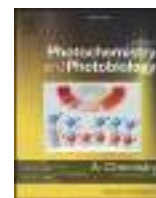




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# A lanthanide doped metal-organic framework demonstrated as naked eye detector of a trace of water in organic solvents including alcohols by monitoring the turn-on of luminescence

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## ABSTRACT

It is very crucial to have a very simple, instant and low-cost detection and estimation of a trace of water in common organic solvents including alcohols. To obtain the sensor material we have synthesized a metal-organic framework (MOF)  $\{[Y_{1.0}Mn_{1.5}(PDA)_3(H_2O)_3] \cdot 3.5H_2O\}$ , **1**, (PDA = 2,6-pyridinedicarboxylic acid) through hydrothermal process. A doping of compound **1** by 10 % terbium  $\{[Y_{0.9}Tb_{0.1}Mn_{1.5}(PDA)_3(H_2O)_3] \cdot 3.5H_2O\}$ , **1:Tb**, was done through an isomorphous substitution technique. The most advantageous point about **1:Tb** was the metal centre luminescence, which was largely Stokes shifted from the excitation light making possible the naked eye observation. The weak metal centre luminescence intensity of dehydrated **1:Tb** (excluding lattice and coordinated water molecules) in organic solvents EtOH, CH<sub>3</sub>OH, CH<sub>3</sub>CN, THF and n-heptane showed huge turn-on in presence of trace amounts of H<sub>2</sub>O in the said solvents. The luminescence intensity of Tb<sup>3+</sup> centre was enhanced by several folds with a limit of detection 1.12 % (v/v), 0.47 % (v/v), 0.04 % (v/v), 0.13 % (v/v) and 0.53 % (v/v) respectively. The coordinated water molecules as well as the lattice water molecules in **1:Tb** play a vital role during sensitization of the Tb<sup>3+</sup> centre by enhancing the rigidity of the structure and facilitating the formation of LMCT state which ultimately results in a huge turn-on of metal centre luminescence.

## 1. Introduction

Most of the organic solvents are frequently contaminated by a trace amount of water. The dry products, moisture sensitive chemicals, oils and petroleum products often contains water as impurity [1,2]. It is very important to detect and estimate the amount of water in solvents, fuels and most importantly alcoholic beverages [3–6]. In the laboratory, the existence of water decreases the reactivity in organic solvents, increases the formation of oxidation products, lowers the yield of reactions or sometimes fires and explosions comes out in some chemical reactions [7]. So, a good sensor of water in organic solvents is of high significance in the field of analytical chemistry, chemical industries, pharmaceutical industries and for scientific applications [8–11].

For the estimation of amount of water in organic solvents a widely used technique is Karl Fischer titration [12,13]. However, such method has several disadvantages for practical applications due to the

requirement of specialized instrument, unpleasant pyridine-based reagent, long time consumption, complicated procedure and requirements of well trained personnel [14]. Colorimetry [15,16], electrochemistry [17], gas chromatography [18], luminescence [19–21] etc. are the various detection techniques employed for detection of water till date. Among them, luminescence sensors have attractive attention because of several reasons. It requires only a small amount of sensor (chemical) for detection, the process is extremely easy and can be done instantly, it is highly sensitive method and can give very accurate results. It can be a widely applicable method because several aspects of luminescence like intensity, peak position, lifetime etc. can be monitored for the detection depending upon the sensor and analyte pair. Most importantly it is cost effective and reliable method [22,23]. So, luminescence-based sensors are ideal alternative for Karl-Fischer titration method [3].

In the literature, there have been reports of various materials such as copper nanoclusters [24–26], conjugated polymer [27,28], fluorescent

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## Eco-friendly Management of Mealy Bug (*Maconellicoccus hirsutus* Green) on Som Plant (*Machilus bombycina* King) using Bio-pesticides

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### ABSTRACT

A field experiment was conducted under Uttar Banga Krishi Viswavidyalaya at Pundibari, Coochbehar, West Bengal, India to study seasonal occurrence of mealy bug (*Maconellicoccus hirsutus* Green) on som plant (*Machilus bombycina* King) and its management using bio-pesticides. The mealy bug was active throughout the year. The peak population of mealy bug (18.68/3 leaves) was recorded on 10<sup>th</sup> standard meteorological week i.e. on 2<sup>nd</sup> week of March. Correlation co-efficient (r) study between pest population with environmental parameter showed that there was significant positive (+) correlation with temperature difference and significant negative (-) correlation with temperature (minimum and average) and relative humidity (maximum, minimum and average). On the other hand, non-significant negative (-) correlation found between mealy bug population and maximum temperature. Bio-efficacy of different treatments against mealy bug showed that Imidacloprid (CONFIDOR 17.8 SL) 1 ml/ 5L was found superior for management of mealy bug (77.39% reduction of mealy bug population) followed by Azadirachtin (NIMARIN 1500 ppm) 2.5 ml/L (57.38% reduction of mealy bug population). However botanical extract of tobacco 50.00 ml/L (5%) (50.48% reduction of mealy bug population), Garlic 50.00 ml/L (5%) (48.73% reduction of mealy bug population), Spilanthes 50.00 ml/L (5%) (45.40% reduction of mealy bug population), polygonum 50.00 ml/L (5%) (40.91% reduction of mealy bug population) and Pongamia 50.00 ml/L (5%) (30.37% reduction of mealy bug population) were found satisfactory to manage the pest.

**Key words:** Abiotic factors, Botanical extracts, Mealy bug, Organic cultivation, Seasonal occurrence

**M**egu silk worm (*Antheraea assama* Westwood) primarily feeds on Som (*Machilus bombycina* King) plant (Bhattacharya *et al.* 1993, Tikader and Rajan 2012). The plant is very prone to attacked by different type of insect pests like gall insect, stem borer, leaf defoliating beetle, aphid, leaf miner, leaf roller, red tree ant etc. (Borgohain 2015). Kumar *et al.* (2011) found that som plant is infested by shoot borer, trunk borer, leaf miner, leaf gall and mealy bug. Due to attack of insect-pests it becomes difficult for the farmers to conduct silk worm rearing (Singh *et al.* 2000). Application of insecticides for the insect-pests control is not advocated as their residual effects is harmful for the silk worm (Subbarani and Jayaprakash 2015).

Botanical insecticide like onion, garlic, zinger, custard apple, turmeric, chrysanthemum, neem, pongamia, tobacco etc. have used for the management of insect-pest in sericulture (Singh and Saratchandra 2005). Ghosh and Senapati (2002) reported that Azadirachtin / neem found moderate control of flea beetle (41.70%) on eggplant in terai region of West Bengal, India. Azadirachtin and extracts of Polygonum were found moderate to higher flea beetle control, recording more than 50% mortality (Ghosh 2014). Polygonum, locally known as "Biskanthali" (Sarkar and Mukherjee 2005) and its crude leaf and flower extracts of *Polygonum hydropiper* are responsible for mortality of *Heterotermes indicola* and *Coptotermes heimi* (Badshah *et*

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## Assessment of variation of land use/land cover and its impact on land surface temperature of Asansol subdivision

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### ABSTRACT

Economic development is a basic need for the growth of the region and it stimulates the rapid transformation of land use and land cover (LULC) units. Urbanization and industrialization are one of the major factors to increase temperature. Asansol sub-division is one of the important industrial and urbanized regions of eastern India. In this study, two different years viz. 1993 and 2018 have taken for the preparation of LULC and land surface temperature map. The kappa coefficient has been implied in this investigation to assess the accuracy of LULC maps. Temperature maps show that summer and winter surface temperature increases at the rate of 0.15 °C and 0.19 °C per year respectively. The result also reveals that temperature mainly increases due to the presence of urban, industrial and coal mine areas. The changing land use and land cover patterns show that the coal mine areas have been increased by 15% and urban areas also increased by 60%. Some correlations have been prepared to show the relationship between Land Surface Temperature (LST) and other spatial indices like NDBI, NDVI, and NDWI, where negative correlation prevails between LST and NDVI also with NDWI, but positive relation exists between LST and NDBI. Lastly, simulation of temperature for the year 2041 has been prepared, which shows that in the upcoming years' temperature may be increased up to 0.21 °C/year.

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### 1. Introduction

For proper identification of a region, Land use and Land cover (LULC) is one of the most vital parameters for the proper identification of a region (Rousta et al., 2018). Rapid transformation from pervious surface to impervious surface through LULC changes has a great impact on local as well as regional environment (Rousta et al., 2018; Zhou et al., 1998). So, the formation of urban heat islands is the most important striking feature of rapid urban and industrial growth in the present era of development (Ranagalage et al., 2018). Buildings, roads, industrial farms, etc. are considered as the impervious surface, which can absorb shortwave incoming solar radiation in one hand but on the other hand, it leads to a reduction in the outgoing longwave terrestrial emission (Ranagalage et al., 2018).

Several studies established that there is a strong influence of LULC on surface temperature and reported that the relative rise in LST depends on LULC change especially in the urban centers (Pal and Ziaul, 2017; Weng et al., 2004). Extension of agricultural land, the concretization of the open land, squeezing of surface water area, depletion of groundwater resources (Das and Mukhopadhyay, 2018), reduction of green vegetation area completely changes the existing environment (Zhang and Huang, 2015; Mahato and Pal, 2018). The negative effect of these kinds of change directly related to health risks & environment (Pal and Ziaul, 2017; Choudhury et al., 2019).

Remote Sensing and geospatial technology are some of the major modern tools for the identification of LULC and extraction of land surface temperature (LST) (Choudhury et al., 2019). Therefore, using both of these technologies, we can properly explain LULC changes as well as to extract the difference in land surface temperature (Hathout, 2002).

This paper attempt to identify the research objectives: (1) To detect the LULC changes over the last 23 years (2) To assess the Spatial as well as the temporal variation of surface temperature

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# Application of DRASTIC model for assessing groundwater vulnerability: a study on Birbhum district, West Bengal, India

Ranjit Ghosh<sup>1</sup> · Subhasish Sutradhar<sup>2</sup> · Prolay Mondal<sup>2</sup> · Niladri Das<sup>3</sup> Received: 13 July 2020 / Accepted: 3 November 2020  
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## Abstract

Groundwater is one of the important necessary renewable resources of the world. Without water, no life can be possible on this earth. It is not only sustaining all biotic elements of the earth but also it helps to fulfill the requirement of various sectors like agriculture, industries, and other domestic purposes. Not all types of water but the mineral added purified water is safe for the human being. Unfortunately, in this age of development, it's very difficult to get naturally purified water because of the application of chemical fertilizer to get more production from agriculture, extensive industrialization pollutes groundwater resources badly. So, it's high time to think about this most valuable resource. In this context, current research aims to identify the most polluted or vulnerable zones of groundwater in the Birbhum district. From several studies, it has been found that Birbhum district is one of the fluoride contaminated districts. Except, fluoride, another chemical component i.e. iron is also another harmful component in this district. Therefore, to assess the most vulnerable groundwater zones DRASTIC model has been applied here. DRASTIC is a widely used model for this purpose. This study deals with how the application of the DRASTIC model can help to extract the vulnerable zones of groundwater. To run the DRASTIC model various parameters viz. Depth to water level, Net recharge, Aquifer media, Soil media, Topography, Impact of the vadose zone, and Hydraulic conductivity have been used here. The final vulnerable map shows that the western part is more vulnerable than the eastern part because the western part consists of the plateau fringe area with basalt and granite and more weathering prone that's why contamination of harmful minerals dissolve with groundwater most quickly. Moreover, the groundwater level is near to surface in the western part due to the presence of hard rocks near the surface than the eastern part. The applied DRASTIC model has been validated using the receiver operating characteristic curve (ROC) and this curve has been prepared based on some random points composed of various harmful chemical components. The result of the receiver operating characteristic curve depicts that this model is 73% valid in this concerned region.

**Keywords** DRASTIC model · ROC curve · Groundwater vulnerability · Net recharge

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## Introduction

About 34% of freshwater of the globe is contribution of groundwater, which is the most valuable natural resource of the world (Shekhar and Pandey 2015). It fulfills our miscellaneous requirements of various fields like the irrigation sector, industrial sector, and domestic use (Agarwal et al. 2013). In India, 50% population of the urban area and 90% population of the rural area depend on groundwater for their domestic use of water. Apart from this 70% of groundwater is used for agricultural activities in India (GEC 2015). But nowadays, high population growth induced massive groundwater pollution due to different harmful actions like unscientific agricultural, industrial activities, and urbanization (Foster 2002). Different anthropogenic activities like



# The response of groundwater to multiple concerning drivers and its future: a study on Birbhum District, West Bengal, India

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## Abstract

Groundwater and its upcoming crisis are the present-day concern of the scientist. This research mainly focuses on responses of groundwater dynamicity to some important drivers, viz. agricultural yield, groundwater irrigated area, groundwater draft, landuse/landcover, and stage of development. The result of this study has been done under three sections. In the first section, the spatiality of groundwater has been discussed where it has been noticed that the western side of the district groundwater level is near the surface due to low drafting and low agricultural yield. Moreover, hard rock geology in the western part disappoints the drilling process. On the eastern part, rich alluvial soil influences high agricultural yield hence groundwater level lowering down rapidly. In the second section, the nature of groundwater levels has been analyzed through the boxplot, and cluster diagram, where boxplots have been drawn over different geological facies, which depicts groundwater is highly fluctuating in hard clay geology. For example, high agricultural intensity and high groundwater draft is the characteristic feature of hard clay geology. The dendrogram in cluster analysis represents a homogeneous groundwater level fluctuating station in three different time series. Last section deals with the future of groundwater level where an artificial neural network (ANN) model has been applied to extract the predicted groundwater level for 2030. This type of environmental analysis, such as groundwater fluctuations in relation to different sensitive parameters and the use of a machine learning model, would aid potential researchers and communities in making wise groundwater use decisions.

**Keywords** Multiple drivers · ANN model · Cluster analysis · Sustainability · Multilinear regression model

## Introduction

Groundwater is one of the earth's precious natural sub-surface assets, and is used in various economic sectors such as irrigation, manufacturing and households. Groundwater is the only source of drinking water and represents 50 per cent of the population of the planet (Tharme 2003; Kløve et al. 2011; Razandi et al. 2015; Das and Mukhopadhyay 2020). Several experiments explain that the freshness of soil water

is contaminated by climate change and increased human demand (Wada et al. 2016; Boretti and Rosa 2019; van Rooyen et al. 2020). The overflow of groundwater through irrigation for cultivation often simulates a daily increase in its depth (Tizro et al. 2018). However, groundwater is expected to be refilled by runoff and water supply (Adhikari et al. 2020). Not only irrigation, but also land use/land cover (LULC), agricultural yield, and soil drainage for different uses spatially and temporarily impact the amount of soil water. Differences in groundwater level impact its consistency directly (Das et al. 2019). LULC variation determines groundwater fluctuations, e.g. land use as well as urban and urbanization processes, affects the drafting and consistency of groundwater, on the one side, and, on the other, forest surface storage and supports groundwater for a long period of time (Wakode et al. 2018). The massive population increase, agricultural growth, urban expansion and changes in the structure of the LULC pattern directly lead to the use of groundwater resources and the degradation of their levels ((Lu et al. 2014; Ahirwar et al. 2020; Ansari et al.

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# Asymmetric nexus between air quality index and nationwide lockdown for COVID-19 pandemic in a part of Kolkata metropolitan, India

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## ABSTRACT

The diffusion of COVID-19 or Coronavirus since last few months is the prime matter of concern for the entire world. The government of India had declared the complete lockdown from 24th March. After the second step lockdown, now third step lockdown was declared. So, India in Lockdown 3.0 situation. Although the economy of our country has severely been affected by the impact of lockdown, this situation is good for natural healing. Major metropolitan cities of India are trying to recover from various pollution. This study, therefore, attempts to analyze the trend of air pollution before and during a lockdown situation in Kolkata metropolitan and surrounding areas. To identify air pollution trends before and during the lockdown, the non-parametric Maan-Kendall test and Sen's slope estimator have been applied in this study. This research has been done based on air quality index data of the Kolkata metropolitan region's observatory stations. The time range of the data set is from mid of February to 2nd May. The study results show that air pollution has been reduced up to 80% in almost all the stations due to strict lockdown.

## 1. Introduction

Air is an utmost important element for the survival of all animals. So, there is a profound influence of air quality deterioration on all biotic elements. With rapid urbanization and industrialization level of pollution is increasing at a high rate. To meet the basic needs of the second-largest populous country of the world, the emission of harmful gases is contaminating the quality of the air drastically. Urban centres occupy nearly 5% of the earth's land surface. The air quality of these urban centres is very vulnerable due to excessive traffic contamination and industrial smog (Haque and Singh, 2017). About 1.1 billion people in the world are breathing unhealthy air (UNEP et al., 2003). The World Health Organization (WHO) estimated that urban air pollution is liable for 5% of the trachea, lung cancer, bronchus and, 1% of respiratory infections mortality and about 2% of cardiorespiratory mortality globally (WHO, 2002). Significant contributors to urban air pollution in India are vehicular emission and emission from red and orange industries (CPCB, 1998; Mukherjee et al., 2012). West Bengal Department of Environment, Chittaranjan National Cancer Institute, and the Central Pollution Control Board observed in a study that approximately 70% of the patients of the Kolkata who experience respiratory infections are caused by air pollution (Haque and Singh, 2017). Chicago University made an observation that air pollution in Kolkata is reducing the life expectancy of its residents by 3.5 years on average (Bandyopadhyay, 2020). Particulate Matters like PM<sub>2.5</sub> and PM<sub>10</sub>,

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# Analysis of unsteady magnetohydrodynamic radiative thin liquid film flow, heat and mass transfer over a stretching sheet with variable viscosity and thermal conductivity

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## ABSTRACT

The present article is related to the study of magnetohydrodynamic (MHD) heat and mass transfer in a thin liquid film over a permeable unsteady stretching surface in the presence of chemical reaction, applied magnetic field, viscous dissipation, and thermal radiation with variable viscosity and thermal conductivity. Computed results for unsteadiness parameter, temperature ratio parameter, radiation parameter in the presence/absence of the viscous dissipation and Ohmic heating are analyzed and discussed. The computed results reveal that the viscous and Ohmic dissipations reduce the temperature gradient profiles in the thin liquid film. Further, the thermal radiation decreases the cooling rate of the thin liquid film but the reverse effect is seen by increasing the Prandtl number.

## KEYWORDS

Magnetohydrodynamics; stretching sheet; thin liquid film; thermal radiation; viscous and Ohmic dissipations; thermal conductivity

## 1. Introduction

The studies on thin film flows of Newtonian fluids over a permeable unsteady stretching sheet are important from engineering point of view such as in extrusion process of metal and polymer, glass fiber and paper production, wire drawing, hot rolling and in application of paints. Wang [1] first investigated on the motion of an unsteady thin finite Newtonian liquid film over a stretching sheet. Pantokratoras [2] investigated theoretically the effect of variable viscosity on heat transfer over a moving plate. Liu and Andersson [3] examined heat transfer in thin liquid film over an unsteady stretching surface by using multiple shooting method. Dandapat et al. [4] analyzed variable thermal properties on flow and heat transfer on a thin liquid film over an unsteady stretching sheet. Rashad [5] analyzed the effect of thermal radiation and variable viscosity on an unsteady rotating fluid over a stretching surface embedded in a porous medium with magnetic field. Liu and Megahed [6] observed effect of thermal radiation with variable heat flux on heat transfer aspect of a thin liquid film. Pal and Mondal [7] investigated thermal radiation effect of on MHD non-Darcy flow and heat transfer over a stretching sheet in presence of Ohmic dissipation.

Reza-E-Rabbi et al. [8] developed a numerical model to examine a multiphase radiative Casson and Maxwell fluids flow behavior over a stretching sheet in the presence of nano sized particles. They also provided an impression of the activity of a nonlinear chemical reaction and the convergence and stabilization criterion of the numerical method. Hsiao [9–10] discussed about composed of activation energy taking electrical MHD Ohmic dissipation and mixed convection and also studied in heat and mass transfer energy conversion using Maxwell fluid. Manivannan et al. [11] studied the effect of thermal radiation and chemical reaction on an isothermal vertical oscillating plate with variable mass diffusion. Pal [12] analyzed the combined effects of thermal radiation and non-uniform heat source/sink on heat transfer over a permeable unsteady stretching surface.

Mahapatra et al. [13] studied effect of chemical reaction on free convection flow through a porous medium. Sharma et al. [14] examined the influence of chemical reaction on unsteady free convection flow and mass transfer. The effect of viscous dissipation on heat transfer in a non-Newtonian liquid film over an unsteady stretching sheet was considered by Chen [15]. Hsiao [16] investigate viscous dissipation effects with MHD toward stretching sheet. Soundalgekar [17]

## Evaluation of Cytotoxic Potential of Acetamiprid on *Allium cepa* L.

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### ABSTRACT

The present study was undertaken to evaluate the genotoxic potential of acetamiprid on *Allium cepa* L. root tip cells. *A. cepa* L. roots were treated with different concentrations of acetamiprid (0.25, 0.5, 0.75 and 1.0 gL<sup>-1</sup>) for different time intervals. The results indicate that acetamiprid significantly decrease the mitotic index when compared with their controls (distilled water) at all concentrations and treatment periods. As well as it significantly increases chromosomal abnormality frequency and mitotic inhibition. Different types of physiological and clastogenic kinds of chromosomal aberration were also recorded. This study therefore confirms that acetamiprid acts as a mitotic depressor and mutagenic agent on plant cells when absorbed in a high dosage with prolonged time duration. Therefore, for every chemicals EC<sub>50</sub> dose must be determined before field application.

**Key words:** Acetamiprid, *Allium cepa* L., Clastogenic aberration, Genotoxic, Mitotic depressor

Now-a-days the use of insecticides in agriculture is a common practice, which constitutes a wide group of chemicals. Though different kinds of insecticides enhance the yield of the crop production, but the residues are a common cause of water and soil pollution (Rasgele 2017). Despite the beneficial outcome associated with the use of insecticides, many of those chemicals may cause potential hazards to humans and the environment (Nag *et al.* 2013). Insecticides have a general property, which is lethal to some groups of targeted insects but not to the rest of other species including humans. But, due to lack of proper knowledge of farmers, unnecessary excessive uses of insecticides lead to harmful toxic effects on crops (Mishra *et al.* 2015). Though the phytotoxicity is not always correlated with genotoxicity (Kovalchuk *et al.* 1998, Fisun and Rasgele 2009, Paul *et al.* 2013). India is such a country that has an agriculture-based economy, so the application of various types of insecticide is a major concern. Thus, cytotoxic investigations of those crops are extremely significant (Rodriguez *et al.* 2015). Many investigations have been performed to understand how the genotoxic effect visualized in newly formed cells through mitotic cycle division following the treatment with various reagents (Umar 2004, Dinez *et al.* 2009, Fisun and Rasgele 2009, Nwangburuka and Oyelana 2011,

Panneerselvam *et al.* 2012, Rasgele 2017).

Acetamiprid is a widely used popular insecticide. This is an organic compound of neonicotinoid insecticide products under the trade name "Pride" (Paul *et al.* 2013). This chemical has a translaminar activity and with contact and stomach action belonging to the group of neonicotinoids. It is used to protect plants against sucking insects such as aphids, Hemiptera, Lepidoptera, Thysanoptera etc. on crops, leafy vegetables, fruit plants, ornamental plants and flowers (Nag *et al.* 2013). The present study was aimed to investigate the cytotoxic potency of the root tip cells of *Allium cepa* L. through mitotic cell division on the effects of acetamiprid – a widely used insecticide. In this study *Allium cepa* L. is used as a test plant because of its relatively large chromosome size and relatively low chromosome number in their somatic cells; that is suitable for cytological manipulation (Mercykutty and Stephen 1980). Farmers of different locality applied this insecticide as a spray in the field on different crops to control sucking insects @ 0.2 to 0.6 gL<sup>-1</sup> of water usually (Nag *et al.* 2013, Nemade *et al.* 2017). Thus, this study was very much effective for the agronomical research in respect of cytological aspects.

### MATERIALS AND METHODS

The chemical formula, CAS (Chemical Abstracts Service) number and molecular mass of the insecticide

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# Evaluation of Phylogenetic Relationships of Some Medicinally Important Species of *Solanum* Based on Seed Protein Profile of SDS-PAGE

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**Abstract** Total amount of soluble seed protein along with its protein profile of nine species of *Solanum* was investigated through SDS-PAGE. *S. nigrum* and *S. macranthum* contain maximum and minimum amount of total soluble seed protein per gm of tissue respectively. A dendrogram based on Jaccard's similarity index and also on the basis of presence and absence of peptide bands revealed two major clusters- upper cluster (UC) and lower cluster (LC). Both the clusters are again sub-divided in two sub-clusters like UC1, UC2 and LC1, LC2. *S. nigrum* being evolutionary more closely (91%) related to *S. villosum* than *S. americanum*, has been placed in UC1 while *S. americanum* along with *S. sisymbriifolium*, *S. macranthum* and *S. torvum* are placed within UC2. *S. indicum* and *S. erianthum* showed close resemblance and are placed in LC1 while LC2 contains only *S. xanthocarpum*, which shows least similarity with other studied species of *Solanum* and thus occupies a distinct place on the dendrogram. Based on these results, the genus *Solanum* can be divided into two sub genera and the distribution pattern of these species in the two sub genera does not corroborate with the conventional classification. The present study thus provides useful information for the identification of the taxa, their relationship and delimitation of their taxonomic status. So, this omega taxonomical approach may be very much beneficial for future proteomics study.

**Keywords** Dendrogram, SDS-PAGE, Seed Protein,

*Solanum*, Sub Genera

## 1. Introduction

*Solanum* is one of the most economically valuable genera among the 98 genera of 'nightshade' family Solanaceae; which contains approximately 2700 species [1]. Members of this genus are distributed throughout the world, especially in tropical and warm temperate regions, among which largest sub-genus *Leptostemonum* or 'spinous *Solanum*' are predominant in India widely [2]. The genus is not only important for its food value but also equally valuable for its pharmaceutical demands. Several major cultivated crops of *Solanum* such as *S. tuberosum* L. (potato), *S. melongena* L. (eggplant), *S. lycopersicum* (tomato), *S. muricatum* Aiton (pepino) etc. are cultivated throughout the world and they provide lots of food security in most of the countries of developing world [2].

More than hundreds of pharmaceutically important alkaloids are found in different wild and cultivated species of *Solanum* such as solasodine, solasonine, solamargine, solanidine etc. Beside alkaloids sterols, saponins, flavonoids, fatty acids, amino acids, glycosides etc. are also present among the members of *Solanum* [3]. That is why most of the species are used as analgesic, antinarcotics,



## Phytochemical Screening and *In-vitro* Evaluation of the Antibacterial Potential of Leaf Extract of *Eucalyptus globulus* against some Pathogenic Bacteria

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### ABSTRACT

Plants are healthy and natural resource of life. In particular, medicinal plants are of great importance with endless therapeutic properties useful for curing various diseases with an advantage of being natural. The present study is to evaluate the qualitative estimation of phytochemicals and antimicrobial activity of ethyl acetate, hexane, chloroform, methanol extracts of leaves of *Eucalyptus globulus* against the following microorganisms: *Bacillus subtilis*; *Enterococcus faecalis*; *Staphylococcus aureus*; *Proteus vulgaris*; *Escherichia coli* and *Klebsiella pneumoniae*. The process was carried out by agar well diffusion method. The extracts were poured into the wells at different concentrations like 25mg/ml, 75mg/ml, 150mg/ml and 300mg/ml. After incubation zones of inhibition were observed. As the concentrations of extract increased the activity also increased and thus the zone of inhibition too increased. Among four extracts, zone of inhibition was best in ethyl acetate extract. In case of *Staphylococcus aureus*, the ethyl acetate extract (300 mg/ml) showed maximum zone of inhibition  $46.0 \pm 2.0$ mm, while in case of *Klebsiella pneumoniae* the hexane extract (25 mg/ml) showed minimum zone of inhibition  $15.0 \pm 0.0$  mm. Ethyl acetate extract is more effective than other three extract. Hence *Eucalyptus globulus* can be used in developing drugs and medicines against various activities of bacteria. Study has also been shown the presence of various phytochemical constituents such as tannin, saponin, glycosides, alkaloids, phenolic content in the leaf of *Eucalyptus globulus*. The *Eucalyptus globulus* oil has antimicrobial activity against different microorganisms and appears to be a viable alternative as germicidal agent hence, further investigation is recommended. Its antimicrobial activity was evaluated against six bacterial species, including food poisoning and spoilage bacteria and human pathogens. The results of the antibacterial activity tests revealed that the leaf extract of *E. globulus* has rather a strong antibacterial activity, especially against *Staphylococcus aureus*.

**Key words:** Antibacterial, *Eucalyptus globulus*, *Bacillus subtilis*, *Enterococcus faecalis*, *Staphylococcus aureus*, *Proteus vulgaris*, *Escherichia coli*, *Klebsiella pneumoniae*

The spread of drug resistant pathogens is one of the most serious threats to successful treatment of microbial diseases and growing problem of antimicrobial resistance has become a important public health concern worldwide and especially in developing countries as a result of overuse and misuse of antibiotics (Ruifang *et al.* 2006). Many plants are used for different industrial purposes such as food, drugs, and perfumery manufacturing (Zarai *et al.*

2012). Their use has taken place since ancient times, and despite many of them were substituted by synthetic ones, the demand for natural products is increasing (Guillén *et al.* 1996). They have been shown to possess antibacterial, antifungal, antiviral, insecticidal and antioxidant properties (Burt 2004, Kordali *et al.* 2005). Aromatic and medicinal plants which push in the whole world have therapeutic virtues, because they produce certain bioactive molecules

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# Electromagnetically induced transparency and electromagnetically induced absorption in Y-type system

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The propagation of a probe field through a four-level Y-type atomic system is described in the presence of two additional coherent radiation fields, namely, the control field and the coupling field. An expression for the probe response is derived analytically from the optical Bloch equations under steady state condition to study the absorptive properties of the system under probe field propagation through an ensemble of stationary atoms as well as in a Doppler broadened atomic vapor medium. The most striking result is the conversion of electromagnetically induced transparency (EIT) into electromagnetically induced absorption (EIA) as we start switching from weak probe regime to strong probe regime. The dependence of this conversion on residual Doppler averaging due to wavelength mismatch is also shown by choosing the coupling transition as a Rydberg transition.

**Keywords:** Y-type system, density matrix method, electromagnetically induced transparency (EIT), electromagnetically induced absorption (EIA)

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## 1. Introduction

Interaction of atom with coherent radiation fields can lead to many interesting physical phenomena like coherent population trapping (CPT),<sup>[1–4]</sup> electromagnetically induced transparency (EIT),<sup>[5–6]</sup> electromagnetically induced absorption (EIA),<sup>[9,10]</sup> lasing without inversion (LWI),<sup>[11,12]</sup> subluminal and superluminal propagation of light,<sup>[13–15]</sup> optical delay generation,<sup>[16,17]</sup> etc. All these phenomena are expected to have useful applications in future optical devices. Since its theoretical prediction<sup>[18]</sup> and experimental realization,<sup>[1]</sup> EIT has become one of the most widely studied topics in quantum optics. EIT makes an otherwise absorptive medium transparent to a resonant or near resonant coherent probe field propagating in the presence of a strong control field. Due to steep variation in the group index around an EIT window and subsequent reduction in the group velocity of the probe pulse,<sup>[19]</sup> EIT has found immense application in optical delay generation,<sup>[16,17]</sup> stopping and storage of light,<sup>[20]</sup> etc. All these are expected to form the backbone of future optoelectronic devices, optical communication, all optical logic gates, and quantum computation. Often a dark-state model is used to explain EIT.<sup>[9]</sup> In bionic systems also, highly efficient energy transfers between donors and acceptor can be modelled by using a dark-state channel.<sup>[21]</sup> This is useful to understand the phenomenon of photosynthesis. Similar theoretical study on artificial light harvesting by using dimcrized Möbius ring has been reported by Xu *et al.*<sup>[22]</sup> All these point towards the diverse fields of application of quantum interference phenom-

ena.

Phillips and his co-workers<sup>[23]</sup> first demonstrated storage of light in Rb vapor at  $\sim 70$ – $90$  °C by forming an effective three-level  $\Lambda$  type system. The three-level  $\Lambda$  type system has also been used to show sub-Doppler resolution in an inhomogeneously broadened medium under intense control field.<sup>[24]</sup> Using an indirectly coupled resonator, Wang and his co-workers studied transparency and absorption, theoretically as well as experimentally, modulated by chiral optical states at exceptional points.<sup>[25]</sup> They also discussed the possibility of using the findings of this study in optical quantum memory devices and optical computation. Agarwal and Harshwardhan<sup>[26]</sup> demonstrated the inhibition and enhancement of two-photon absorption in a four-level Y type system. They used two counter propagating weak fields in the  $\Xi$  formation and then applied a strong control field which is co-propagating with respect to the weak probe field. The control field acts from the intermediate level, which is common to all three fields, to another excited state. They have considered both Doppler free medium as well as Doppler broadened medium. Later, Gao *et al.*<sup>[27]</sup> showed electromagnetically induced inhibition of two-photon absorption in sodium vapor at 230 °C under two-photon resonance condition. Mirza *et al.*<sup>[28]</sup> demonstrated the effect of the wave vector mismatch on electromagnetically induced transparency in a four-level Y-type system under weak probe propagation in presence of two stronger fields. They compared the probe absorption and EIT line shape for the same propagation constants of the control

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## Atom localization in cascade type system

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**Abstract:** A three-level cascade type system is subjected to a standing wave (SW) field acting between the ground energy level and the intermediate energy level of the system and the probe field scans the uppermost energy level from the intermediate energy level. Optical Bloch equations (OBE) for this three-level system are derived from the Liouville equation (Master equation) where the decay terms are added phenomenologically. These OBEs are solved analytically under steady state condition by using weak probe approximation. Under doppler free condition precession of localization was controlled by tuning the SW rabi frequency and relative orientation of the applied fields.

### Introduction:

Atom localization [1] is a process in which atoms get confined within a very narrow spatial region. Precession measurement of a single atom has potential application in nanolithography [2], Bose Einstein Condensation [3] and laser cooling [4]. The strong localization of atoms in cold atomic system also modifies the optical properties of the medium and can be used in fabricating optical logic gates, storage of light etc. There are several reports on different techniques to localize atoms within a narrow spatial region. Thomas and his co-workers demonstrated that sub optical wavelength localization could be achieved via a light-shift gradient for atom imaging [5]. Later atom localization was achieved by atoms interacting with a standing wave and this was confirmed by using the phase shift measurement of the optical field [6], homodyne detection [7] and quantum trajectories [8]. Later phase shift of atomic dipole-moment [9] and entanglement between the atomic position and its internal state were used to localize the atom without directly affecting the spatial wave function of the particle [10]. Detection of spontaneously emitted photon due to its interaction with a classical standing wave field and the reservoir modes [11] has also been suggested by several groups but it is not easy to control spontaneous emission experimentally. To overcome this difficulty measurement of upper level population [12], probe absorption [13] and coherent population trapping [14] were used for atom localization study. All these mentioned phenomena [12-14] have experimental realization in pump-probe experiment. B.K. Dutta et al discussed the electromagnetically induced grating [15] phenomenon by using a three level  $\Xi$  type system interacting with one dimensional (1D) standing wave field. Ivanov and Rozhdestvensky have proposed a two-dimensional (2D) atom localization scheme using a four-level tripod system via measurement of the population in the upper state or in any ground state [16]. Atom localization via spontaneous emission in a five-level M-type atomic system



## Electromagnetically induced transparency in Y-type atomic system

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**Abstract.** Probe field propagation through a four-level Y-type system is studied analytically under steady state condition by using density matrix formulation. The probe field scans the intermediate state from the ground state whereas two other coherent radiation fields, namely the control field and the coupling field, are set to couple two different excited states from the intermediate energy level. Under Doppler free condition, simulated probe absorption shows single or twin EIT windows depending on whether the control and the coupling field are on-resonant or detuned. Under Doppler broadened condition, the residual Doppler averaging due to wavelength mismatch between the probe field and the control field as well as that between the probe field and the coupling field plays significant role in the formation of transparency window.

### 1. Introduction

Electromagnetically induced transparency (EIT) [1-5] arises due to destructive quantum interference between two absorption pathways and makes an otherwise absorbing medium transparent to a weak probe field in presence of a resonant or near resonant coherent control field. The two fields share a common energy level. Out of the three basic three-level systems  $\Lambda$ , V and  $\Xi$ , the  $\Lambda$  type system is ideal for observing EIT [5]. Study of probe response using multi-level systems like 'M' type, 'N' type, Y-type, inverted-Y type etc. often shows additional features because in multi-level systems the presence of additional coherent radiation fields introduces additional coherence effects. The multi-level systems may be considered as a combination of more than one basic three-level systems. As for example, the inverted-Y type system is conceived of as a superposition of  $\Lambda$  and  $\Xi$  type systems [6-9]. Similarly the four-level Y-type system can be considered as a superposition of two  $\Xi$  type systems [10]. Agarwal and Harshawardhan discussed how transparency can be created in a two-photon absorption background. They also showed the possibility of enhanced two-photon absorption in presence of Doppler broadening [10]. Later, using a Y-type scheme Gao and co-workers demonstrated inhibition of absorption in Na vapor kept at 230°C [11]. B. K. Dutta *et al* discussed the effect of vacuum induced







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Original research article

## Microwave assisted gain in inverted-Y type atomic system

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### ABSTRACT

The probe response in four-level inverted-Y configuration shows gain without population inversion in presence of microwave field. At on-resonant probe field, switching between superluminal and subluminal probe propagation under the influence of microwave field is discussed in details. Both the bandwidth and sharpness of optical switching can easily be controlled by varying the microwave power. The switching action improves immensely if the control transition is chosen to be a Rydberg transition. The transient behavior of the atomic system ultimately settles into probe gain under the influence of the microwave field. A way of transferring population to the highest excited state through the application of microwave field is also discussed.

### 1. Introduction

Interaction between coherent electromagnetic fields and multi-level atomic systems leads to modification in the absorptive and dispersive properties of multi-level systems. Propagation of resonant or near resonant probe field through an atomic system is largely affected by the presence of a coherent control field which shares a common energy level with the probe field but excites a different transition path. Electromagnetically induced transparency (EIT) [1] is the result of destructive quantum interference between two transition pathways sharing a common energy level and is easiest to demonstrate in a three-level  $\Lambda$  type system [2] although one can find many reports on EIT in 'V' [3–4] and  $\Xi$  type systems [2,5,6] too. In multi-level atomic systems like Y type [7,8], inverted-Y type [9,10], N-type [11,12], M-type [13,14] etc. EIT has been achieved. Storage of light in Rb vapour under  $\Lambda$  type configuration was demonstrated experimentally by Phillips et al. [15]. Agarwal and co-workers discussed how lasing without population inversion occurs in a basic three-level  $\Xi$  type system in presence of a phase diffusing field as well as a chaotic field as the coupling field instead of a coherent control field [16]. They used this coupling field between the ground energy level and the intermediate energy level while the probe field is applied between the intermediate energy level and the uppermost energy level. In a later work Agarwal et al. demonstrated a way of controlling the light propagation from subluminal to superluminal through a three-level  $\Lambda$  type system by using a microwave field between the two closely spaced ground levels [17]. They also compared the group index variation in a Doppler free medium as a function of the Rabi frequency of the microwave field with that in a Doppler broadened medium. Li et al. demonstrated the dependence of probe transmission through Rb vapor on relative phases of optical and microwave fields [18]. The vapor cell contained Ne as buffer gas at 5 Torr pressure and the cell was kept within microwave cavity for efficient coupling of microwave field with Rb

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# An experimental and theoretical understanding of a UV photodetector based on Ag nanoparticles decorated Er-doped TiO<sub>2</sub> thin film

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## Abstract

Glancing angle deposition (GLAD) was employed to synthesise plasmonic Silver (Ag) nanoparticles (NPs) on the chemically prepared Erbium-doped Titanium dioxide (Er:TiO<sub>2</sub>) thin films (TFs). The impact of using Ag NPs on the morphological, optical, and electrical aspects of Er:TiO<sub>2</sub> TFs were sequentially analysed. From the field emission scanning electron microscopy (FESEM) image, the Ag NPs appeared spherical and uniformly distributed on the Er:TiO<sub>2</sub> TFs. The size (diameter) of the maximum number of Ag NPs was ~15 nm (calculated from FESEM image). Energy dispersive X-ray (EDX) spectra assured the presence of Ag NPs on the TFs. X-ray diffraction (XRD) pattern for Ag NPs decorated Er:TiO<sub>2</sub> TFs closely resembled the face centred cubic crystal structure of Ag NPs and body centred tetragonal Ag–O compound. The optical spectroscopy (UV–visible diffuse reflectance and photoluminescence) elucidated that the absorption of light was significantly enhanced in the UV–visible spectral range for the TFs in which Ag NPs were sandwiched between Er:TiO<sub>2</sub> TF layers (Er:TiO<sub>2</sub>/Ag NPs/Er:TiO<sub>2</sub>). The Schottky contact-based Au/Er:TiO<sub>2</sub>/Si photodetector (PD) and Au/Er:TiO<sub>2</sub>/Ag NPs/Er:TiO<sub>2</sub>/Si (plasmonic) PD were constructed. The plasmonic PD offered a better photo-responsivity of ~4.5 fold higher as compared to Er:TiO<sub>2</sub> TF-based PD upon 380 nm illumination under ~6 V bias. An increase in detectivity and a decrease in noise equivalent power was observed for the plasmonic device compared to Er:TiO<sub>2</sub> device in the UV region. A theoretical approach had been adopted to calculate the wavelength-dependent responsivity for both devices. Further, the important parameters like photoconductive gain, electron transit time and electron mobility were calculated by simulating the experimental responsivity curves of the devices. These parameters exhibited improvement in the UV regime for the plasmonic PD. The fast temporal response with short rise and decay time proves the excellent efficiency of the plasmonic UV PD.



# Detection technique for vitamin D<sub>3</sub> using Er-doped TiO<sub>2</sub> nanowire-based UV photodetector

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**Abstract.** Vitamin D<sub>3</sub> acts as a crucial biomarker for various diseases. Current methods for vitamin D<sub>3</sub> detection are time-consuming, expensive, and require trained personnel. We report a simple and cheap photodetector (PD)-based vitamin D<sub>3</sub> detection technique for the first time using Ag nanoparticles-covered Er-doped TiO<sub>2</sub> nanowires. The operational stability of the device was tested under the dark as well as the UV light illumination. Vitamin D<sub>3</sub> solution produced absorption bands at 222 and 280 nm, respectively. The PD current density varied from  $1.29 \times 10^{-4}$  A/cm<sup>2</sup> to  $1.74 \times 10^{-4}$  at -4 V for pure ethanol solution and 20 pg/ml D<sub>3</sub> solution, respectively (under 220 nm illumination). The average absolute current values were reduced from 3.25 nA (220 nm) and 2.9 nA (340 nm) for 5 pg/ml to 2.95 nA (220 nm) and 2.54 nA (340 nm) for 30 pg/ml D<sub>3</sub> solution, respectively. The current gradually increased up to 3.34 nA (220 nm) and 2.7 nA (340 nm) as the concentration was increased up to 80 pg/ml. The PD current/vitamin D<sub>3</sub> concentration decreases exponentially from 0.58 to 0.03 nA/g/ml for 5 and 80 pg/ml, respectively, under 220 nm excitation, from which an unknown concentration of vitamin D<sub>3</sub> can be obtained. © 2020 Society of Photo-Optical Instrumentation Engineers (SPIE) [DOI: 10.1117/1.JNP.14.046001]

**Keywords:** Er-doped TiO<sub>2</sub>; glancing angle deposition; nanowires; optoelectronic properties; photodetector; vitamin D<sub>3</sub> detection.

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## 1 Introduction

Lab-on-a-chip devices have been developed for the detection of bio-species<sup>1</sup> via electrochemical,<sup>2</sup> microelectronics-mechanical system (MEMS),<sup>3</sup> and photon detection<sup>4,5</sup> methods. The electrochemical and MEMS technology preferred direct contact of the biomolecules with the active medium of the sensors.<sup>3</sup> In case of biosensors, the sensing of biospecies can be done by changing the dielectric constant of the material medium under physical contact with the bio-specimen. So it can be manifested that the change of dielectric constant, as well as the resistance of the detection layer (material media) on interaction with the specimen, is the main principle for the analysis of biomolecules. Extraction of biospecimen from a human cell for the *in vitro* testing is painful and the reuse of the sensors are questionable.<sup>6,7</sup> The field-effect transistor-based biosensors are mostly studied for biospecimen sensing due to the changes in the capacitance,<sup>8</sup> or in the resistance (or current)<sup>9,10</sup> of the devices. In the above viewpoint, optical detection and imaging technology would be far more attractive to clinical researchers and biotechnology

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UNIQUENESS OF DIFFERENCE DIFFERENTIAL  
POLYNOMIALS OF L-FUNCTIONS CONCERNING  
WEIGHTED SHARING

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**Abstract:** In this paper, we mainly investigate the value distributions of difference differential polynomials of L-functions. Concerning small and rational functions sharing we prove uniqueness theorems on difference differential polynomials of L-functions. The results improve some recent results of W.J. Hao, J.F. Chen [3], W.Q. Zhu, J.F. Chen [17] and N. Mandal, N.K. Datta [10].

**AMS Subject Classification:** 11M36, 30D35

**Key Words:** meromorphic functions; L-functions; weighted sharing; uniqueness

### 1. Introduction

The Riemann hypothesis and its extension to the general classes of L-functions is the most important open problem in today's pure mathematics. In the modern number theory the L-functions play very important role.

$L(z) = \sum_{n=1}^{\infty} a(n)/n^z$  is said to be an L-function in the Selberg class if it satisfies the following assumptions:

- (i)  $a(n) \ll n^{\epsilon}$ , for every  $\epsilon > 0$ ;

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## UNIQUENESS OF L-FUNCTION AND ITS CERTAIN DIFFERENTIAL MONOMIAL CONCERNING SMALL FUNCTIONS

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**Abstract.** Concerning Small functions and weighted sharing we study the uniqueness of L-function and its certain differential monomial. Our results in this paper improve and extend some earlier results.

**Keywords:** L-function; uniqueness; small function; weighted sharing; differential monomial.

**2010 AMS Subject Classification:** 11M36, 30D35.

### 1. INTRODUCTION

For a long time a lot of attention have been given by many scholars on the Riemann hypothesis. The Riemann zeta function is defined by the following infinite series  $\zeta(s) = \sum_{m=1}^{\infty} 1/m^s = \prod_p (1 - 1/p^s)^{-1}$  where  $s = \sigma + it$ ,  $\sigma > 1$  and  $p$  denotes prime number and the product is taken over all prime numbers. Throughout the paper an L-function  $L$  means an L-function  $L$  in the Selberg class. Such an L-function is defined by  $L(s) = \sum_{m=1}^{\infty} a(m)/m^s$  satisfying the following hypothesis

(i) Ramanujan hypothesis: For every  $\varepsilon > 0$ ,  $a(m) \ll m^\varepsilon$ .

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## ON THE UNIQUENESS THEOREMS OF L-FUNCTIONS CONCERNING WEIGHTED SHARING

NIRMAL KUMAR DATTA AND NINTU MANDAL<sup>1</sup>

ABSTRACT. We mainly study the properties of L-functions using Nevanlinna value distribution theory in the extended selberg class. In this paper, we investigate the relationship between meromorphic functions and L-functions concerning weighted sharing with the help of Nevanlinna value distribution theory. We prove a uniqueness theorem of a meromorphic function and an L-function when they share  $(0, 0)$  and  $(1, 1)$ . We also get valuable information about the counting of the zeros of L-functions. The results of this paper improve some recent results of W. J. Hao and J. F. Chen [1].

### 1. INTRODUCTION

L-functions play very important role in the modern number theory. One common thing is that all the L-functions can be described by an Euler product. So all the L-functions can be described as a product taken over prime numbers. Considering unique prime factorization of integers we can represent L-functions as Dirichlet series. We may regard the famous Riemann zeta-function,  $\zeta(z) = \sum_{n=1}^{\infty} 1/n^z = \prod_p (1 - 1/p^z)^{-1}$  where  $z = \sigma + it$ ,  $\sigma > 1$  and  $p$  denotes prime number and the product is taken over all prime numbers, as the prototype. We can get valuable information on the algebraic structure from the value distributions of the L-functions which is not obtainable by the elementary algebraic method. In particular, the distribution of zeros of L-functions is of special

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2020 Mathematics Subject Classification. 11M36, 30D35.

Key words and phrases. Meromorphic functions, L-functions, Weighted sharing, Uniqueness.

## Small Functions and Uniqueness of Difference Differential Polynomials of L-functions

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### Abstract

In this paper, we study the value distributions of L-functions in the extended Selberg class. We prove two theorems which shows how difference differential polynomials of L-functions and difference differential polynomials of meromorphic functions uniquely determined concerning weighted sharing of small or rational functions. Our results improve and generalize some recent results due to W. J. Hao, J. F. Chen [3], W. Q. Zhu, J. F. Chen [16] and N. Mandal, N. K. Datta [10].

**2010 Mathematics Subject Classification:** 11M36, 30D35

**Keywords:** Meromorphic functions, L-functions, Weighted sharing, Uniqueness.

### 1. INTRODUCTION

L-functions are the most important objects in the modern number theory. The Riemann hypothesis and its extension to the general classes of L-functions is the most important unsolved problem in pure mathematics.

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# Polynomial Sharing and Uniqueness of Differential-Difference Polynomials of L-functions

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## Abstract

In this paper, we study value distributions and uniqueness problems of differential-difference polynomials of L-functions. Considering polynomial sharing of certain differential-difference polynomials of an L-function with that of a meromorphic function we prove a uniqueness theorem which improve and generalize some earlier results due to Hao, Chen [4], Zhu, Chen [16], Mandal, Datta [10] and Datta, Mandal [2].

**Keywords and phrases:** Meromorphic functions, L-functions, Weighted sharing, Polynomial sharing, Uniqueness.

**2010 Mathematics Subject Classification:** 11M36, 30D35

## 1. INTRODUCTION

For the last 150 years the most important open problem in pure mathematics is considered to be the Riemann hypothesis and its extension to the general classes of L-functions. L-functions are most important objects in the modern number theory. Let a function  $L$  be defined by the Dirichlet series  $L(z) = \sum_{n=1}^{\infty} a(n)/n^z$  with  $a_1 = 1$  satisfying the axioms (i)  $a(n) \ll n^\epsilon$ , for every  $\epsilon > 0$ , (ii) there exists an integer  $k \geq 0$

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# Uniqueness Theorems Concerning Homogeneous Differential Polynomials of L-functions and Weakly Weighted Sharing

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## Abstract

In this paper, we prove some uniqueness results when a polynomial and a homogeneous differential polynomial of an L-function weakly share a rational function. Our results improve and generalize some earlier results due to Mandal, Datta [10].

**Key words and phrases:** L-function, meromorphic function, uniqueness, weakly weighted sharing, homogeneous differential polynomial.

**2010 Mathematics Subject Classification:** 11M36, 30D35

## 1. INTRODUCTION

In 1992 a model for L-functions is introduced by Selberg. The study of value distributions of L-functions is mainly concerned with the set  $\{z \in \mathbb{C} : L(z) = a\}$  where  $a \in \mathbb{C}$ .

A meromorphic function  $L$  is said to be an L-function in the Selberg class if it satisfy the following properties.

- (i)  $L(z)$  can be expressed as a Dirchlet series  $L(z) = \sum_{m=1}^{\infty} a(m)/m^z$ .
- (ii)  $|a(m)| = O(m^\epsilon)$ , for any  $\epsilon > 0$ .

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## UNIQUENESS THEOREMS CONCERNING L-FUNCTIONS AND WEAKLY WEIGHTED SHARING

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**Abstract.** In this paper, we establish some uniqueness theorems when  $p(L)$  and  $P(L)$  share “ $(R(z), l)$ ” where  $p$ ,  $P$  and  $R$  denote polynomial function, homogeneous differential polynomial function and rational function respectively and  $L$  denotes an L-function in the extended Selberg class. Our results improve and generalize some recent results due to Mandal, Datta [11].

**Keywords:** L-function; meromorphic function; uniqueness; weakly weighted sharing; homogeneous differential polynomial.

**2010 AMS Subject Classification:** 11M36, 30D35.

### 1. INTRODUCTION

A model for L-functions is formulated by Selberg in 1992. The study of value distributions of L-functions is mainly concerned with the set  $\{z \in \mathbb{C} : L(z) = a\}$  where  $a \in \mathbb{C}$ .

An L-function  $L$  in the Selberg class is a meromorphic function satisfying the following properties.

(i)  $L(z)$  can be expressed as a Dirichlet series  $L(z) = \sum_{n=1}^{\infty} a(n)/n^z$ .

(ii)  $|a(n)| = O(n^\varepsilon)$ , for any  $\varepsilon > 0$ .

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# Uniqueness Theorems Concerning Homogeneous Differential Polynomials of L-functions and Weakly Weighted Sharing

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## Abstract

In this paper, we prove some uniqueness results when a polynomial and a homogeneous differential polynomial of an L-function weakly share a rational function. Our results improve and generalize some earlier results due to Mandal, Datta [10].

**Key words and phrases:** L-function, meromorphic function, uniqueness, weakly weighted sharing, homogeneous differential polynomial.

**2010 Mathematics Subject Classification:** 11M36, 30D35

## 1. INTRODUCTION

In 1992 a model for L-functions is introduced by Selberg. The study of value distributions of L-functions is mainly concerned with the set  $\{z \in \mathbb{C} : L(z) = a\}$  where  $a \in \mathbb{C}$ .

A meromorphic function  $L$  is said to be an L-function in the Selberg class if it satisfy the following properties.

- (i)  $L(z)$  can be expressed as a Dirchlet series  $L(z) = \sum_{m=1}^{\infty} a(m)/m^z$ .
- (ii)  $|a(m)| = O(m^\epsilon)$ , for any  $\epsilon > 0$ .

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## Optical, structural, and antibacterial properties of biosynthesized Ag nanoparticles at room temperature using *Azadirachta indica* leaf extract

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Ag nanoparticles  
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### ABSTRACT

We report an enhancement of antibacterial properties of Ag nanoparticles (NPs) synthesized at room temperature using leaf extract of *Azadirachta indica* (Neem) following green synthesis route. To study such antibacterial properties Ag NPs of sizes within 9 nm to 17 nm were synthesized by varying the concentration of Neem leaf extract (NLE). The NP size and size distribution were seen to increase and decrease, respectively, with increase in NLE concentration. Also Ag NPs having a fixed size (~26 nm) was also synthesized by varying the precursor (AgNO<sub>3</sub>) concentration. It is noticed that concentration of NLE has significant effects on the control of NP size as well as size distribution whereas there is almost no role of precursor concentration of the NP size. All the Ag NPs are found to have face-centred-cubic crystal structure with preferential growth along (111) plane which is stable one. The peak of X-ray diffraction at ~32.4° (2θ value), which is prominent for low concentrations of NLE and precursor, is identified as (101) plane of Ag crystal. The generation and growth of Ag NPs had also been confirmed using electron microscopic studies. These Ag NPs show prominent surface plasmon resonance (SPR) absorption at ~ 420 nm confirming again the genesis of Ag NPs. The SPR peak shifts towards longer wavelength (redshift) with a corresponding reduction in full width at half maximum with increase in NP size. All of the samples containing Ag NPs show a broad blue photoluminescence (PL) emission at ~ 471 nm. Emission peak is seen to redshift with increase in NP size and is consistent with the optical absorption data. Such PL emission is argued as due to interband transition or plasmon luminescence. Being biocompatible of the green synthesis process, antibacterial properties of these Ag NPs were studied in details considering all the samples (with varied NP size for one set and with fixed NP size for other set of samples). As per our knowledge this is the first report of size related total study of Ag NPs, showing increased antibacterial effect as size decreased and equal antibacterial effect as size equals. It is found that smaller Ag NPs has enhanced antibacterial effects due to large surface area to volume ratio in comparison with bigger sized Ag NPs.

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## مكانة الحديث والسنة عند الإمام الفراهي

- السيد رضوان أحمد الإصلاحي<sup>1</sup>

ترجمة من الأردوية: د. محمد معتمم الأعظمي<sup>2</sup>

إن الحديث والسنة أهم مصادر الشريعة الإسلامية بعد كتاب الله، ولقد اهتم المحدثون بالحفاظ على أقوال وأفعال ومواقفات الرسول ﷺ، وليست هذه خدمة جلية للمسلمين فحسب، بل هي مساهمة انفردوا بها ولا تستطيع البشرية أن تقدم نظيرها في تاريخها الطويل، ولكن على الرغم من ذلك هذا واقع أن مستوى بحث جميع كتب الأحاديث ليس متساوياً، وبما أن الحديث والسنة يتعلقان بأصول الإسلام فعزوا قول أو عمل أو موافقة إلى الرسول ﷺ أمر خطير، وإذ جعلت أصول الرواية هي المستوى الوحيد لقبول الحديث غفلوا عن أصول الدراية عامة، وقد قُررت الرواية أيضاً معياراً لقبول النص والاستدلال منه حتى بعد جمع الحديث، ولم توجه عناية خاصة إلى الدراية. حتى اهتموا بالشروح والتعليقات حال اختلافها. وهذا أسفر عن أهمية المصطلحات وعم الاتجاه بين عامة المسلمين بأن تقبل الأخبار كلها التي جاءت بكلمة "حدثنا" و"أخبرنا" ولا يُسمح لأحد بالتفحيص في هذا الصدد مما أدى إلى نشر سوء فهم الدين بين الأمة، وهكذا وقع الجمود في نقد الأحاديث، فقد بذل العلامة الفراهي أكبر جهد في كتابه "إحكام الأصول بأحكام الرسول" للقضاء على الاتجاه التقليدي القديم في الأصول، ولتقديمه

<sup>1</sup> أحد المتخرجين من مدرسة الإصلاح وأمير الجماعة الإسلامية لولاية بيهار، الهند

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## دور علماء مدرسة الإصلاح في تطوير الصحافة العربية في الهند

- د. محمد معتصم الأعظمي<sup>1</sup>

تاريخ الصحافة العربية في الهند غير المنقسمة بتبديء من المجلة الأسبوعية "النفع العظيم لأهل هذا الإقليم" التي صدرت في السابع عشر من شهر أكتوبر 1871م تحت رئاسة الشيخ مقرب علي<sup>2</sup> وإدارة تحريرها الفخري. جي. دبليو. ليتنر (G.W. Leitner). ومنذ تلك الفترة صدرت مجلات عديدة من الهند وباكستان بعض منها توقفت بينما البعض يستمر صدورها.<sup>3</sup>

مدرسة الإصلاح مدرسة إسلامية تأسست لنيل الاختصاص في القرآن الكريم وعلومه. وكان من مؤسسيها ومنشئها العلامة شبلي النعماني والإمام عبد الحميد الفراهي، وكل منهما كان عالماً كبيراً للغة العربية وشاعراً لها. ولقد تطوّرت المدرسة تطوّراً كبيراً تحت إدارة الإمام عبد الحميد الفراهي رحمه الله تعالى.

درّبت هذه المدرسة وخرّجت علماء كباراً وأدباء بارزين وشعراء مفلقين لمختلف اللغات قاموا بتقديم خدمات جليلة في مختلف المجالات العلمية والأدبية والفنية مما يطول بذكرها المقال. ففي هذه العجالة نركّز حديثنا على خدماتهم في مجال الصحافة العربية.

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<sup>2</sup> سليم الرحمن الندوي: الصحافة الإسلامية في الهند تاريخها و تطورها، ص 81 وأيوب تاج الدين الندوي: الصحافة العربية في الهند نشئها وتطورها، ص 83

<sup>3</sup> المصدر نفسه، ص 3 وسليم الرحمن خان الندوي: الصحافة الإسلامية في الهند تاريخها وتطورها، ص 81

## المعاهد التعليمية التي تعلم فيها البروفيسور فيضان الله الفاروقي رَحْمَةُ اللَّهِ

- د. محمد معتمم الأعظمي<sup>1</sup>

إن الأستاذ فيضان الله الفاروقي بن السيد سبحان الله كان ينتمي إلى مديرية أعظم كره من ولاية أوترا براديش (الهند)، ولد في الـ5 من يوليو 1952م<sup>2</sup> في قرية كوئربار (Koeriyāpār)<sup>3</sup>، وبدأ دراسته من قريته حيث شدّ من العلم وتعلّم اللغة العربية ثم التحق بـ"دار العلوم" مئونات بهنجن 3 ذي الحجة 1376هـ في الصف الثالث من الأردوية ولم يبلغ السادسة من عمره ودخل في الصف السادس من الفارسية في 12 شوال عام 1379م ثم تم قبوله في الصف الأول من العربي عام 1387هـ فدرس كتب الأدب العربي وعلوم القرآن والأحاديث والفقه وما إلى ذلك من 1962م إلى 1965م ثم التحق بـ"إحياء العلوم"، مباركفور، ودرس الكتب العربية للصفوف المتوسطة ومكث بها من 1965م إلى 1967م ثم التحق بـ"دار العلوم"، ديوبند في عام 1967م وشفى غليله العلمي فيها متخرجاً منها عام 1968م ثم التحق بـ"كلية شبلي"، أعظم كره بالكالوريوس وحصل على الشهادة عام 1974م. ثم ذهب إلى مدينة إله آباد والتحق بـ"جامعة إله آباد" وحصل على شهادة الماجستير في اللغة العربية عام 1976م وكذلك حصل منها أيضاً على شهادة الدكتوراه عام 1984م.

وانتهى هنا زمن تعليمه، وبدأ يعلم ويفيد الطلاب والباحثين. وفيما يلي تعريف وجيز بالمدارس والمعاهد التي درس فيها الأستاذ الفاروقي:

أولاً: المدرسة الإسلامية العربية دار العلوم بمدينة مئونات بنجن: تعتبر "المدرسة

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<sup>2</sup> بينما ذكر تاريخ ميلاده في سجل موجود في دار العلوم بمدينة مئونات بنجن 4 يونيو 1950م

<sup>3</sup> الواقعة الآن في مديرية مئو بولاية أوترا براديش، الهند

## الملا نظام الدين مخططاً للمناهج الدراسي النظامي

- العلامة شبلي النعماني<sup>1</sup>

ترجمة من الأردوية: د. محمد معتصم الأعظمي<sup>2</sup>

إنّ المنهاج الدراسي لتعليم اللغة العربية الموجود في جميع أنحاء الهند اليوم يُعرف بـ"النظامية" ولكن يدهشنا أنّ معظم الناس لا يعرفون متى وُضِعَ هذا المنهاج الدراسي ومن واضعها؟ ونُسبَ إلى نظام الملك وزير الدولة السلجوقي في مقال حديث، وأما العلماء القدامى فهم يعرفون أنّ مخطّطه الملا نظام الدين اللكاوي، لكنهم لا يعلمون أكثر من هذا.

ونظراً للدرجة التي بلغها الملا نظام الدين والسمعة التي نالها من أجل هذا المنهاج التعليمي كنت أتطلع منذ مدة بعيدة إلى معرفة ظروفه التفصيلية، ولكن تسجيل سير كبار العلماء لم يكن رائجاً، فلم أكن أتوقع تحقيق أمنيّتي، وقد ذكره مير غلام علي آزاد جملاً في كتابه "سبحة المرجان"، وهو غير كاف. وبعد بحث طويل وجدت كتيباً للشيخ ولي الله الفرنكي محلي (محمشي صدر) ناقش فيه حياة الملا رحمه الله لكن الأحوال الحقيقية قليلة جداً، إنّما هو ديوان لمعجزاته وعاداته وهو غير مناسب لزمنا هذا.

ومع ذلك، في سياق "لا يدرك كله لا يترك كله" أقدم عرضاً موجزاً لسيرته الذاتية للقارئ.

أحوال العائلة: مقاطعة شهيرة من أعمال لكناؤ كثيرة السكان هي "سهالي" والتي

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<sup>2</sup> نائب مدير تحرير المجلة ومدرس، قسم اللغة العربية وآدابها، سيوري فيديا ساغر، بنغال الغربية، الهند