted in the establishment of the Department of Virology, first of its kind in India, in 1987. Sreenivasulu became Head of the Department of Virology in 1990. He was the founding coordinator for M.Sc. courses in Biotechnology (1995-96) and Microbiology (2000-05) at SVU. He held such important positions at SVU as Chairman of the Board of Studies of Virology Department, Vice-Principal and Principal of the College of Biological and Earth Sciences. Sreenivasulu was mainly responsible for bringing international recognition to the Virology Department. During his tenure as Principal, he introduced many academic refinements for the welfare of students as well as faculty. He was invited by International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) to participate in all the international meetings connected with virus research. He was one of the main resource persons selected to participate in technology transfer courses organized by ICRISAT. The laboratory manuals prepared by him for the short-term training courses funded by the University Grants Commission (India) and the Department of





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## The unique potency of Cowpea mosaic virus (CPMV) *in situ* cancer vaccine†

Sourabh Shukla<sup>a</sup>, Chao Wang<sup>‡,a</sup>, Veronique Beiss<sup>a</sup>, Hui Cai<sup>a</sup>, Torus Washington II<sup>a</sup>, Abner A. Murray<sup>b</sup>, Xingjian Gong<sup>c</sup>, Zhongchao Zhao<sup>d</sup>, Hema Masarapu<sup>e</sup>, Adam Zlotnick<sup>d</sup>, Steven Fiering<sup>f</sup>, Nicole F. Steinmetz<sup>a,g,h,i,j</sup>

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### Abstract

The immunosuppressive tumor microenvironment enables cancer to resist immunotherapies. We have established that intratumoral administration of plant-derived Cowpea mosaic virus (CPMV) nanoparticles as an *in situ* vaccine overcomes the local immunosuppression and stimulates a potent anti-tumor response in several mouse cancer models and canine patients. CPMV does not infect mammalian cells but acts as a danger signal that leads to the recruitment and activation of innate

† Electronic supplementary information (ESI) available. See DOI: [10.1039/d0bm01219j](https://doi.org/10.1039/d0bm01219j)

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Author contributions

SS designed and carried out particle engineering, characterizations, *in vitro* cellular assays, VNPs/VLPs – ID8 ovarian cancer studies in mice, analyzed the data, prepared figures and developed the manuscript; CW carried out *ex vivo* flow cytometry studies, QB-CT26 tumor model studies; VB prepared CPMV/eCPMV particles, performed HBVc-B16F10 studies; HC performed CCMV-B16F10 studies; TW and XG contributed to VOPBA assays; AM contributed mice studies; ZZ engineered HBVc particles; HM designed and provided PhMV plasmid and prepared SeMV particles; AZ designed and engineered HBVc particles; SF provided consultation on immunological analyses; NFS conceptualized the study, designed experiments, analyzed the data, developed and prepared the manuscript. All authors reviewed and edited the manuscript.

‡ Current address: MD Anderson Cancer Center, Houston, TX 77030, USA.

Conflicts of interest

Drs Fiering and Steinmetz are co-founders of and have a financial interest in Mosaic ImmunoEngineering Inc. The other authors declare no potential conflict of interest.



# dsRNA Molecules From the Tobacco Mosaic Virus p126 Gene Counteract TMV-Induced Proteome Changes at an Early Stage of Infection

Naga Charan Konakalla<sup>1,2,3</sup>, Mukesh Nitin<sup>1,4</sup>, Athanasios Kaldis<sup>1</sup>, Hema Masarapu<sup>2</sup>, Sebastien Carpentier<sup>3,5\*</sup> and Andreas Voloudakis<sup>1\*</sup>

<sup>1</sup> Laboratory of Plant Breeding and Biometry, Agricultural University of Athens, Athens, Greece, <sup>2</sup> Department of Virology, Sri Venkateswara University, Tirupati, India, <sup>3</sup> Department of Biosystems, KU Leuven, Leuven, Belgium, <sup>4</sup> School of Life Sciences, Jawaharlal Nehru University, New Delhi, India, <sup>5</sup> SYBIOMA: Facility for Systems Biology Based Mass Spectrometry, Leuven, Belgium

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Exogenous application of double-stranded RNA (dsRNA) in the tobacco–*Tobacco mosaic virus* (TMV) pathosystem was shown previously to induce resistance against TMV providing an alternative approach to transgenesis. In the present study, we employed proteomics technology to elucidate the effect of TMV on tobacco as well as the effect of exogenous application of TMV p126 dsRNA molecules (dsRNAp126) at an early stage of the tobacco–TMV interaction. The proteome of tobacco leaf at 15 min post inoculation (mpi) in the presence or absence of dsRNAp126 molecules was studied. Thirty-six tobacco proteins were differentially accumulated in TMV-infected vs. healthy tobacco leaf tissue. The identified main differential TMV-responsive proteins were found to be involved in photosynthesis, energy metabolism, stress, and defense responses. Most of the virus-induced changes in the tobacco leaf proteome were not observed in the leaves treated with dsRNAp126 + TMV. The results indicated that the protein changes induced by TMV infection were counteracted by the exogenous application of dsRNAp126 molecules. Moreover, using small RNA sequencing, we showed that the exogenously applied dsRNAp126 was efficiently processed in tobacco as early as 15 min post application (mpa) to produce small interfering RNAs (siRNAs); the dicing pattern was not affected by the presence of TMV. The presence of dsRNAp126 reduced TMV p126 RNA abundance suggesting virus titer reduction *via* a sequence-specific mechanism, since a non-homologous dsRNA did not protect from TMV infection nor affect TMV accumulation.

**Keywords:** double-stranded RNA, plant proteomics, RNA interference, silencing suppressor, *Tobacco mosaic virus*, tobacco

## INTRODUCTION

RNA interference (RNAi) plays an important role in plant defense against subcellular pathogens including viruses (Padmanabhan et al., 2009; Wang M. B. et al., 2012). Double-stranded RNA (dsRNA) and stem-loop RNAs are the crucial players in RNAi initiation (Meister and Tuschl, 2004; Brodersen and Voinnet, 2006). The dsRNA-specific nucleases, known as DICER-like proteins

## Pothur Sreenivasulu (1950–2020): a humble virologist who made eminent contributions to virology discipline in India

Hema Masarapu<sup>1</sup> · P. Lava Kumar<sup>2</sup>  · Satyanarayana Tatineni<sup>3</sup> · D. V. R. Reddy<sup>4,5</sup>

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Plant virology lost an outstanding scientist and an eminent teacher with the sudden demise of Prof. Pothur Sreenivasulu (hereafter, Sreenivasulu) on 19th August 2020 in Bangalore. We lost a mentor and a most trustworthy friend. He was known for his pioneering contributions to the characterization of viruses infecting groundnut, sugarcane, sorghum, rice, banana, pigeonpea, vegetable and aroid crop

plants in India, and development of diagnostic tools for their detection based on serological and nucleic acid properties. As a co-founder, he made immense contributions to the Department of Virology's growth at Sri Venkateswara University (SVU), Tirupati, Andhra Pradesh, India. Several of his students have become renowned scientists around the world. The first three co-authors of this contribution were his students, and the last author was his mentor for postdoctoral research.

Sreenivasulu was born in Thagguparthi village in Anantapur District, Andhra Pradesh, on 1st June 1950. He was awarded Konri Venkatagiri and Srimathi Ganjam Venkata Ramanaiah memorial prizes for obtaining the first rank in his M.Sc. degree, indicating his brilliance and interest in higher education. He earned a Ph.D. degree in plant virology in 1978 from SVU under the guidance of Prof. M. V. Nayudu. He was a recipient of the Council of Scientific and Industrial Research (CSIR), New Delhi Junior-, Senior and Postdoctoral Research fellowships (JRF/SRF/PDF).

Sreenivasulu had spent his entire career at the SVU. He was appointed as a lecturer in the Department of Botany in 1979. Subsequently, sustained efforts by him and Prof. M. V. Nayudu resulted in the establishment of the Virology department with University Grants Commission (UGC) recognition to offer M.Sc. and Ph.D. programs at SVU in 1987, first of its kind in India. Prof. Sreenivasulu made significant contributions to the design of the virology course curriculum on par with international standards. It was the first and only department in SVU to offer an interdisciplinary post-graduate (PG) program in a semester system during that time.

Sreenivasulu became a Reader and, in 1994, became a Professor of Virology. He became Head of the Department of Virology (1990–1992; 1994–2005); and served as Chair

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D. V. R. Reddy: Former Principal Virologist.

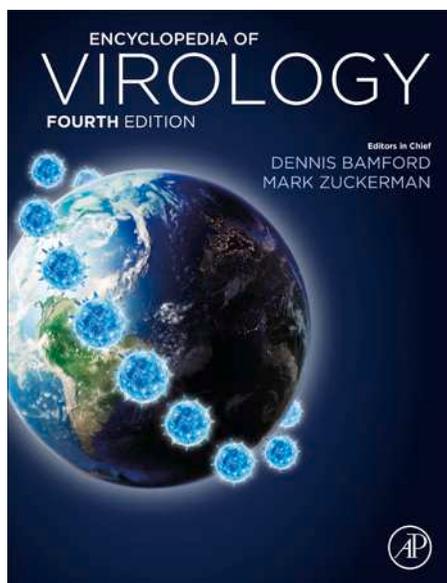
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## Pecluviruses (*Virgaviridae*)

**Hema Masarapu and Pothur Sreenivasulu**, Sri Venkateswara University, Tirupati, India

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### Nomenclature

**aa** Amino acid(s)

**AGO** Argonaute 1

**CITE** Cap-independent translation enhancer

**Co-Pro** Protease-cofactor

**CP** Coat protein or capsid protein

**CRP** Cysteine-rich protein

**ELISA** Enzyme-linked immunosorbent assay

**ER** Endoplasmic reticulum

**HC-Pro** Helper component-proteinase

**IRES** Internal ribosome entry site

**kb** Kilobase

**kDa** Kilodalton

**LAMP** Loop-mediated isothermal amplification

**mAbs** monoclonal antibodies

**MP** Movement protein

**NCR** Noncoding regions

**nt** Nucleotide(s)

**OAS** Origin of assembly

**ORF** Open reading frame

**pAbs** Polyclonal antibodies

**PCR** Polymerase chain reaction

**RdRp** RNA-dependent RNA polymerase

**RISC** RNA-induced silencing complex

**RT-qPCR** Reverse transcription quantitative PCR

**satRNA** satellite RNA

**UTR** Untranslated region

**VIGS** Virus-induced gene silencing

**VLPs** Virus-like particles

**VPg** Viral protein genome-linked

**VRC** Virus replication complex

**vRNA** virion RNA

### Glossary

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## The unique potency of Cowpea mosaic virus (CPMV) *in situ* cancer vaccine†

Sourabh Shukla<sup>a</sup>, Chao Wang<sup>‡,a</sup>, Veronique Beiss<sup>a</sup>, Hui Cai<sup>a</sup>, Torus Washington II<sup>a</sup>, Abner A. Murray<sup>b</sup>, Xingjian Gong<sup>c</sup>, Zhongchao Zhao<sup>d</sup>, Hema Masarapu<sup>e</sup>, Adam Zlotnick<sup>d</sup>, Steven Fiering<sup>f</sup>, Nicole F. Steinmetz<sup>a,g,h,i,j</sup>

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### Abstract

The immunosuppressive tumor microenvironment enables cancer to resist immunotherapies. We have established that intratumoral administration of plant-derived Cowpea mosaic virus (CPMV) nanoparticles as an *in situ* vaccine overcomes the local immunosuppression and stimulates a potent anti-tumor response in several mouse cancer models and canine patients. CPMV does not infect mammalian cells but acts as a danger signal that leads to the recruitment and activation of innate

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Author contributions

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‡ Current address: MD Anderson Cancer Center, Houston, TX 77030, USA.

Conflicts of interest

Drs Fiering and Steinmetz are co-founders of and have a financial interest in Mosaic ImmunoEngineering Inc. The other authors declare no potential conflict of interest.



# Development of carbon-based nanocomposite biosensor platform for the simultaneous detection of catechol and hydroquinone in local tap water

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## ABSTRACT

The significant aspect of this work is to develop a nanocomposite biosensor based on the combination of Fe<sub>3</sub>O<sub>4</sub> nanoparticles (NPs)—multi-walled carbon nanotubes (MWCNTs) (Fe<sub>3</sub>O<sub>4</sub>-MWCNTs), tyrosinase (TYR), and silica sol-gel (SiSG). The obtained material was drop cast on the glassy carbon electrode (GCE) to attain a nanocomposite biosensor (SiSG-TYR/Fe<sub>3</sub>O<sub>4</sub>-MWCNTs/GCE). The surface morphology of Fe<sub>3</sub>O<sub>4</sub>-MWCNTs was characterized by FE-SEM, TEM, and EDS techniques. The analytical performance of the electrochemical biosensor was evaluated by using cyclic voltammetry (CV), differential pulse voltammetry (DPV), and electrochemical impedance spectroscopy (EIS). The SiSG-TYR/Fe<sub>3</sub>O<sub>4</sub>-MWCNTs/GCE was applied as an efficient biosensor for the simultaneous determination of catechol (CC) and hydroquinone (HQ). A good linear relationship was figured out between the peak currents and analyte concentrations from 1.5 to 30 μM and 1.5–40 μM for CC and HQ with detection limits down to the concentrations of 0.055 and 0.057 μM, respectively. Several kinetic parameters such as charge transfer coefficient, the heterogeneous rate constant, and the number of electrons involved were successfully calculated. The developed biosensor exhibited satisfactory repeatability, reproducibility, good stability, and anti-interference performance. The proposed biosensor was efficiently used for the detection of CC and HQ in spiked local tap water with satisfactory results.

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Materials Letters

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Featured Letter

# Microwave-assisted synthesis of palladium nanoparticles using *Frankincense* resin and evaluation of their catalytic properties

Kondaiah Seku <sup>a</sup>, Syed Sulaiman Hussaini <sup>a</sup>, Narasimha Golla <sup>b</sup>, Girija Mangatayaru K <sup>c</sup>, Sri Maha Vishnu D <sup>d</sup>, Sridhar Rapolu <sup>e</sup>, Rajkumar Bandi <sup>f</sup>, Bhagavanth Reddy G <sup>c</sup>  [Show more](#) [Outline](#) | [Share](#)  [Cite](#) <https://doi.org/10.1016/j.matlet.2020.128427>[Get rights and content](#)

Highlights

FEEDBACK 

## Article

# Phytosynthetic Fabrication of Lanthanum Ion-Doped Nickel Oxide Nanoparticles Using *Sesbania grandiflora* Leaf Extract and Their Anti-Microbial Properties

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**Abstract:** Over the past few years, the photogenic fabrication of metal oxide nanoparticles has attracted considerable attention, owing to the simple, eco-friendly, and non-toxic procedure. Herein, we fabricated NiO nanoparticles and altered their optical properties by doping with a rare earth element (lanthanum) using *Sesbania grandiflora* broth for antibacterial applications. The doping of lanthanum with NiO was systematically studied. The optical properties of the prepared nanomaterials were investigated through UV-Vis diffuse reflectance spectra (UV-DRS) analysis, and their structures were studied using X-ray diffraction analysis. The morphological features of the prepared nanomaterials were examined by scanning electron microscopy and transmission electron microscopy, their elemental structure was analyzed by energy-dispersive X-ray spectral analysis, and their oxidation states were analyzed by X-ray photoelectron spectroscopy. Furthermore, the antibacterial action of NiO and La-doped NiO nanoparticles was studied by the zone of inhibition method for Gram-negative and Gram-positive bacterial strains such as *Escherichia coli* and *Bacillus subtilis*. It was evident from the obtained results that the optimized compound NiOLa-04 performed better than the other prepared compounds. To the best of our knowledge, this is the first report on the phytosynthetic fabrication of rare-earth ion Lanthanum (La<sup>3+</sup>)-doped Nickel Oxide (NiO) nanoparticles and their anti-microbial studies.

**Keywords:** *Sesbania grandiflora* leaf extract; green synthesis; NiO nanoparticles; characterization; antibacterial activity

## 1. Introduction

Transition metal oxide nanoparticles (NPs), such as Cu<sub>2</sub>O, MnO<sub>2</sub>, NiO, TiO<sub>2</sub>, Co<sub>3</sub>O<sub>4</sub>, SnO<sub>2</sub>, and Fe<sub>2</sub>O<sub>3</sub>, are excellent candidates for use in electrocatalytic activity as they promote electron-transfer reactions and in medicinal applications. Among these, semiconductor



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# Prophylactic Measures to be Taken by Oral Health Care Professionals During a Pandemic Outbreak of COVID-19

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## ABSTRACT

Many viruses have been posing threat to the world from time to time and recently in this category, a novel coronavirus called COVID-19 (SARS-CoV2) was detected in December 2019 and is causing havoc all over the world. COVID-19 spreading through person-to-person transmission routes including direct transmission, like cough, sneeze, droplet inhalation and contact transmission, like contact with oral, nasal and eye mucous membranes. The operators in oral health care profession expose to great risk of COVID-19 infection due to face-to-face communication and their exposure to fluids from the conjunctiva, oral cavity, nose and also other body fluids, and handling with the sharp instruments. Oral health care professionals (dentists and dental hygienists) play a prime role in preventing the spread of COVID-19. Several dental hospitals and clinics have been completely closed or have been providing minimal treatment for emergency cases. However, prophylactic and emergency treatments are being provided in some countries and a few supporting regular dental treatment. Oral health practitioners are prone to risk as they are hardly prepared for such unexpected global outbreak. Lack of universal protocol or guidelines to control the infection and dental care provision during such a pandemic condition could be of better help. The present study fills in the missing gap with necessary recommendations comprising of preventive steps for disease/infection transmission during dental practice to block the operator-to-patient and vice-versa transmission routes in dental clinics and hospitals.

**Key Words:** COVID-19, Coronavirus, Dental, Precautions, Lockdown, Awareness

## INTRODUCTION

Viruses have always been challenging to mankind with their dynamicity in structure, virulence, prevalence, transmission, and potentiality to claim lives. One among those recently discovered is the Novel Coronavirus 2019. In late December 2019, Wuhan City province of China suffered through a pneumonia outbreak, which kept spreading at an exponential rate to other parts of China and neighbouring countries. Even before it became clear about its aetiology and mode of transmission, it was reported in more than 25 other countries and WHO declared it as a Public Health

Emergency of International Concern on January 30, 2020.<sup>1</sup> Within no time, Covid-19 had spread around 18 countries in which four countries reported human-to-human transmission. On February 26, 2020, the first case of this disease was recorded in the United States, which was not imported from China. As of today, April 10, 2020, COVID-19 has affected around 210 countries and territories all over the globe including, two international conveyances namely, Diamond Princess Cruise harboured at Yokohama, Japan, and Holland America's MS Zaandam Cruise as retrieved from WHO coronavirus disease situation dashboard on April 11, 2020.<sup>2,3</sup>

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Research Article

# Green synthesis of silver nanoparticles using flower extracts of *Aerva lanata* and their biomedical applications

Sashikiran Palithya , Susmila Aparna Gaddam , Venkata Subbaiah Kotakadi ,  
Josthna Penchalani , Narasimha Golla , Suresh Babu Naidu Krishna  & ...show all

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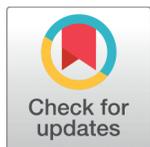
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## Abstract

In the present study, green synthesis of silver nanoparticles (AgNPs) was performed using flower extracts of *Aerva lanata* (Al) from Amaranthaceae family. The size, shape, and elemental composition of the silver nanoparticles (AgNPs) was studied using transmission electron microscopy (TEM), scanning electron microscopy (SEM), energy dispersive X-ray analysis (EDX), and UV-visible spectroscopy. The dynamic

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# Structural, Optical and Antibacterial Properties of neodymium ( $\text{Nd}^{3+}$ ) doped nickel oxide (NiO) Nanoparticles using *Sesbania grandiflora* Leaf Extract

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## Abstract

**Objectives:** To study the eco-friendly green synthesis of neodymium doped nickel oxide nanoparticles and to study their structural, optical and antibacterial activities. **Method:** *Sesbania grandiflora* herb has been used to synthesize NiO nanoparticles. With the materials present in the plant extract, such as sugar, flavonoid, protein, enzyme, polymer, and organic acid, acting as the reducing agent the green approach takes charge in bio induction of metal ions into nanoparticles. Structural and Optical Properties of nanoparticles were studied by following XRD, SEM, EDAX, FTIR and UV-Vis-NIR (DRS). The antibacterial activity of the resultant neodymium ( $\text{Nd}^{3+}$ ) doped nickel oxide (NiO) was tested on Gram negative and Gram positive bacteria with suitable standard. **Findings:** From the XRD analysis, it is revealed that the size of the particles is in the order of 9.2 to 23.06 nm. JCPDS data confirmed that  $\text{Nd}^{3+}$  ion-doped NiO nanoparticles exhibit phases of (111), (200), (220), and (311). SEM with EDAX proved that existence of  $\text{Nd}^{3+}$  ion-doped NiO nanoparticles. Cubical and spherical shapes of the nanoclusters having a size of 20-40 nm are shown by SEM analysis. Most promising peaks at  $420\text{ cm}^{-1}$  and  $657\text{ cm}^{-1}$  associated to Ni-O vibration bond and Ni-O-H stretching bond were analyzed from FTIR graph of the sample before annealing while for the sample at  $500^\circ\text{C}$  shows the Ni-O vibration bond at  $411\text{ cm}^{-1}$ . The direct band gap of  $\text{Nd}^{3+}$  ion-doped NiO nanoparticles calculated as 3.08 eV at the concentration of NiONdO<sub>3</sub> mol%. By doping with  $\text{Nd}^{3+}$  ion, energy gap increases with doping concentration proved by UV-DRS spectroscopy that confirms Quantum confinement. The eco-friendly synthesized nanoparticles exhibited good antibacterial activity against pathogenic bacterial strain is an indication of antibacterial efficiency of nanoparticles. **Novelty:** Eco-friendly synthesis of NiO nanoparticles and characterization and doped nanoparticles exhibited good antibacterial activity.

**Keywords:** Green synthesis; NiO particles; Characterization; Cubical; spherical shapes; Direct band gap semiconductors; NIR laser; Antibacterial activities

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## Isolation and Screening of Marine Actinobacteria for their Antimicrobial Compounds

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**Abstract:**

**Objective:** The objective of this study is to assess the antimicrobial activity of marine actinobacter Pradesh, India. **Materials and Methods:** Using sterile techniques, soil samples were collected from Ma Pradesh, India. Biochemical tests were performed to identify isolated actinobacteria. Antimicrobi performed by the disk plate technique. **Results:** In this study, six mangrove soil samples were cc methods to obtain marine actinobacteria. A total of five actinobacteria were isolated in which two e activity. Among the five, MCP-2 isolate had shown promising antibacterial and antifungal activity. **Co** revealed that the coastal marine actinobacteria are an important source of novel antibiotics

**Keywords:** Actinobacterial screening (</articles?f%5Bkeyword%5D=1895>), Antibacterial ([/articles?f%5Bkeyword%5D=1896](/articles?f%5E (/articles?f%5Bkeyword%5D=1896)), Machilipatnam (</articles?f%5Bkeyword%5D=1897>), mangrove so novel isolates (</articles?f%5Bkeyword%5D=1899>)

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# A rapid microwave-assisted synthesis of silver nanoparticles using *Ziziphus jujuba* Mill fruit extract and their catalytic and antimicrobial properties

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## Abstract

An eco-friendly and sustainable approach was developed for the synthesis of silver nanoparticles (AgNPs) of *Ziziphus jujuba* Mill (*ZJM*) fruit extract by a microwave-assisted technique. The developed method was simple, economically viable, sustainable, and eco-friendly. Concentrations of  $\text{AgNO}_3$  and *ZJM* fruit extract and reaction time were optimized for the final properties of synthesized AgNPs. The prepared AgNPs were characterized by UV-visible and FTIR spectrophotometers, powder XRD, TEM, and DLS. XRD results showed a face-centered cubic structure for the prepared AgNPs. The obtained size of AgNPs was  $8 \pm 1$  nm with spherical shape. The FTIR spectrum indicates that *ZJM* is a good capping agent to stabilize AgNPs. A negative zeta potentials value of  $-21.2$  mV indicates the stability of AgNPs. The AgNPs has good stability over a wide range of pH and ionic strength. The role and efficacy of AgNPs in the catalytic degradation of methylene blue (MB) and Congo red (CR) dye were studied, and the reduction reaction rate constants were found to be  $0.033 \text{ s}^{-1}$  (180 s) and  $0.025 \text{ s}^{-1}$  (200 s) respectively. The synthesized AgNPs showed rapid and excellent catalytic reduction of MB and CR dyes. The rapid catalytic reduction reactions followed pseudo-order kinetics. The *ZJM* fruit extract-capped AgNPs showed good antimicrobial activity against tested bacterial and fungal cultures.

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## Nickel tolerance and biosorption potential of rhizobia associated with horse gram [*Macrotyloma uniflorum* (Lam.) Verdc.]

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### ABSTRACT

The rhizobia isolated from root nodules of horse gram were screened for nickel (Ni) tolerance *in vitro*. The strain HGR-4 could tolerate 1000 µg g<sup>-1</sup> of Ni. It was also observed that horse gram plants associated with HGR-4 have shown Ni stress tolerance in Ni amended soils up to a concentration of 100 µg g<sup>-1</sup>. In another experiment, the plants associated with HGR-4 have shown higher nodulation, nitrogen level, and leghaemoglobin content at 80 µg g<sup>-1</sup> of Ni than control plants without HGR-4 inoculation. Analysis of biosorption potential of Ni in horse gram plants inoculated by the strain HGR-4 was done using atomic absorption spectroscopy revealed maximum biosorption in bacterial root nodules. Besides, there was a reduction in the content of the heavy metal in the soil samples which demonstrates a fair amount of heavy metal extraction and accumulation of Ni by rhizobia associated root nodules of the horse gram. This study demonstrates that the strain HGR-4 (GQ483457 *Rhizobium* sp. ATCC BAA-2335) could be a potential source for phytoextraction of Ni contaminated soils upon its association with horse gram. The study could be of use in phytoremediation of metal (Ni) contaminated soils in the future.

### KEYWORDS

Biosorption; metal tolerance; nickel; phytoremediation; rhizobium

**Novelty statement:** The phytoremediation of nickel (Ni) using of rhizobia associated with horse gram remains unevaluated till now. Horse gram associated with rhizobia could produce nodules and fix nitrogen even in Ni amended soils. The biosorption potential of the rhizobial strains was analyzed from both root nodules and soil. These findings imply that horse gram plants associated with these rhizobial strains could be used to remediate Ni metal in contaminated soils.

### Introduction

Contamination of soils by metals is widespread due to human, agricultural, and industrial activities (Beladi *et al.* 2011). These activities result in the accumulation of traces of metals in agricultural soils which pose a threat for food safety and public health (Dary *et al.* 2010). This accumulation of metals leads to soil fertility loss since the composition of microbial flora and microbial activities are affected severely (Krujatz *et al.* 2012). Some metals, though essential in micro-quantities for organisms are harmful in excess. Heavy metal pollution is one of the most dramatic threats to the environment and living organisms (Wo-Niak and Basiak 2003).

Among all the environmental pollutants, nickel (Ni) is one of the ubiquitous trace metals emitted in the environment through both natural and anthropogenic activities. Anthropogenic activities further accelerate Ni release into the soil through various sources like burning of fossil fuels for power generation, mining, smelting, emissions from vehicles, disposal of household, municipal and industrial waste, steel manufacturing, and cement industry (Salt *et al.*

2000). Ni is used as a raw material in the metallurgical and electroplating industries. It is also used as a catalyst in the chemical and food industry and as a spare in electrical batteries (Salt *et al.* 2000; Orlov *et al.* 2002).

Release of Ni into the environment is of great concern, including its deposition in agricultural soils (Salt *et al.* 2000; Jamil *et al.* 2014). Nickel is among the ubiquitously distributed heavy metals in soil and water constituting about 0.08% of the earth crust (Kupper and Kroneck 2007). Nickel toxicity is a severe concern to agriculture, ecosystem, and human health (Pandey and Singh 2011). Nickel is one among essential micronutrients (Brown *et al.* 1987). It is associated with some metallo-enzymes that are necessary for various plants processes (Giridhara and Siddaramappa 2002). The harmful effects of excess Ni in plants have become a significant problem, menacing sustainable agro-ecosystem. Impact of Ni toxicity on plant's physiological and metabolic activities is influenced by plant species, age and growth conditions, Ni concentration, and exposure time in the soil (Yusuf *et al.* 2011). Ni interferes with other

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## Bio-inspired multifunctional zinc oxide nanoparticles by leaf extract of *Andrographis serpilifolia* and their enhanced antioxidant, antimicrobial, and antidiabetic activity—a 3-in-1 system

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### ABSTRACT

In this research article, we present a simple and rapid method for synthesis of zinc oxide nanoparticles (ZnONPs) using zinc acetate dehydrate, sodium hydroxide and leaf extract of an important anti-diabetic plant *Andrographis serpilifolia* (As). The results reveal that UV-visible absorption spectrum indicates peaks at 325 nm which confirms the biosynthesis of ZnONPs. Fourier transform infrared spectroscopy (FT-IR) results indicate the characteristic peak at  $511.93\text{ cm}^{-1}$  for ZnO nanoparticles. EDX analysis revealed the purity of As-ZnONPs and the particle size was between 70 nm and  $80 \pm 10$  nm by both dynamic light scattering analysis (DLS) and Transmission electron microscopy (TEM) analysis. The As-ZnONPs were moderately stable with negative zeta potential value  $-11.1\text{ mV}$ . Atomic force microscopy (AFM) analysis also revealed the same results as TEM and DLS. The x-ray diffraction (XRD) data revealed that the particles are facets of face-centered cubic crystal structure of ZnO. The As-ZnONPs have exhibited potential antioxidant activity and effective antibacterial activity against gram-positive bacteria. The As-ZnONPs have also potential anti-diabetic activity *in vivo* (rat model). The anti-diabetic activity of As-ZnONPs comparable to that of the standard drug glibendamide was evidenced by various biochemical parameters like HbA1C, serum lipid profiles, liver and renal functional markers.

### KEYWORDS

Zinc oxide nanoparticles (ZnONPs); spectral characterization; antioxidant; antibacterial; antidiabetic activity

## 1. Introduction

Rapid modernization led to uncontrolled urbanization causing various diseases such as diabetics, obesity, etc. Diabetes mellitus has become one of the world's most onerous diseases of the healthcare system. World Health Organization (WHO) and scientists globally agreed to halt the rise of diabetes and obesity by 2025 (World Health Organization 2020). Most complications of diabetes include chronic foot ulcers leading to amputation, diabetic retinopathy, nephropathy, and neuropathy. Presently, the number of diabetics is expected to grow to 562 million by the end of the year 2035 out of which 85% are expecting to be type 2 diabetics (International Diabetes Federation 2015). Hence it is highly essential to find out alternative drugs apart from pharmacological drugs. Zinc is the major component in maintaining the structure and function of insulin. It is already known that beta-cells consist of high levels of zinc, around 70%, in insulin secretory granules (ISG). The Zinc transporter ZnT8 plays an important and active role in the synthesis of insulin (Nicolson et al. 2009; Roohani et al. 2013). Several researchers studied the relationship between Zinc levels and diabetes mellitus

complications. In view of various studies on the role of zinc in diabetes, scientists have carried out research on zinc-related drugs in the treatment of diabetes with cynicism because of the importance of zinc in pancreatic function and diabetes (Scott and Fisher 1938). Zinc, through oral supplementation, does not show any improvement in diabetes prevention and treatment. Hence, the scientists investigated alternative methods of Zinc supplementation, currently using nanotechnology as the best possibility. Umrani and Paknikar in 2014 have claimed the first medicine against diabetes based on Zinc Oxide nanoparticles, the results of their study were promising and zinc oxide nanoparticles (ZnONPs) proved to be safe even at higher concentrations. (Umrani and Paknikar 2014). It is well-known that ZnO has a wide range of applications in various areas due to its large surface area, diverse physical & chemical properties. ZnO has a wideband energy gap of 3.37 eV at room temperature, due to which ZnO has been widely used in catalytic reactions. ZnO consists of various desirable properties such as catalysts, sensors, photoelectron devices, and ZnO nanomaterials also have novel electronic, structural, and thermal properties (Wang 2004; Huang et al. 2006; Kooti and Naghdi Sedeh 2013). Ever since the progress

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A  
G

P. B. Kavi Kishor  
Manchikatla Venkat Rajam  
T. Pullaiah *Editors*

# Genetically Modified Crops

Current Status, Prospects and  
Challenges Volume 2





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## GM Crops for Plant Virus Resistance: A Review

A. M. Anthony Johnson, D. V. R. Sai Gopal, and Chinta Sudhakar

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### Abstract

Plant viruses have been a major threat to the agricultural productivity in tropics and sub-tropics compared to the other pathogens such as bacteria and fungi. Researchers have been striving hard to develop methods of plant virus resistance in various ways. Conventional practices such as border crops, cross protection have a very limited ability to control the epidemics at the field level. Hence the production of GM crops conferring resistance to various plant viruses has become a most important research objective. With the advent of techniques of genetic engineering, there has been a revolutionary enhancement in the production of GM crops resistant to various plant viruses through various strategies. Pathogen-derived resistance (PDR) have been widely employed for the production of GM crops resistant to plant viruses. PDR deals with the expression of various plant viral proteins such as coat protein, movement protein, and replicase, which act as decoys preventing the virus invasion. The other techniques of PDR include antisense RNA, RNA interference (RNAi)-mediated gene silencing, artificial microRNA (amiRNA) targeting, etc. The techniques involved in pathogen-targeted resistance (PTR) involve the use of the newly evolved strategies such as use of zinc finger nucleases (ZFNs), transcription activator-like effector nucleases (TALENs), clustered regularly interspaced short palindromic repeats CRISPR/Cas9 or CRISPR/Cas13 for targeting the mutation or cleavage of viral DNA and RNA genomes, thereby conferring resistance to various plant viruses. In the present chapter, we made an attempt to journey through these strategies and their applications for the production of virus resistant genetically modified (GM) crops.

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OPEN

# Pathophysiology of high fat diet induced obesity: impact of probiotic banana juice on obesity associated complications and hepatosteatosis

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The high fat diet alters intestinal microbiota due to increased intestinal permeability and susceptibility to microbial antigens leads to metabolic endotoxemia. But probiotic juices reported for various health benefits. In this background we hypothesized that pectinase treated probiotic banana juice has diverse effects on HFD induced obesity and non-alcoholic steatohepatitis. 20 weeks fed HFD successfully induced obesity and its associated complications in experimental rats. The supplementation of probiotic banana juice for 5 months at a dose of 5 mL/kg bw/day resulted significant decrease ( $p < 0.05$ ) in body weight ( $380 \pm 0.34$ ), total fat ( $72 \pm 0.8$ ), fat percentage ( $17 \pm 0.07$ ) and fat free mass ( $165 \pm 0.02$ ). Reduction ( $p < 0.05$ ) in insulin resistance ( $5.20 \pm 0.03$ ), lipid profile (TC  $120 \pm 0.05$ ; TG  $160 \pm 0.24$ ; HDL  $38 \pm 0.03$ ), liver lipid peroxidation ( $0.7 \pm 0.01$ ), hepatic enzyme markers (AST  $82 \pm 0.06$ ; ALT  $78 \pm 0.34$ ; ALP  $42 \pm 0.22$ ), and hepatic steatosis by increasing liver antioxidant potential (CAT  $1.4 \pm 0.30$ ; GSH  $1.04 \pm 0.04$ ; SOD  $0.82 \pm 0.22$ ) with normal hepatic triglycerides ( $15 \pm 0.02$ ) and glycogen ( $0.022 \pm 0.15$ ) contents and also showed normal liver size, less accumulation of lipid droplets with only a few congestion. It is concluded that the increased intestinal *S. cerevisiae* yeast can switch anti-obesity, antidiabetic, antioxidative stress, antioxidant and anti-hepatosteatosis effect. This study results will have significant implications for treatment of NAFLD.

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## Ethno-pharmacological insulin signaling induction of aqueous extract of *Syzygium paniculatum* fruits in a high-fat diet induced hepatic insulin resistance

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*Syzygium paniculatum*

### ABSTRACT

**Ethnopharmacological relevance:** The ethnopharmacological significance of the fruits of *Syzygium paniculatum* Goertia (Magenta Cherry) is widely recognized in the Indian traditional medicine system to treat various disorders, such as diabetes, hyperlipidemia, hypertension, and cardiovascular problems.

**Aim of the study:** This research work investigated the supplementation of the aqueous extract of *S. paniculatum* fruit (AESPF) on liver function; the molecular effects on the expression of the protein of insulin receptor (IR) and insulin receptor substrate 1 (IRS-1) in high-fat diet-induced hepatic insulin resistance in the rat model.

**Materials and methods:** High-fat diet was used to induce obesity in albino Wistar for 120 days. Biochemical, enzymatic, and histopathological analysis, as well as analysis of hepatic insulin resistance proteins and expression of IRS-1, were performed.

**Results:** The supplementation of AESPF with a dose of 100 mg/kg bw significantly reduced bodyweight, blood sugar, insulin, lipid profiles, and liver enzymes. Hepatic insulin resistance was improved with a reduced level of IR and IRS-1 to protein levels. HFD alters the sensitivity of hepatocytes to insulin due to the down-regulation of insulin receptor proteins.

**Conclusion:** The fruits of *S. paniculatum* possess biological activities to alleviate all risky effects by regulating hepatic lipogenesis activity that can be used in the progress of medication for HFD-induced hepatic insulin resistance and metabolic disorders.

### 1. Introduction

The modern lifestyle accompanied by inadequate nutritional habits has resulted in several health-related problems; obesity is one of the most concerned. Nutritional diets that include excessive calorie content produce the accumulation of triglycerides in body tissue, including the

liver (Ding et al., 2014). Fat accumulation leading to obesity results in altered cellular and physiological functions (Kakimoto et al., 2016). Insulin resistance has also become a concern in the recent past, as it emerges as a common clinical problem worldwide. Insulin resistance is a situation in which insulin cannot facilitate glucose absorption and subsequent metabolism between hepatocytes, skeletal muscle, and

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# Research Journal of Pharmaceutical, Biological and Chemical Sciences

## *In-vitro* Antioxidant Capacity And Membrane Protection By Leaf Aqueous Extract of *Piper betle* L.

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### ABSTRACT

Antioxidants are natural or man-made substances that can prevent cell damage. Vitamin C, Vitamin E, Vitamin K, quercetin, kaempferol, catechin-gallate, catechin, hydroxybenzoic acids, hydroxycinnamic acids, and carotenoids are some of the crucial antioxidants, which help in preventing diseases. The present study is aimed to evaluate the antioxidant and membrane protection ability of leaf aqueous extract (LAE) of leaves of *Piper betle* L. Initially, LAE was prepared from shade dried leaves by employing maceration process for 5 to 7 days. Later, antioxidant activity assays were performed to measure the percent-scavenging efficacy of LAE. In this view, ABTS radical scavenging activity of LAE revealed that at a concentration of 40  $\mu\text{M}$ , LAE possessed maximum ABTS radical scavenging activity with an IC-50 of 12.2  $\mu\text{M}$ . In addition, ferric reducing capacity LAE has been performed using potassium ferricyanide and different concentrations of LAE, and demonstrated that LAE is showing potent ferric reducing ability with an IC-50 of 13.9  $\mu\text{M}$ . Similarly, HO scavenging activity and DPPH radical scavenging activity were performed in the presence and absence of LAE. It has shown that IC-50 of LAE for HO scavenging activity and DPPH radical scavenging activity are 14.7  $\mu\text{M}$  and 14.3  $\mu\text{M}$  respectively. Furthermore, effect of LAE on lipid peroxidation was assessed using oxidized LDL and concluded that LAE is showing significant inhibition of lipid peroxides when compared to that of control group. Together, all these findings can conclude that LAE is showing potent antioxidant activity and also showing significant inhibition of lipid peroxides in vitro.

**Keywords:** *Piper betle*, Antioxidant activity, lipid peroxides, LDL.

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# 2-Amino-3-cyano-4H-chromene-4-ylphosphonates as potential antiviral agents: Synthesis, in ovo and in silico approach

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## Abstract

A simplistic synthetic procedure for the synthesis of structurally diversified 2-amino-3-cyano-4H-chromene-4-ylphosphonates (**4a-j**) were developed by the treatment of substituted salicylaldehydes, malononitrile, and dialkyl phosphite in presence of Cu(OAc)<sub>2</sub> catalyst at room temperature and neat conditions. The synthesized compounds were tested for their antiviral assay. Among all, the compounds **4a**, **4d** and **4h** have shown good in ovo antiviral activity against New castle disease virus (NDV) at a concentration of 150 µg/mL. The remarkable reduction in NDV virus population in embryos treated with title compounds (**4a-j**) in a dose dependent manner, indicated that the synthesized compounds are extreme by toxic to the NDV virus. The title compounds were also docked against hemagglutinin neuraminidase enzyme and the more bio-active compound **4a** showed highest docking score than the standard antiviral drug tariabavirin while the compounds **4d** and **4h** has the same docking score as that of the standard.

## 1 | INTRODUCTION

Due to broad spectrum of promising optimistic and industrial applications of alkyl phosphonate derivatives and 2-amino-4H-chromene<sup>[1–5]</sup> they have generated interest in developing latest methodologies for the synthesis of 2-amino-3-cyano-4H-chromene-4-ylphosphonates by coupling alkyl phosphonates with 2-aminochromene rings. (2-Amino-3-cyano-4H-chromene-4-yl) phosphonic acids diethyl esters have been outlined to have high in vitro antimicrobial and antioxidant activity.<sup>[6]</sup> Early reported methodologies for the synthesis of chromenyl phosphonates through multicomponent reactions (MCRs) are limited till to-date. Multicomponent reaction technique is currently an attractive method for the synthetic organic

chemists for the synthesis of newer and diverse molecular structures<sup>[7–10]</sup> due to several advantages such as simple procedures without solvent and with inexpensive purification process.<sup>[11]</sup> MCR<sup>[12–20]</sup> endowed with such advantages play vital role in the evaluation of synthetic methodologies for the development of variety of structurally associated complex compounds.

Different types of Bronsted acids<sup>[21–24]</sup> and bases<sup>[25]</sup> have been reported in the literature to serve as effective catalysts for the synthesis of diversity of pharmacologically valuable reactions in synthetic organic chemistry. One-pot synthesis of (2-amino-3-cyano-4H-chromene-4-yl) phosphonic acids diethylesters by the use of InCl<sub>3</sub> as a Lewis acid catalyst<sup>[26]</sup> reported by Perumal et al after then few other methodologies have been outlined for the

# Hepatitis C virus genotype distribution and molecular epidemiology in chronic patients with hemodialysis and the comparative evaluation of screening methods

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Awareness,  
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Molecular epidemiology,  
Prevalence.

## ABSTRACT

The objective of this research is to investigate the prevalence and the distribution of hepatitis C virus (HCV) genotypes in chronic hemodialysis (HD) patients in Andhra Pradesh, India, through different serological and molecular detection methods. We investigated the HCV prevalence in 410 chronic HD patients during 2015–2017 and evaluated by collecting the different data on their personal status of awareness on HCV infection. The RT-PCR results revealed that few samples that were HCV negative in the tri-dot test (serological method) turned out to be positive in PCR. The HCV *Core* gene was amplified, cloned, and sequenced, analyzed that the prevalent genotype was found to be 3b. Based on the above studies, it is concluded that HD patients are not effective or sensitive in detecting HCV samples as compared to PCR detection. Hence, extensive precautions and creating awareness in the HD patients is essential to avoid severe contamination. For several HD patients infected with HCV, the awareness of the health care system and bio-safety regulations is not clear.

## 1. INTRODUCTION

The hepatitis C virus (HCV) is a spherical enveloped, positive-sense, and single-stranded RNA virus that belongs to genus *Hepaciviridae*, a member of family *Flaviviridae*. Based on genetic differences between HCV isolates, the HCV species is classified into six genotypes [1,2] of which genotype 3 is thought to have its origin in South East Asia [3]. Genotypes differ by 30–35% of the nucleotide sites over the complete genome [4]. Geographically, HCV genotypes 1, 2, and 3 are more prevalent and affect approximately 170–200 million individuals around the world with an addition of 3–4 million people being infected and causing 350,000 deaths every year [5–7]. HCV is transmitted through contaminated blood which makes the intravenous drug users, hemodialysis (HD) patients, and recipients of blood products at higher risk. Moreover, it has been found that one of the most common modes of HCV transmission is nosocomial [8]. No effective HCV vaccine is currently available and recent studies indicate that it is possible to develop a vaccine to prevent HCV. Depending on the absence or presence of cirrhosis, treatment with pan-genotypic direct-acting antivirals may cure most patients with HCV infection, and the duration of treatment is limited (usually 12–24 weeks) [9].

Most of the dialysis centres follow Tri-dot and ELISA methods to screen HCV which are highly sensitive in normal cases. However, reports confirmed that dialysis treatment may show a decrease in cellular and humoral immunity, which may lower the sensitivity of the HCV test and show false-negative results [2,4]. Comparison studies conducted in 2019 in Kolkata, East India, have shown that ELISA alone cannot be recommended for diagnosis because of high number of false positives. They also found that TRI-dot was cost-efficient, rapid, and sensitive with exceptions of early infection detection for which PCR was considered a better option [10]. The HCV prevalence rate of HD patients in India is reported to be 3–45% [8]. This study aims to investigate the HCV prevalence in HD patients of Andhra Pradesh, Southern India and to inspect the efficiency of different serological and molecular detection methods. A similar study conducted in 2015 in Punjab, Northern India, where 15% of people are actively infected by HCV showed that the awareness in common people was below 50% in all of the above-mentioned categories [11,12].

## 2. METHODOLOGY

### 2.1. Sample Collection

A total of 1656 patients in various districts of Andhra Pradesh are admitted to different government and private dialysis centres. Those districts covered are predominantly Chittoor, Kadapa, Kurnool, Anantapur, and Nellore. First screened for date of joining and number of dialysis per week using oral questionnaire and data collected from

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## Annexure X

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**CENTRE FOR WOMEN'S STUDIES**  
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CHITTOOR DISTRICT, ANDHRA PRADESH

**A Study on the Knowledge of Family Planning  
Methods among Women in Tirupati**  
K.Srilatha Kishori

**ABSTRACT**

*Population and environment are interdependent on each other. Over population leads to environmental degradation. So reduction in population would benefit the environment. Fewer births will benefit women, enabling them to be more efficient in enacting their role as environmental managers. The practice of family planning by women can make a significant contribution in the reduction of population growth rate. For women, the availability of family planning methods is a boon as this gives them the right to choose the size of their families.*

*No doubt the practice of family planning methods is the most important investments, to balance the over population. The same was included in Amsterdam Declaration which proclaims the pressing needs and issues in the field of population, recognize that women are the centre of the development process and that the improvement of their status and the extent to which they are free to make decisions affecting their lives and that of their families will be crucial in determining future population growth rates. Since women represent half of the global population, they must be aware of family planning methods.*

*With this backdrop the present paper discusses about the knowledge of family planning methods among women.*

**Keywords:** Family Planning Methods, Population, Environment.

**Introduction**

Population pressure is a key factor in environmental degradation; it is to be assumed that a reduction in population would benefit the environment. Fewer births will benefit women,

## **“Government Initiation to Promote Education among Drown Trodden Women and Girls in India”- A Study**

**V. Jagadeeswari**

### **ABSTRACT**

*Women represent half of the population in the world. But women are considered as secondary, due to the differences in every field including education. Literacy gap based on gender make it clear. Apart from gender there are other sources for low literacy among women such as caste, region, low income, etc. Women also contribute for the development of the country. Since the country's development depends on its human resources, it is essential to increase the female literacy from primary education to higher education. The governments are trying to increase the same through many programmes. The present paper describes about the government initiation to promote education among women especially drown trodden.*

**Key words:** Education, Development, Drown trodden, Human Resources, Initiation, Gender.

### **Introduction**

Education acts as the means through which the aims and habits of a group of people sustain from one generation to the next. Generally, it occurs through any experience that has a formative effect on the way one thinks, feels, or acts. Education is the formal process by which society deliberately transmits its accumulated knowledge, skills, customs and values from one generation to another ([www.wikipedia.org](http://www.wikipedia.org)). Education not only moulds the new generation, but reflects a society's fundamental assumptions about itself and the individuals which compose it.

*The real difficulty is that people have no idea of what education truly is. We assess the value of education in the same manner as we assess*

## **A Study on Economic Empowerment of Women through Self Help Groups**

**D.Raja Rajeswari**

### **ABSTRACT**

*Mahatma Gandhi states that the position of women in the society is an index of its civilization. Further he said that "Train a man and you train an individual, Train a woman and you build a nation". The SHGs (Self Help Groups) are the major resource of inspiration for women's welfare. For uplifting the women's position, the government has initiated Women Welfare Programmes through development centers, rural agencies, banks, NABARD etc. Self-help groups objectives are to inculcate the habit of saving and banking habits among the rural women; to build up trust and confidence between the rural women and the bankers; to develop group activity so that various welfare and developmental programmes can be implemented in a better way with the participation of these women groups; and to achieve women and child welfare programme goals by actively involving these women groups in Universal Immunization Programme, small family norm, Universal Elementary Education, etc. Self-help groups (SHGs) is as an instrument to change the conditions of women socially and economically. With this back ground the present paper describes about the role of SHGs in economic empowerment of women.*

**Key Words:** Civilization, Self Help Groups, Rural agencies, Saving and Banking.

### **Introduction**

The movement of Self-help groups (SHGs) as the most effective tools for financial inclusion was started some decades back. This has evolved into a national movement with the proactive role of the state governments gaining recognition from all the major

## **Impact of Climate Resilience on Gender and Livelihood**

**D.Ramana**

### **ABSTRACT**

*Gender is a central organizing factor in societies, and it can significantly affect the processes of production, consumption and distribution. In fact, the influence of gender on people's lives and livelihoods is substantial. Gender is mostly handled in a men-versus-women dichotomy, in this patriarchal society men have more access to utilize the natural resources and choice to select livelihood practices to get more earnings to sustain their family and reach the role assigned by the society. Little attention has been paid to social and political relations for women. Multiple social, economic, and cultural characteristics interact with gender in influencing power inequities and explaining how and why people face and manage climate change in external stresses and disturbances as a result of social, political, and environmental change in different ways. Climate change affects rural women and men's ability to secure their livelihoods. Climate change is likely to exacerbate inequalities between women and men if efforts to integrate gender concerns in climate change responses are neglected. In view of the increased climate variability, there is a pressing need to adopt gender-sensitive approaches in order to achieve food security and poverty reduction.*

*In this context, the present paper focuses on Gender, Livelihood and Climate Resilience, and discusses how and why women and men are differently affected by climate change and the need for addressing gender inequality in a gender sensitized society.*

**Keywords:** Climate resilience, Environmental stress, Gender Climate change.

### **Introduction**

Across societies the of climate change impacts women and men differently. Women are often responsible for gathering and producing food, collecting water and sourcing fuel for heating and cooking. With climate change, these tasks are becoming more

## **Empowerment of Women Through MGNREGA: Issues and Challenges**

**P. Suneetha**

### **ABSTRACT**

*Empowerment is a process aimed at changing the nature and direction of systematic forces, which marginalize women and other disadvantaged sections in a given context. Gender is the inevitable push factor for growth and development of a nation like India. In India women constitute a major share of chronically poor population. A large segment of Indian womanhood still suffers deprivation and discriminatory attitudes. It is necessary to mobilize the vast women power, if the country has to progress in all sphere of development. Empowerment of women is a long and difficult process. In spite of the draw backs in the implementation of the legislation, Government has framed different programmes/schemes to uplift the women from poverty and vulnerability of life. One such women friendly Programme is Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA) which was enacted in 2005. This paper presents issues and challenges in the way of women participation in MGNREGS and suggestions for making MGNREGS more effective for women.*

**Keywords:**Empowerment, Women Participation, Employment Programs, and MGNREGA.

### **Introduction**

Active participation of any community in the development process is recognized as a tool for its empowerment. In Indian social set up, the participation of women in the development process has to be ensured through tangible measures taken at various levels for their overall development. The government has taken a conscious view to make adequate provisions in its policies and programmes, through which it is to be ensured that the women of the country are not only empowered but also become active participants in the development process in the country. Various programmes of the