

3.3.2 Number of research papers per teacher in the Journals notified on UGC website during the year (2020-2021)

Ans.: 29 papers during the year (2020-2021)

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Effect of Green Synthesized Cuprous Oxide Nanoparticles on Agronomical Traits Of Tomato (*Lycopersicon esculentum*)

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1. INTRODUCTION

Nanotechnology has transformed many frontages of the current society with its widespread applications in field of agriculture. Nanoparticles are among likely contenders for modulating redox status there by altering the performance, quality and development of plant [1]. Hence germination is critical for deciding the plant density at the end, whenever planted; seeds should be able to germinate entirely and vigorously. Phytotoxicity of higher plant ought to be explored so as to build up far-reaching toxic profiling of nanoparticles. Seed propagation and root system growth is a very quick process and is generally utilized intensely for phytotoxicity test which is attributable to simplicity, sensitivity, low price and appropriateness for unstable chemical compounds [2].

Tomato (*Lycopersicon esculentum*) is a common vegetable of economic significance and is recognized as a classical plant as it contains a variety of secondary metabolites that can encourage biological, chemical and physiological examinations in expansion to an elective typical plant *Arabidopsis thaliana* [3]. Tomato is a perfect plant for numerous studies as it can proliferate in laboratories with least structure as compared to what is used for *A. thaliana* [4].

The examination of antioxidants enzymes and its gene expression often tells about biotic and abiotic stress that occurs in the plant. The increased and decreased level of antioxidant enzymes tell about the development of reactive oxygen species (ROS) which is the indication of DNA damage in plant.

Hence the present study was focused to identify the role of cuprous oxide nanoparticles (Cu_2O NPs) in augmenting tomato plant growth with phytotoxicity effects

2. MATERIALS AND METHODS

2.1 Collection of Tomato Seeds and Sterilization

The PKM-1 Tomato variety seeds were procured from local market Bengaluru, India and were stored in a dry place for further use. Seeds immersed in distilled water for 10 min to check the viability. The floating seeds were discarded and the settled seeds were used for surface disinfection in 5% NaOCl solution for 10 min followed by 5-6 times washing in distilled water.

2.2 Preparation of Cu_2O NPs Solutions

Various concentrations of Cu_2O NPs [5] have been prepared directly by suspending Cu_2O NPs in distilled water and dispersed for 30 min using ultrasonic vibration.

2.3 Lab Experiments

To assess the impact of Cu_2O NPs, the experiment was conducted with three replications for every treatment. Two sets of experiments were conducted. The first set of experiment was conducted in laboratory to determine the effect on germination of seeds and seedling growth, the results were reported [5]. The second set was pot culture experiment.

2.4 Plant Growth Study in Soil

For the second set of experiment, 12h treated seeds were sown in module trays filled with peat moss and grown for 10 days. After 10 days, the tomato plants were removed carefully with intact roots, washed and placed in plastic cups containing different Cu_2O NPs solution for 12h. The treated and untreated 10 day old plants were transplanted to plastic pots filled with soil. Each treatment was represented by three pots with three tomato plant per treatment. After 20 days of transplanting, the tomato plants were studied for various parameters. For the experiment, the soil was collected from the agriculture farm land, top 5 cm

PRELIMINARY PHYTOCHEMICAL ANALYSIS AND ANTIOXIDANTS PROPERTIES OF *MYRICA NAGI*-A HIMALAYAN JEWEL

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ABSTRACT: *Myrica nagi*, popularly known as Kafal in Ayurveda is a crown of wild Himalayan region and used traditionally to cure several ailments. This study attains to understand the preliminary phytochemical analysis and antioxidant activity of different solvent (water and methanol) extracts of *Myrica nagi*. The preliminary phytochemical screening revealed the existence of alkaloids, flavonoids, glycosides, saponins, sterols, and tannins in both of extracts. Antioxidant activity was done using standard scavenging assays like 2,2-diphenyl-1-picrylhydrazyl (DPPH), FRP and H₂O₂. The result indicated that methanol as the most potent solvent for polyphenols extraction. The methanol extract found to have higher phenolic content and flavonoid content (95 ± 8.14 mg of equivalent gallic acid (GAE)/g; 118.74 ± 6.41 mg quercetin equivalent (QE)/g) than the aqueous extract (89.01 ± 8.26 GAE/g; 35.77 ± 0.14 QE/g), respectively. The methanol extract of *M. nagi* demonstrated the highest DPPH scavenging activity (IC₅₀ 29.62 µg/mL), at the same time the aqueous extract (IC₅₀ 22.54 µg/mL) showed minimum antioxidant impeding. To conclude, these results suggested that the methanolic extract from *M. nagi* leaves found to have more antioxidant prospective and serving a considerable basis of natural antioxidants for the traditional formulation.

KEY WORDS: *Myrica nagi*, antioxidant, extracts, methanol

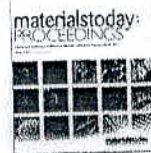
1. INTRODUCTION

Without oxygen, survival of human life is impossible. But, it can affect human beings by its different forms like superoxide anion, hydroxyl radical, hydrogen peroxide etc. known as ROS (Reactive oxygen species). It causes diseases such as asthma, dementia, carcinoma, arthritis and Parkinson's disease [1]. Normally, at small quantity these ROS and Reactive Nitrogen species (RNS) shows necessary physiological activities namely metabolism, programmed cell death, transportation of solutes etc. But, when the concentration exceeds the optimum, the risk factors also increases and it can cause various incurable diseases in humans like chronic inflammatory reaction, auto immune and neurodegenerative diseases, cardiovascular disease, diabetes, cancer [2,3].

Antioxidant is the best precaution taken for the above mentioned pathological conditions. It is the direct scavenger of ROS and RNS [2, 4]. Besides that, isolation of secondary metabolite having antioxidant property is one of the hot topics of the current research era. So, screening of medicinal plants is valuable for their antioxidant properties. The medicinal plants have been formulated to treat different diseases all over the world since time immemorial [5,6,7]. Now-a-days scientists are more attentive towards the natural products to synchronize their potentiality with traditional system of medicine and their scientific validation [7,8,9].

Most of antioxidant activity of different phytochemicals in nature is found in polyphenols [10]. However, polyphenols can change their properties while, processing of food and storage, where it can directly affect the stability of food. But in this era, people are facing a huge problem with synthetic antioxidants and that gave a chance to think about natural antioxidants [11]. So, plant derived phytochemical is the only hope for the adequate antioxidant in the body. Connecting to the present perspective, the aim of the study is to understand naturally occurring antioxidants and their scavenging activity of *Myrica nagi* which can further show a huge impact on the modern system of medicine by its medicinal properties.

Myrica nagi also called 'Box myrtle', a sub temperate evergreen tree. It is widely distributed all over the mid Himalayas, Khasia hills, Sylhet and southwards up to Singapore, Malay island and in China and Japan [12]. This evergreen and dioecious plant is a medium to large woody, 12-15 meters in height. Leaves are crowded



Characterization, anticancer, antibacterial, anti-diabetic and anti-inflammatory activities of green synthesized silver nanoparticles using *Justica wynaadensis* leaves extract

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ABSTRACT

In this experiment plant mediated method used to prepare silver nanoparticles using *Justica wynaadensis* leaf extract. The leaf extract solution reduced and stabilized the AgNO_3 into Silver nanoparticles. The synthesis of silver nanoparticles was observed by the colour reaction and monitored by UV-visible spectroscopy in the range of 400 nm to 500 nm for silver nanoparticles. The synthesized nanoparticles were subjected to characterization technique by using X-ray diffraction (XRD), Transmission Electron Microscope (TEM), Fourier Transform Infrared spectroscopy (FTIR). TEM analysis of the silver nanoparticles were found to be crystalline in structure, varying in size from 30 nm to 50 nm. The biological activities of Ag nanoparticles showed significant results against anti-bacterial, anticancer activity (Cell line A549). The anti-diabetic and anti-inflammatory activities of *Justica wynaadensis* Ag nanoparticles also has proved that it is a good alternatives in medicine and industrial application.

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1. Introduction

There is no doubt about the nanotechnology, which is very beneficial to man. The knowledge of the nanotechnology is applicable to micro-organisms to human body and medical to field to the industries, nanotechnology has retained its name in enhancing the treasure of knowledge possessed by the man. [1] The recent development in the biosynthesis of inorganic, metallic, oxide, sulfide and other typical nanoparticles were highlighted [2]. The utilization of these nanoparticles in the emerging field of medicine, Food industry, Pharmacy, Agriculture [3] imaging and nanotechnology etc, brought revolution in the life of mankind (Fig. 1, Fig. 2).

Several studies and many research techniques have been helping in developing new method of synthesizing Nobel metal nanoparticles, including chemical, physical biological and plant mediated synthesis. Out of all the green synthesis [4] is widely accepted because environmental friendly, cheap, without a stabilizing or reducing agent [5,6]. Whereas physical and chemical

methods require surfactants, solvents and reducing agents which has potential biological concern. Many scholars are working since the beginning on extracellular and intra cellular synthesis of noble metal nanoparticles using fungi, bacteria, yeast and many plants and parts of the plants [7]. According to WHO larger part of the world is dependent on the traditional system of medicine as resources of drug for health care [8]. The presence of biomolecules which is present in the plant extracts can be used as reducing agent to reduce metal ions to its nanoparticles in a single step green synthesis [9]. In recent days, different parts of the plant material have been extensively studied in this direction [10] such as extracts [11] fruits [12] bark [13] fruit peels [14] roots [15] callus [16] etc. For this study *Justica wynaadensis* leaf, locally called as "Maddu Thoppu" belongs to the family Acanthaceae is used for the synthesis of AgNPs. This herb is endemic to the rainforest region of the Western Ghats [17]. Common in Kodagu district of Karnataka state, India. The plants believed to be possessing numerous medicinal properties, twenty four compounds were identified [18]. The extract of this plant is consumed in the form of sweet dish in the monsoon season, believed to be having maximum medicinal properties which keep them healthy throughout the year. The use of

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Cuprous Oxide Nanoparticles Induced Antioxidant Response and Genotoxicity in *Lycopersicum esculentum*

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Abstract

High doses of copper (Cu) will cause hindrance in the plant development including structural, catalytic and regulatory activities in spite of the fact that copper is a basic and vital component for biological process in plants. The positive effect of cuprous oxide nanoparticles (Cu₂O NPs) might be due to firstly, by the prevention of damage to cell membrane, secondly by up keeping oxidation and expression of some antioxidant-related enzymes and enzymes like superoxide dismutase, glutathione peroxidase, catalase, polyphenol oxidase and aspartate aminotransferase (aspartate aminotransferase) which showed an antagonistic regulation in contrast with plant that were treated with 100 ppm Cu₂O NPs. Damage caused by cuprous oxide nanoparticles on tomato plant is measured with various cellular assays. The comet assay for DNA damage analysis revealed the nuclear DNA damage in different treatments of plants. The micronucleus assay showed the formation of micronuclei as a result of DNA damage and the increments in micronucleus were seen with increased concentrations of Cu₂O NPs. The per cent micronuclei induction was found to be 0.53 and 3.26 for 100 ppm and 1000 ppm Cu₂O NPs which is statistically significant. DNA fragmentation/apoptotic events occurring both in the control and treated leaves of tomato plants were assessed. DNA fragmentation was measured in a ROI by estimating fluorescence intensity. The per cent damage was found to be 2.16, 5.72 and 11.3, respectively, for control, 100 ppm and 1000 ppm Cu₂O NPs-treated samples.

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Large-scale production of enzymes for biotechnology uses

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Enzymes are biocatalysts that speed up the chemical reaction to obtain the final valuable product/s. Biotechnology has revolutionized the use of traditional enzymes to be applicable in industries such as food, beverage, personal and household care, agriculture, bioenergy, pharmaceutical, and various other segments. With respect to the exponential growth of enzymes in biotech industries, it becomes important to highlight the advancements and impact of enzyme technology over recent years. In this review article, we discuss the existing and emerging production approaches, applications, developments, and global need for enzymes. Special emphasis is given to the predominantly utilized hydrolytic microbial enzymes in industrial bioprocesses.

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Introduction

Biocatalysis is evolving into a powerful technology that is fast replacing chemical catalysis due to efficient kinetics, economic benefits, and eco-friendly alternatives. The last few decades have seen a drastic surge in commercial applications of enzymes in diverse sectors like food, agro, biofuel, pharmaceutical, textile, leather, cosmetics, waste management, and so on [1]. Nearly 75% of all the enzymes produced at an industrial scale are hydrolases and biotech. companies such as Novozymes, Dupont, DSM, Roche are at the forefront in the world enzyme market [2]. The global demand and trade for industrial enzymes is growing steadily and it is estimated to reach \$7.0 billion by 2023 [3]. Approximately 60% of industrial enzymes are produced from fungi, 24% from bacteria, 4% from yeast, and the rest 10% from plant and animal

sources [4]. Microbial enzymes however are preferred due to high yields, activity, reproducibility, cost-effective production, exponential growth, use of inexpensive media, easy optimization, and strain improvement [5]. It is also a rich biodiversity that can be explored to discover new enzymes using the latest technologies like metagenomics and genome mining.

A deeper understanding of enzyme engineering and integrated use of in silico analysis has not only increased the number of industrial enzymes but it has also improved efficiency and production. Nearly 90% of commercial enzymes are engineered [6]. Furthermore, efficient downstream processing and immobilization strategies, have immensely helped in increasing the stability, purity, and reusability of the enzymes. A couple of fine recent reviews giving a comprehensive view on this topic needs a mention for the benefit of readers [7,8**].

In this review, we deliberate on the emerging trends in the multidimensional design of bioprocess technology which include, bioprospecting, strain improvement, media optimization, bioreactor design, purification, extracellular secretory systems, enzyme immobilization, and whole-cell use that have greatly impacted the enzyme industry (Figure 1). We also discuss the use of this rational approach in improving the activity and production of hydrolases which are one of the most commercially exploited enzyme class. Table 1 recaps the hydrolases used in different sectors of the biotechnology industry.

Bioprospecting

Nature is a vast and abundant resource for harnessing natural biocatalysts. Conventional methods that combine standard microbiology procedures with whole-genome sequencing and proteomics have hugely helped in the screening and identification of thousands of enzymes from diverse microorganisms. These strains are deposited in many world-wide culture repositories (ATCC, NCTC, NCIMB, NCYC, CCM, JCM, etc) having easy access. With the advent of new generation sequencing, efforts are underway to acquire data on large metagenomes via programs such as the Earth microbiome project [9], Fungal genome project [10], Microbial genome sequencing project [11], Human microbiome project [12], Plant genome project [13]. The integrated approach where metagenomics along with the 'Omics' information [14], structural and biochemical data has opened a possibility to explore novel and diverse genomes of microorganisms and discover new enzymes with better features.



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A rhodamine based dual chemosensor: Colorimetric recognition of Zn^{2+} and fluorimetric recognition of Sn^{4+}

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ABSTRACT

The potential newly contrived, synthesized and attested rhodamine derivative for colorimetric detection of Zn^{2+} and fluorimetric detection of Sn^{4+} . The action of probe with these two metals results in commutation of optical property which has been ascertained to be sensitive, selective and hardly influenced by other metal ions. The Zn^{2+} induced absorption changes whereas the Sn^{4+} induced emission changes with the probe. This dual sensing effective probe can be used for detection of these two physiologically/environmentally important metal ions by dual mode detection i.e. Zn^{2+} by UV-Vis spectroscopy and Sn^{4+} by and fluorescence spectroscopy.

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1. Introduction

The design and development of optical chemosensors for the environmentally and biologically important metal ions is one of the emerging research areas in analytical chemistry. Among these, metal ions that are found to be more toxic to the human as well as animal life and lethal to the environment are found to be more of interest for this research. The two metal ions Zn^{2+} and Sn^{4+} are found to be both biologically as well as environmentally very important as the Zn^{2+} essential nutrient and Sn^{4+} are essential trace nutrient for human body [1,2]. The Zn^{2+} is second abundant transition metal in the human body and cofactor in more than 300 enzymes. It plays crucial role in various cellular processes like neurotransmission, signal transduction, cell immunity and gene expression as well as regulation [3]. The deficiency of it in the human body causes various health problems like neurological disorders, diabetes, cancers and reproductive dysfunction [4]. Similarly Sn^{4+} is an essential trace mineral in human as well as animal life. It plays major role in various cellular processes [5]. Its deficiency causes various disorders like poor growth and loss

of hearing and causes immunological and neurological disorders like gastrointestinal related problems like nausea, vomiting and abdominal pain [6]. Then release of these two into the environment is increased in these days due to their extensive applications in various fields' results in the contamination of water and soil [7]. It is very much necessary to assess the flux of these two metal ions in the environment so, development of sensitive and reliable techniques for monitoring of these metal ions are needed. Among various registered analytical methods fluorogenic sensing systems with appropriate probes are preferable because they are nondestructive, sensitive, rapidly performed and suitable for high throughput screening applications [8]. To till date so many fluorogenic probes has been reported for Zn^{2+} as well as Sn^{4+} ions [2,9–18]. However, the rhodamine family probes are extensively used as fluorogenic probes in recent years for various analytes [19]. These probes possess excellent photo physical properties like long emission wavelength, high quantum yields, great photo stability, and high excitation wavelengths [20]. So, many fluorogenic probes of rhodamine family have been reported for Zn^{2+} and Sn^{4+} ions [2, 9, 11, 17, and 18]. Recently, some authors reported single fluorogenic probe for monitoring more one analytes [21–25]. In these protocols one analyte possess shorter excitation wavelength and another analyte possess longer wavelength under similar conditions with the single probe. Interestingly, some reports are

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Original Research Article (Experimental)

Potential of herbal cocktail of medicinal plant extracts against 'big four' snake venoms from India

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Herbal cocktail

ABSTRACT

Background: Venomous snake bites cause acute medical emergencies and are fatal. India accounts for large proportion of snake-bite deaths globally. Medically important 'BIG FOUR' snakes of India are *Bungarus caeruleus* (krait), *Naja naja* (cobra), *Echis carinatus* (saw-scaled viper) and *Daboia russelii* (Russell's viper). Polyherbal formulations have been proved to be effective in treatment of diseases than a single formulation.

Objective(s): To evaluate aqueous ethanolic extract cocktail of *Azadirachata indica*, *Butea monosperma*, *Citrus limon*, *Clerodendrum serratum* and *Areca catechu* for antidote potential against BIG FOUR venoms in *ex vivo* and *in vivo* model.

Materials and methods: Anti-hemorrhagic and venom neutralization studies were performed in seven-day old chick embryo model for *ex vivo* studies. *In vivo* studies were performed using male Swiss albino mice for antivenom potential of herbal cocktail by performing anti-edematic, anti-hemorrhagic, anti-myotoxic activity, and venom neutralization.

Results: Herbal cocktail exhibited differential venom inhibition potential against four venoms tested. Hemorrhagic activity was completely neutralized by the herbal cocktail; myotoxic activities of krait and Russell's viper venom were neutralized; while anti-edematic activity was observed for krait and cobra venom. Herbal cocktail completely neutralized venom lethality (3*LD₅₀) of krait and saw-scaled viper venom.

Conclusion: Inhibitions of various venom components of all four venoms suggests presence of phytochemicals in herbal cocktail with therapeutic properties. Further studies would help in the development of a formulation as a first-aid towards treatment of snake bite victims.

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1. Introduction

Snake venom is a complex cocktail of majorly proteins (enzymatic, non-enzymatic proteins) and other components like inorganic ions, carbohydrates, lipids, amines and nucleotides found in minor quantities [1–3]. Synergistic effect of enzymatic and non-enzymatic components is responsible for clinical effects of venom.

Snake envenomation is a neglected tropical disease listed under Category A by the World Health Organization [4]. In India, 49,500 mortality occurs due to snake bite [5]. 'BIG FOUR' snakes of India

namely, *Bungarus caeruleus* (krait), *Naja* (cobra), *Echis carinatus* (saw-scaled viper) and *Daboia russelii* (Russell's viper) are medically important snakes, as they are responsible for highest mortality and morbidity.

Polyvalent anti-snake venom (PASV), sera obtained from immunized horse against BIG FOUR is the currently available treatment for snake bite in India [6]. However, factors like storage, side-effects induced, neutralization of only free circulating venom components, and decreasing efficiency of PASV over years has led to search for new alternate therapies to treat snake-bite [7–9].

Medicinal plants with anti-ophidian properties used in traditional system can serve as potential antidote or help in better treatment along with PVAS. Apart from these, studies also suggest that compounds from medicinal plants have the ability in treating

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Photocatalytic and electrochemical sensor for direct detection of paracetamol comprising γ -aluminium oxide nanoparticles synthesized via sonochemical route

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ABSTRACT

Aluminium oxide nano particles (Al_2O_3 NPs) were synthesized using simple but effective probe sonication method. The structural, photocatalytic, and electrochemical sensor properties of Al_2O_3 NPs were investigated by powder X-ray Powder Diffraction (PXRD), Scanning electron microscopy (SEM), Transmission Electron Microscopy (TEM), Fourier Transform Infrared Spectroscopy (FTIR), UV-vis Spectroscopy, and Electrochemical analyzer potentiostat. The impact of sonication on the physical properties of Al_2O_3 NPs was elucidated. From the powder X-ray diffraction (PXRD) studies the material exhibited a face centered cubic structure and γ phase with crystallite size in the range from 6 to 16 nm. The semiconductor behavior has been confirmed from the study of energy band gap via diffuse reflectance spectroscopy (DRS). The conductivity of the samples was studied by cyclic voltammetry (CV) and Electrochemical Impedance spectroscopy (EIS) in 0.1 M HCl and 0.1 M NaOH as aqueous electrolytes. The electrode exhibited specific capacitance of 0.866 F g⁻¹ and 0.488 F g⁻¹ at scan rate 10 mV/s in acidic and alkaline electrolytes, respectively. EIS measurements showed reduction in the charge transfer resistance in acidic electrolyte. Modified carbon paste electrode employing γ - Al_2O_3 NPs has sensed Paracetamol in both acidic and alkaline electrolytes. The electrode displayed high sensitivity for paracetamol detection under varying concentrations. A linear calibration curve for paracetamol detection was obtained with a limit of detection (LOD) 2.3602×10^{-3} mol/L. These results confirm that the γ - Al_2O_3 NPs are promising electrode material for sensing paracetamol with high electrode reversibility and as an excellent photocatalyst.

1. Introduction

Now a days, growing attention has been drawn towards the improvement of nano alumina particles for progressive engineering and industrial applications. Al_2O_3 has numerous metastable polymorphs like δ , θ , and χ phases, but the α - Al_2O_3 is considered to be thermodynamically most stable form of Al_2O_3 [1]. The alpha (α) phase along with gamma (γ), and amorphous (am) Al_2O_3 phases are of importance because

of their applications. As each structural phase is different, each form is characterized by distinctive band gap energies. The experimental band gap values reported for the α , γ , and am Al_2O_3 phases are 8.8 eV [2], 7.0–8.7 eV [3,4] and 5.1–7.1 eV [4], respectively. It is worth mentioning that the value of band gap is governed by the method of synthesis. For example, the am- Al_2O_3 film synthesized by atomic layer deposition (ALD) showed band gap of 6.2 eV [5], whereas the am- Al_2O_3 film, grown by spray pyrolysis route exhibited a band gap of 5.6 eV [6].

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DEVELOPMENT AND VALIDATION OF SPECTROPHOTOMETRIC METHODS FOR THE ASSAY OF MIRABEGRON IN BULK AND PHARMACEUTICAL FORMULATIONS

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UDC 543.42.062

Simple, sensitive, precise, and validated spectrophotometric methods have been developed for the assay of Mirabegron in bulk and pharmaceutical dosage forms. The techniques are premised on the oxidation of Mirabegron with slight excess of *N*-bromosuccinimide (NBS), and estimating the unconsumed oxidant by assessing the amount of unreacted NBS by amaranth dye (method A), safranin dye (method B), aniline blue (method C), and rhodamine B (method D) at $\lambda_{\max} = 530, 530, 610, \text{ and } 560 \text{ nm}$, respectively. Under optimum conditions, Beer's law was obeyed in the concentration range of 5–30, 10–60, 20–45, and 1–15 $\mu\text{g/mL}$ for methods A, B, C, and D, respectively. The proposed methods were validated in terms of specificity, linearity, range, precision, and accuracy. Furthermore, the limit of detection (LOD) and limit of quantification (LOQ) values were also calculated. The recommended methods were successfully applied to the determination of drug in pure as well as in dosage forms, without any interference from the common excipients present in pharmaceutical formulations.

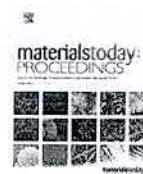
Keywords: mirabegron, *N*-bromosuccinimide, spectrophotometry, pharmaceutical preparations.

Introduction. Mirabegron (MRB) [2-(2-amino-1,3-thiazol-4-yl)-*N*-(4-2-((2*R*)-2-hydroxy-2-phenylethyl)amino)ethyl)phenyl]acetamide] is the first of a new class of compounds, a potent and selective β_3 -adrenoreceptor agonist used for the treatment of overactive bladder [1], with a mode of action that is different from antimuscarinic agents. MRB activates β_3 -adrenoreceptor on the detrusor muscle of the bladder to facilitate filling of the bladder and urinary storage [2]. Currently, MRB and solabegron are in phase I and phase II clinical trials for the treatment of overactive bladder [3]. A literature survey reveals that only three methods were developed and validated for the determination of MRB. The above techniques comprise LC-MS/MS [4], RP-HPLC [5], and spectrophotometry. Nevertheless, the reported methods, except spectrometry, necessitate expensive and sophisticated instruments and are tedious to perform in all quality control laboratories. They may not be within reach of most laboratories. Spectrophotometry is one of the most convenient analytical methods due to their simplicity, high sensitivity, cost effectiveness, and wide availability in all quality control laboratories. Therefore, the development and validation of new spectrophotometric methods for the determination of MRB that can overcome the drawbacks of the presented methods are essential.

The present paper illustrates rapid, simple, sensitive, accurate, and precise spectrophotometric methods for the determination of MRB in bulk and pharmaceutical dosage forms, followed by the evaluation of their biological activities. Only one spectrophotometric method was reported by Roopa et al. [6] for the validation of MRB. In continuation of our work on the pharmaceutical and biological importance of drugs such as cefepime, cefazolin sodium, and cefalotin sodium [7], risperidone [8], pyridoxine hydrochloride, dobutamine hydrochloride, and linezolid Form-1 [9], dobutamine hydrochloride

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MoO₃ nanoparticles based electrodes as novel electrochemical sensors for the detection of H₂O₂

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ABSTRACT

A rapid and facile method for the detection of hydrogen peroxide (H₂O₂) in chemical reactions has been reported using molybdenum oxide Nanoparticles (MoO₃ NPs) synthesized via an eco-friendly and economical solution combustion route using *Centella Asiatica* leaf powder. The formation of porous agglomerated NPs has been confirmed by subjecting the synthesized material to various analytical and spectroscopic techniques to understand their size, morphology, and nature. In this study, MoO₃ NPs-based electrode has been fabricated and its electrochemical sensing capabilities have been investigated. Electrochemical investigation of hydrogen peroxide exhibits an increase in the peak current response at pH 13. The cyclic voltammetry (CV) results indicate an appreciable reversibility of the electrode reaction. The anodic and cathodic peaks show a greater inclination towards the positive and negative sides with a significant development in the reversibility of the oxidation and reduction states. These findings open up new avenues for the exploration of various other metal oxide based NPs as sensors for the detection of chemically toxic substances.

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1. Introduction

One of the most important universal oxidants used in environmental, biological and industrial processes is hydrogen peroxide (H₂O₂) and monitoring H₂O₂ is of utmost significance, because of its applications in a variety of fields [1]. Hence, developing a highly sensitive, fast and cost-effective method to monitor the release of H₂O₂ is very essential. The contribution of electroanalytical methods to this effect is highly appreciable and quite a good number of studies have been reported in the past using various nano/micro materials and methods [2–9]. In the recent times, NPs have been widely used in the detection of small molecules such as H₂O₂, because of their interesting chemical and physical properties with which the sensitivity and selectivity of the sensors can be

enhanced. This nanoparticle is stable, biocompatible, offers higher surface area, and facilitates rapid electron transfer. Among the several NPs studied and reported in the past, MoO₃ NPs have attracted our attention because of its good chemical stability, faster redox process and simple process for the preparation of nano-sized particles. Because of its ability to exist in three different oxidation states, MoO₃ NPs can readily participate in redox reactions and present excellent electrical conductivity. Thus, MoO₃ NPs can act as superior electron redox mediators and effectively contribute to the electrochemical sensing of H₂O₂. Previously, researchers have modified MWCNTs and developed MoO₃-based amperometric sensors for the determination of H₂O₂ traces in milk with a high amount of accuracy. Several other researchers on similar lines developed a hybrid material combining graphene, CNT and MoO₃ and tested it as a non-enzymatic H₂O₂ sensor [10]. The electrocatalytic activity of those sensors were found to be very high and exhibited lower detection limits as compared to earlier reported

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Centella asiatica and its carbonaceous composites as novel materials for photocatalytic and electrochemical applications

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ABSTRACT

In the recent times, global interest on plant-based research has increased significantly. Through this article, a simple heat treatment method to synthesize Centella asiatica (CA) powder has been suggested. The synthesized samples have been subjected to various structural and morphological characterizations, in addition to electrochemical studies. Although the medicinal value of Centella asiatica is well known, its use in other applications is hardly explored. Hence, by combining the cyclic nature of CA and the layered structures of carbonaceous materials, composites of Centella asiatica with graphite powder, GO and rGO have been prepared for the first time and their photocatalytic and electrochemical properties have been investigated. In spite of some agglomeration and flake like structures, the nanosize (14 nm) of the prepared CA sample contributes largely to the aforementioned applications. One of the phenomenal aspects of the synthesized sample is that the low energy gap and high conductivity makes it an excellent photocatalytic material which is also evident from its ability to decolorize AO 8 dye under UV light to a great extent. Among the composites of CA-carbonaceous materials prepared, Centella asiatica-rGO exhibited superior electrochemical properties with high capacitance and low charge transfer resistance.

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1. Introduction

For over 2000 years, Centella asiatica has been used as traditional herb. It is a native of India, Malaysia, South Africa, Sri Lanka, and Madagascar. In India, it is described as Mandukaparni in Ayurvedic system of medicine that is used to treat diseases like skin, urethritis, asthma, bronchitis, gastric, leprosy and kidney troubles [1–3]. Studies on the aerial parts of Centella asiatica have revealed three new compounds namely, centellin, asiaticin and centellicin [3–4]. Centella asiatica contains pentacyclic triterpenoids, including asiaticoside, brahmioside, asiatic acid, and brahmie acid (madecassic acid). Other constituents include centellose, centelloside, and madecassoside [5–7]. Numerous benefits of this plant have been identified that exhibits anxiolytic and antidepressant [8–9]

related to nervous system and its recent *in vivo* and clinical studies have demonstrated the ability of CA to enhance the cognitive function [10–14]. In spite of Centella asiatica's varied biological properties that contribute to wound healing [15–18], its triterpene derivatives are an interesting part that seems to exhibit unique electrochemical properties because of the cyclic nature of the compound that unfortunately haven't been investigated in the past. Among the various carbonaceous materials, graphene is known to exhibit high surface area, excellent conductivity and capacitance, and has relatively low production costs [19]. By combining the cyclic nature of triterpene derivatives in CA and the sheet like structures of graphene based carbonaceous materials, an attempt has been made through this work to investigate the morphological changes in the (CA + Graphite, or GO or rGO) composites, effect of functional groups, and electrochemical behavior and their suitability to be used as electrodes for supercapacitor applications in aqueous media [20].

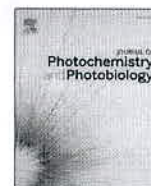
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Microwave assisted Biginelli cyclocondensation for the synthesis of dihydropyrimidinones catalysed by H₂SO₄–Clay NPs and their applications

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ABSTRACT

The Acid Modification of Bentonite clay (AMC) process was firstly reported and has been developed in one pot by ionic exchange of inorganic interlayer clay combined with different concentrations of acid (H₂SO₄) under Microwave irradiation. The maximum basal spacing of 28 Å was found in 2 M AMC clay confirmed PXRD analysis. EDAX micrographs of raw and AMCs showed the percentage of elemental analysis (H% = 38.21 for 2 M). Further, it was successfully applied in the Biginelli reaction of Dihydropyrimidinones (DHPMs) synthesis by cyclocondensation reaction under microwave irradiation and structurally confirmed by spectral techniques such as HNMR, C¹³NMR, FT-IR, Mass and UV-Visible absorption spectra. The yields of DHPMs are 88%, 90%, 92% and 92.6% for EMDHPM, EMNDHPM, EMMDHPM and EMHMDHPM respectively. The antimicrobial activity of synthesized dihydropyrimidinones was examined using Gram-positive (*Staphylococcus aureus*) and Gram-negative (*E. coli*) bacterial species showed efficiently inhibited the bacterial growth activities at 4 mg/mL concentration. The results confirmed that the newly prepared DHPMs compounds act as efficient antimicrobial agent and synthesized AMC material as potential catalyst.

1.0. Introduction

Currently, the heterogeneous catalysts are played a vital role in various organic syntheses. Therefore, the cost effective and essentially occurring clay materials are consisting layered structures, which are altered by acid treatment for various applications such as economical areas, and environmental activities [1,2]. Their specific properties such as smaller particle size and unique crystal structures of clay materials needs to utilize in various applications. The properties of clay materials can be modified by acid treatment and applied in the chemical synthesis. The acid cation distributions situated between the clay layers, which are easily substituted by other cations or ions. The isomorphous replacements occurs inside the clay layers like Al³⁺ exchanged by Mg²⁺ or Fe²⁺ in the octahedral sheet and Si⁴⁺ exchanged with Al³⁺ in the tetrahedral sheet leads to acquire permanent negative charges are balanced with replaceable cations (Na⁺ and Ca²⁺) [3–5]. These modification leads to very good platform for altering the physico-chemical properties that govern their performance as catalysts [6]. Therefore, AMC materials will

offer new usage for such chemical conversions. Chemically modified Bentonite clays are potentially considered as the most effective nano materials for organic synthesis. Several chemical reactions are catalyzed by homogeneous catalysts like H₂SO₄, HCl, HNO₃, pTSA etc., showed several environmental issues and these are replaced by solid catalysts such as zeolites, ion-exchange polymer, clays etc. [7–9].

Biginelli reaction protocol is evidently very interesting for combinatorial chemistry and most significant multicomponent condensation reactions [10] afford for the synthesis of DHPMs compound by single step reaction of β -ketoester with an aldehydes and urea under acid catalysis condition [11]. The catalytic potential of AMC acid-derived catalyst system was investigated for the three component reaction of β -ketoester, different types aldehydes, and urea to form 2,4,5-trisubstituted imidazoles [12]. DHPMs and its derivative compounds are heterocyclic components gaining significant attention due to their wide spectrum in industrial and biological applications such as anti-viral, anti-tumor, anti-hypertensive, antioxidant, anti-inflammatory agents, anti-bacterial, etc. [13,14]. Literature reveals that the different catalysts

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Secure Energy Efficient Geographical Opportunistic Routing for Wireless Sensor Networks

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Abstract – Design of Efficient routing algorithms is the most essential and prioritized task to improve the QoS in WSNs. There are mission critical applications which inherently demands high level reliability, security and energy efficiency. Existing Geographical opportunistic routing methods have attempted to increase the quality of these parameters by considering Packet Reception Ratio (PRR) and One_hop Packet Progress (OPP) of next hop node towards the sink. But these parameters alone cannot provide reliable, energy efficient and secure communication. In order to achieve better QoS we have designed and implement Secured Energy efficient Geographic Opportunistic Routing (SEGOR) for WSN. It is designed with an efficient mechanism by considering unique parameters such as Trust level, Residual energy, Energy requirement, Packet Reception Ratio (PRR) and Single-hop Packet Progress (SPP) at each hop from source to sink. This protocol provides more reliable, secured and energy efficient routing when compared to earlier works.

Keywords – Candidate Set, Geographic Opportunistic Routing, Trust level, Sensor Networks.

1. Introduction

Design of efficient QoS based routing protocol is a major issue due to scarce resources in WSNs. Dead-line-driven applications demands better QoS based routing algorithms to meet their basic requirements [1]. The energy efficiency in routing play an important role in extension of network life time, energy balance and network throughput [2-4].

Synchronized communication and reliability are the two major factors that has significant role in delay reduction process in a network. It is one of the challenging tasks to achieve better results of these parameters due to uncertain channel conditions and partial network failures. These conditions causes frequent changes in network topology and connection that introduces higher energy consumption and delay. These issues are addressed in some of the earlier works and have proposed different solutions to improve the timely communication and reliability [7-10]. Reliability and latency play crucial role in attaining better network throughput. Some of the earlier State-of-Art works have discussed these issues and proposed multipath routing schemes to enhance the values of these parameters to provide better QoS for WSNs [12-14]. But these schemes involve higher energy consumption, channel contention and interferences.

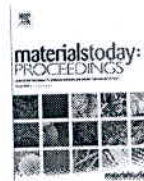
A. Motivation

Reliable data delivery is an important issues in WSNs. Achievement of the better security and the latency is another challenging task. In earlier works, the multipath routing techniques are used for secure and fast data transmission with minimum latency. But these techniques are unable to achieve the reliability to the required extent. The geographical Opportunistic Routing (GOR) technique is designed to provide reliable data transmission. But it results in poor energy efficiency and latency due to less significant parameters. Hence, it is necessary to device an efficient approach to maximize energy efficiency, reliability and minimize latency with most significant and relevant design



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DC conductivity of europium oxide doped alkali boro-tellurite glasses

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ABSTRACT

The DC conductivity of Eu^{3+} ions embedded in lead boro-tellurite glasses has been accomplished as a function of temperature in the range of 343–483 K. The Cole-Cole (Impedance) plots of glasses contained only one perfect semicircle at different temperatures. This realizes the material's conductivity which presumes an ideal Debye type relaxation. In the Cole-Cole plot at 483 K, the semicircle is well defined and fitted into an equivalent parallel RC circuit. The DC conductivity exhibits the Arrhenius behavior and compositional dependence. The DC activation energy (E_{dc}) was estimated for all samples by using linear regression analysis. The values range from 0.202 to 0.231 eV.

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1. Introduction

It is well known that oxide glasses comprising alkali ions like Li^+ , Na^+ and K^+ are fundamentally solid electrolytes, and current is conceded by moderately mobile alkali ions [1–4]. The presence and movement of alkali ions in glasses are most significant, not only due to their chemical durability and ion exchange kinetics but also because of its electrical conductivity. The review of the literature revealed that in the present era, considerable research is on-going on boro-tellurite glasses due to their extensive diversified applications in the field of optoelectronics, solid-state laser, optical amplifiers, optical device, and solid-state electrolytes [3–6]. These applications are specifically due to the unique properties of boro-tellurite glasses such as high transparency, high refractive index, relatively low phonon energy, slow crystallization rate, good mechanical strength, and long durability. Further, these glasses show good infrared transmission and less hygroscopic as well [5–8]. The electrical conductivity originated from polaron hopping can be identified in transition metal oxides (TMO) implanted glasses,

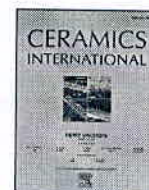
and the ionic conductivity can be acknowledged in alkali doped glasses. PbO as both glass former and network modifier can give stable glass with low rates of crystallization [9,10]. The rare-earth ions embedded in glasses affect the conductivity in them. The europium trioxide embedded glasses find their desirable applications in solid-state laser, optical amplifiers, display due to their sharp emission bands in visible and near-infrared regions [11,12]. The glasses exhibit enhanced mechanical strengths and moisture resistance with the addition of alkali oxides such as Na_2O and Li_2O . Na_2O is used to convert BO_3 triangular units into BO_4 tetrahedral units and hence makes structure more compact, which in turn leads to development in mechanical strength. Dielectric and structural studies on alkali oxides and heavy metal oxide ions doped borate glasses are reported in references [13–15]. Until now, only few transport property studies on alkali boro-tellurite glasses activated with Eu^{3+} ions are reported by others [1–3]. Therefore, in this paper, transport property studies have been investigated, and results are reported.

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Optical properties of bismuth tellurite glasses doped with holmium oxide

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ABSTRACT

The study of polarizability, optical basicity, and electric susceptibility carried out on the new and very rare set of bismuth – tellurite glasses doped with Ho^{3+} ions were fabricated by the conventional melt quenching process. The non-crystalline nature was confirmed by X-ray diffractometer measurements. Physical properties such as rare earth ion concentration, interionic distance, polaron radius, and average tellurium – tellurium separation were investigated by appropriate formulae. By UV absorption spectra, optical properties of Ho^{3+} ions doped glasses were found in the wavelength limit from 400 to 700 nm. The optical properties like optical dielectric constant, electronic polarizability, metallization criterion, electronegativity, optical basicity, and electric susceptibility were measured with appropriate mathematical relations. The impact of Ho^{3+} ions on nonlinearity in optical parameters discloses bismuth tellurite glass as a new applicant for holmium doped fiber amplifier applications.

1. Introduction

The significant properties of rare earth (RE) ion doped of glasses, such as physical and optical properties, have kind attention because of their promising and wide range of applications in laser technology and optical materials [1–3]. It is reported that emission efficiencies due to electrons transitions among 4f-4f and 4f-5d were considerably more in the glasses doped with RE's [4–6]. These type of transitions gives mainly intense patterns of fluorescence to the infrared region via ultraviolet (UV) [7,8]. Due to excellent advantages as high luminescent nature, infrared detectors, high-density memory storage devices, and optical communications REs doped glass materials currently have an exciting interest [9,10]. As reported in the earlier research, Ho_2O_3 doped glasses registered applications in X-ray imaging, infrared detection, telecommunication, and solid-state lasers [5,11–13]. Among the heavy metals, bismuth is one of the curious and extraordinary metal because of its non-toxic and harmless nature [2,8]. Oxide glasses having Bi_2O_3 in it have been intentionally studied for optical properties as a consequence of its function as both glass modifier and former. Bismuth shows considerable and voluble electronic applications due to the greater polarizability of Bi^{3+} [14–17]. Among boro-phosphate, boro-silicate, and boro-tellurite glasses, the tellurite glasses have greater non-linear and linear refractive indices, excellent transmission in IR regions, and low melting point, because of which tellurite glasses having useful applications as amplifiers in the field of optical fibers. The low melting

temperature, i.e., 600–800 °C, greater refractive index, chemical stability, physical strength, and non-linear optical properties, made bismuth tellurite glasses to have an immense magnitude in the making of optoelectronic devices [2,14,16].

In this current work, authors have been attempted to report the measurements and results of important optical, physical, and structural properties of holmium doped bismuth tellurite glasses.

2. Experimental procedures

Bismuth tellurite glasses doped with Ho^{3+} ions are fabricated through a conventional melt quenching technique. The chemical composition of these glasses is $85\text{TeO}_2 - (15-y)\text{Bi}_2\text{O}_3 - y\text{Ho}_2\text{O}_3$, where y takes the values of 0.0, 0.1, 0.2, 0.3, 0.4 & 0.5 mol %, and here onwards, the glasses are named as HBT0, HBT1, HBT2, HBT3, HBT4, and HBT5. The raw materials, Bismuth (Bi_2O_3), Tellurium oxide (TeO_2), and Holmium oxide (Ho_2O_3), having 99.9% purity by sigma aldrich in powder form, are weighed as per batch matrix. The homogeneous mixture of powder is then transferred into aluminum crucibles and kept inside the electrical furnace to heat up to 1100 °C for about 2 h. The obtained molten was sandwiched between two brass molds for quenching. The glass samples are taken for the annealing process at 390 °C over 2 h to remove thermal stress. The obtained transparent glass samples were cut into appropriate size and shapes, and then polished by using P1500 grade emery paper for different characterizations.

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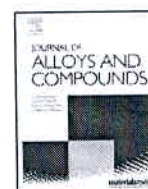
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Structural, thermal and spectroscopic studies of Europium trioxide doped lead boro-tellurite glasses

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ABSTRACT

Six glass samples composed of the $(70-y) \text{B}_2\text{O}_3\text{-}15\text{TeO}_2\text{-}10\text{Na}_2\text{O-}5\text{PbO-}y\text{Eu}_2\text{O}_3$, where $y = 0.0, 0.1, 0.2, 0.3, 0.4$, and 0.5 mol\% , have been synthesized by conventional melt quenching technique. The properties such as the structural, thermal and spectroscopic properties were studied by employing the suitable characterizations tools, such as X-ray diffraction, differential scanning calorimetry, Raman spectroscopy, fourier transform infrared spectroscopy, magic angle spinning nuclear resonance spectroscopy, scanning electron microscopy, and energy dispersive X-ray spectroscopy. The XRD, SEM and EDS confirm non-crystalline nature, micro-structural and homogeneous, absence of impurity of glass samples, respectively. The DSC data reveals the good thermal stability of glasses. The FT-IR and Raman studies reveal the contribution of boron and tellurium in the network of prepared glasses, the presence of BO_3 and BO_4 , a small amount of six-member boroxol rings, TeO_3 and TeO_4 structural groups. The MAS-NMR studies reveal the presence of quadrupolar interaction of BO_4 and quadrupolar broadening of BO_3 in all glasses and it also discloses the fact that only a small amount of BO_4 is converted into BO_3 during structural evolution.

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1. Introduction

The optimistic and attractive studies on borate-based glasses have been carried out since few decades due to their high-quality and desirable properties such as high rare-earth ions solubility, easy to prepare, good transparency, low melting point and low phonon energy. These properties of borate-based glasses are applicable in optics, shielding applications, optical device fabrication [1–3]. The borate glass network contains a well-defined gathering of BO_4 tetrahedra and BO_3 triangles to form stable borate units such as diborate, triborate, and tetraborate. This composes the random three-dimensional network [4,5]. It is well known that pure TeO_2 based glasses show a good moisture-resistant and transparency property [6–9]. It is shown that the metals and metal oxides containing tellurite based glasses exhibit relatively good optical [10,11], elastic [12,13], electrical conductivity and dielectric [14,15], thermal [16] and shielding [17] properties. It was reported that [18], the pure borate based glasses attain relatively high phonon energy in the

range of $1300\text{--}1500 \text{ cm}^{-1}$. Also, when these kinds of glasses contain TeO_2 and alkali oxide, they show significant drop in phonon energy of order $600\text{--}800 \text{ cm}^{-1}$. Also, it was showed that the high-quality glasses can be formed by addition of two good glass formers, like accumulation of TeO_2 into the borate network, gives better quality glasses with amended refractive index, transparency, physical, elastic and electric properties [2,19]. Besides, borate and tellurite based glasses illustrated high refractive index and great optical nonlinearity properties, due to which these glasses are used in the production of different innovative optical devices [20]. The verification of development in BO_4 tetrahedra groups and other structural groups could be acknowledged by referring to the change in the boron coordination number from three to four. It is reported that, due to the creation of non-bridging oxygen, trigonal pyramids (tpb) TeO_4 gets translated into trigonal pyramids (tp) TeO_3 [21,22].

The boro-tellurite glasses are special because they portray positive compromise with desired properties such as relatively great chemical durability, low phonon energy, good thermal stability, and easy to prepare [23]. The lead oxide activated borate-based tellurite glasses show wide glass-forming possibility and least capability of crystallization [24,25]. Rare-earth-doped oxide glasses reveal the

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Mechanical and Wear Characterization of Ceramic Boron Carbide-Reinforced Al2024 Alloy Metal Composites

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Abstract

In the present research, the effect of 44- μm -sized B_4C addition on the mechanical and wear performance of Al2024 alloy has been studied. The Al2024 alloy metal matrix composites reinforced with varying wt% (2, 4, 6 and 8) of B_4C particulates were fabricated by stir cast route. The synthesized composites were subjected to microstructural studies, mechanical and wear properties testing. Microstructural characterizations of obtained samples were carried out by SEM microscopy and XRD patterns. The presence of B_4C particles was confirmed by the XRD patterns. The hardness, tensile and compression strengths of metal composites have been enhanced with the addition of B_4C reinforcement. There was, however, a decrease in the ductility of the Al2024 alloy composite after the incorporation of the reinforcement. The wear behaviour of the prepared samples was tested at varying loads and speeds. The microcomposites exhibited superior wear resistance. Various fracture and wear mechanisms were observed in the Al2024– B_4C composites using SEM.

Keywords Al2024 alloy · B_4C particles · Microstructure · Hardness · Tensile strength · Wear · Fractography · Wear debris

1 Introduction

Al-based metal matrix composites (MMCs) are specifically used in aviation, transportation and protection applications because of its exceptional explicit quality, wear obstruction and fatigue opposition in contrast with traditional unreinforced materials [1, 2]. For Al-based MMCs, one of the basic prerequisites for the application is the formation of an enhanced interfacial bond between Al grid and fortification, which command the mechanical properties of the

composites because the load moves between the lattice and fortifications [3–5].

The expansion of support material into the metal lattice improves strength, stiffness, wear, creep and fatigue when contrasted with the regular engineering materials. Based on support materials, there are four categories of MMCs; particulate MMCs, short fibre-strengthened MMCs, continuous fibre-fortified MMCs and layered MMCs [6]. Earlier examines uncover that the use of consistent fibre-strengthened MMCs have been blocked by high-assembling costs related with the significant expenses of the fortification strands. Therefore, use of these materials has been constrained to military and other exceptionally precise applications. Despite the fact that fibre-strengthened MMCs have seemed to have great strength and thermal stability comparative with those of particulate fortified materials, the commercialization of these fortified MMCs has been delayed because of significant expenses related with immediately accessible fibres, faulted inner structure of stubbles and so on [7]. The particulate MMCs have as of late been utilized in different building applications in view of the simplicity of formability and moderately unassuming expense. Unequivocally, the particulate aluminium matrix composites (PAMCs) have been effectively utilized as segments in car, aviation, opto-mechanical gatherings, braking mechanisms of trains and

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INVESTIGATIONS ON MECHANICAL BEHAVIOR OF B₄C AND GRAPHITE PARTICLES REINFORCED AL2117 ALLOY HYBRID METAL COMPOSITES

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Keywords: Al2117 Alloy, B₄C-Graphite Particles, Stir Casting, Microstructure, Mechanical Behavior

ABSTRACT

In the present Investigation an attempt is made to develop and study the microstructural and mechanical properties of Al2117 hybrid metal composites. Al2117 alloy is used as the matrix material and B₄C and graphite particulates are used as the reinforcement. B₄C contributes high stiffness and hardness and Graphite contributes smooth machining property and acts as a solid lubricant. Stir casting technique is employed due to its easy setup, low cost, uniform dispersion of reinforcement. MMC is obtained by incorporating B₄C in varying % i.e., 3% and 6wt% and 5wt% of graphite is kept as constant. Microstructural study shows that the K₂TiF₆ increases the

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Paradigm change in Indian agricultural practices using Big Data: Challenges and opportunities from field to plate

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ABSTRACT

Agriculture is the backbone of the Indian Economy. However, statistics show that the rural population and arable land per person is declining. This is an ominous development for a country with a population of more than one billion, with over sixty-six percent living in rural areas. This paper aims to review current studies and research in agriculture, employing the recent practice of Big Data analysis, to address various problems in this sector. To execute this review, this article outline a framework for Big Data analytics in agriculture and present ways in which they can be applied to solve problems in the present agricultural domain. Another goal of this review is to gain insight into state-of-the-art Big Data applications in agriculture and to use a structural approach to identify challenges to be addressed in this area. This review of Big Data applications in the agricultural sector has also revealed several collection and analytics tools that may have implications for the power relationships between farmers and large corporations.

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Adhesive and abrasive wear behavior of Kenaf long fiber reinforced epoxy composites

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ABSTRACT

Polymers are widely used as replacement of convention metal components for various applications of engineering. In order to improve mechanical properties of polymers, fiber is introduced as reinforcing phase. In this work epoxy was used as polymer whereas Kenaf long fiber was used as reinforcement. This paper presents wear properties of alkali treated long Kenaf bast fiber reinforced epoxy composites. The weight percentage of reinforcement was increased from 10 to 40%. Hand layup technique was used to fabricate the composite plate. The results showed that wear strength is increased with increase in reinforcement. Both adhesive wear and abrasive wear behavior of Kenaf long fibers reinforced epoxy polymer composites were discussed. The adhesive wear experiment was carried out using pin on disc machine at different normal load and sliding velocities whereas abrasive wear experiment was conducted at different abrasive size particles using Olsen wearometer. Adhesive wear was conducted perpendicular to the direction of fibers and abrasive wear was conducted along the direction of fibers. From the experimental results, the 30% wt. fiber loading has best wear resistance both in adhesive and abrasive wear compared to rest of the composites.

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1. Introduction

Natural plant fiber reinforced polymer composites are newly developed composite materials as compared to the traditional synthetic fiber reinforced composites. In FRP composites, minimum one reinforcing phase is embedded in a single matrix. The FRP composites can exhibit good mechanical properties and energy absorbing characteristics. The FRP composites can be used in manufacturing of automotive, aircraft, ship and house hold components. The main purpose of adding natural fibers with matrix is to improve interfacial bonding strength and to reduce material removal rate in sliding action. The main disadvantage of plant fibers is high water absorption due to their structural compositions such as lignin, pectin, cellulose, hemicellulose and waxy elements which leads to poor bonding strength. The alternate way to increase bonding strength is surface modification by chemical

treatment. In the recent decades, FRP composites have tempted the researchers and scientists to study various properties because of their less density, light weight, low cost, ease of fabrication, easy availability, non-toxicity and renewability. Due to increased environmental regulations of the government, the development of renewable materials is growing day by day. In India, natural fibers such as jute, Kenaf, flax, hemp, banana, sisal etc. were abundantly available. Table 1, Table 2, Table 3.

Analysis of wear behavior of FRP composites is very important for the reason that wear and friction leads to failure of many machine components. Among four types of composites like metal matrix composites (MMCs), polymer matrix composites (PMCs), ceramic matrix composites (CMCs) and carbon-carbon composites (CCCs), PMCs are extensively used as engineering tribo-materials due to their high resistance to wear and corrosion and self-lubricating properties. The wear properties of FRPs are affected by various parameters such as fiber length, fiber orientation, fiber weight fraction, chemical treatment and operating conditions. With regards to the usage of FRPs in tribological applications such

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TECHNICAL ARTICLE—PEER-REVIEWED

Mechanical Fractography and Worn Surface Analysis of Nanographite and ZrO₂-Reinforced Al7075 Alloy Aerospace Metal Composites

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Abstract In the present research, an effect of nano-graphite and zirconium oxide (ZrO₂) dual reinforcement addition on the mechanical and wear behaviour of Al7075 alloy has been studied. The Al7075 alloy with constant 3 wt.% of graphite particles and varying (3 and 6) weight percentages of ZrO₂ particle-reinforced hybrid composites were fabricated by stir casting method. The synthesized dual particle-reinforced Al7075 alloy hybrid composites were subjected to microstructural studies, mechanical and wear properties testing. Microstructural characterizations of obtained samples were carried out by scanning electron microscopy. The graphite and ZrO₂ particles were evenly distributed in the Al7075 alloy matrix. The hardness, impact and tensile strength of hybrid composites have been increased with the addition of dual reinforcements. There was slight decrease in the ductility of the Al7075 alloy after the incorporation of these reinforcements. The wear

behaviour of the prepared samples was tested at varying loads and speeds. The hybrid composites exhibited a superior wear resistance as compared to base matrix alloy Al7075. Various fracture and wear mechanisms were observed in the Al7075 alloy with graphite and ZrO₂ particle-reinforced composites using SEM.

Keywords Al7075 alloy · Graphite · ZrO₂ particulates · Microstructure · Impact strength · Tensile strength · Wear

Introduction

The promising ideas for the cutting edge design of aeronautical and automotive ventures depend on the use of metal matrix composites (MMC's). Properties like low density, high strength, high stiffness, resistance against wear, fatigue and low coefficient of thermal extension (CTE) makes aluminium (Al) and its compounds increasingly reasonable over different other conventional materials [1, 2]. By adding earthenware particulates to framework metal gives new item which is an appealing combo of thermal, mechanical and basic properties.

The properties of MMCs are overseen and protected effectively by prime components, for example, matrix, support and interface [3]. Metals are having combination of properties, for example, high-temperature resistance, ductility and high strength with low stiffness. Since, ceramic particulates are stiff and furthermore strong. By adding these ceramic particles to the grid metal, composite material which has intermediate properties between reinforcement and matrix is produced [4]. Composite material properties depend on properties of constituent

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Electric Field and Potential Distribution of Porcelain Insulator using FEM Method

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Abstract: The porcelain insulators are investigated with the high voltage transmission line in outdoor condition. The MATLAB finite element simulation are used here to test the performance of the porcelain. The PDE software is helpful in modelling the porcelain insulator in two dimensional. The pollution layer in the porcelain assumed to be uniform. The simulation demonstrates the electric field and potential distribution in the porcelain insulator. The porcelain insulators have higher field distribution near to the high voltage line. The results are represented as graphs. The MATLAB 2017b comes with preinstalled PDE tool. In this paper the PDE tool is used for the results and analysis.

Keywords : Porcelain, Insulators, MATLAB PDE tool, Finite element method

I. INTRODUCTION

The power system reliability is one of the important security criteria to operate the power system reliable [1,3]. Generally ceramic insulators are used in power transmission lines for the insulation purpose. The insulators are facing problem as it is installed in the outdoors. The pollution is one of the major problems while installing the insulators [2,5]. In industrial and dustier or polluted area there is a commonly one layer is available on the insulator. The dry insulator usually remains unchanged. Due to rain another layer is formed with dust and this makes some leakage current [4]. This leakage current is responsible for the arcing and creates a flashover of the insulator [7]. So, determining the electric field around the surface is very important. This can help in the detection of faulty insulators [6]. Many other insulator related literatures [8-26] are helpful to make the model. This paper deals with the porcelain insulator electric field and potential field is analyzed with the high voltage and added pollution layer simulated in PDE software of MATLAB. The results are described in the upcoming sections.

II. STATEMENT OF PROBLEM

The power system requires a detailed simulation study before it is implemented. There are many simulation studies available to design the power system parameters like

electrical quantities such as Voltage rating, current rating, power rating of the varies devices. And also studying the impact of fault like security studies. But any of these described studies not including the physical parameters and environmental parameters. So, there is a problem in power system reliability when the transmission system insulators are placed in the out space. It has many impacts like due to rain, dust and temperature effects. To analyse these effects we go for Partial Differential Equation modelling of the devices which can analyse the electromagnetic effects with temperature change.

III. PROPERTIES OF THE MATERIALS

The insulators are usually manufactured with two components. The porcelain and glass which are dielectric components and used at the caps and pins. The housing of the insulators is built with the glass and porcelain and it has the better elative permittivity. To support the mechanical strength of the insulator her it requires the crimped fitting of dielectric material. The porcelain material and glass are the perfect insulator which has the les conductivity. The thickness of the pollution layer also added in the simulation and which is added to the conductivity of the material. It is assumed that it is spread over uniform on the insulator. The pollution layer conductivity of the pollution layer is taken from [9] which is a practical laboratory value. The parameters used in the insulator is depicted in Table I.

Table I: Porcelain and Glass insulator Dimensions

Material	Relative permittivity, ϵ_r	Conductivity, $\sigma(S/m)$
Air	1.0	1×10^{-15}
Porcelain	4.2	1×10^{-14}
Glass	4.2	1×10^{-14}
Steel	1.0	1.45×10^6
Cement	2.09	1×10^{-14}
Pollution layer	81	600×10^{-6}

The 50Hz and 11 kV system is used as the energized at the cap point of the insulator which is a high voltage level. The IEC 60507 standard says that the insulator in dry and wet condition the rms value is same. The 0V or ground is at the lower pin point. the air region is also considered larger and it also influences the insulator profile.

IV. RESULTS AND DISCUSSION

The finite element analysis is the predictive computer analysis for structures applied with vibrations, loads, heat and any other physical effects. This method makes the solutions to the boundary value problems with physics of PDE. It makes the geometries into computer grid or meshes or fill it will small triangles.

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FEM Based Electric Potential Distribution Analysis of Porcelain Insulator using MATLAB PDE tool

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Abstract: In high voltage transmission porcelain materials are important one. To mount the transmission line on a transmission tower we need an insulation material. Many literatures deal about the silicon and rubber-based insulators. In this paper the porcelain is modelled as FEM model using the PDE tool and electric potential distribution is analyzed. the PDE tool come in handy to draw the shape of the insulator. In this paper the straight shed and alternate shed insulators are analyzed with the MATLAB PDE tool and results are analyzed. then using some random water droplets in the insulator, the impact is observed.

Keywords: Porcelain Insulator, Partial Differential Equation, Finite Element Method, Potential Distribution Analysis

I. INTRODUCTION

To operate the power system in a protected environment then the power system is operated in reliable way. To ensure that power system protection is one of the important methods [1,3]. The power system usually has the generators, transmission and distribution. While transmitting the high voltage has to be transmitted. While transmitting high voltages the towers need a proper insulator. Usually the towers are used here with ceramic insulators. But as the power transmission is done on outdoors the contamination is more. The major problem is pollution on insulators [2, 5]. The dry insulators have no problem in performance. But if the insulators are contaminated while it is placed near the road ways then there will be dust and water droplets. If so then the current leakage may happen due to the water droplets [4]. This leakage current may create flashover due to arcing [7]. This makes the interruption of transmitting the power. Determining the electric field around the insulator with water droplets are important [6]. This analysis may show whether the insulators are in safe region even with random water droplets. Many literatures are used to understand the concept which are listed in [8-26]. In this paper the porcelain insulator is added with water drop. Then it is discussed with straight shed and alternate shed insulators. The electric field and potential field is analyzed with Partial Differential Equation (PDE) tool in MATLAB.

II. STATEMENT OF THE PDE PROBLEM

The power system requires a detailed simulation study before it is implemented. There are many simulation studies available to design the power system parameters like electrical quantities such as Voltage rating, current rating, power rating of the devices. And also studying the impact of fault like security studies. But any of these described studies not including the physical parameters and environmental parameters. So, there is a problem in power system reliability when the transmission system insulators are placed in the out space. It has many impacts like due to rain, dust and temperature effects. To analyse these effects, we go for Partial Differential Equation modelling of the devices which can analyse the electromagnetic effects with temperature change. By calculating the potential distribution, the electric field can be calculated. The field can be obtained by minus gradient of electric potential distribution.

$$E = -\nabla V \quad (1)$$

Using maxwell's equation

$$\nabla E = \nabla(-\nabla) = \frac{\rho}{\epsilon} \quad (2)$$

where, ρ - resistivity Ω/m

ϵ - dielectric constant of the material ($\epsilon = \epsilon_0 \epsilon_r$)

ϵ_0 - dielectric space constant ($8.854 \times 10^{-12} \frac{F}{m}$)

ϵ_r - relative dielectric material constant

Substituting equation (1) in (2) Poisson's equation is obtained as

$$\epsilon \cdot \nabla(\nabla V) = -\rho \quad (3)$$

Substitute $\rho = 0$ the equation (3) shows

$$\epsilon \cdot \nabla(\nabla V) = 0 \quad (4)$$

Cartesian system coordinates can be shown as equation $F(u)$

$$F(u) = \frac{1}{2} \int_D \left[\epsilon_x \left(\frac{du}{dx} \right)^2 + \epsilon_y \left(\frac{du}{dy} \right)^2 \right] dx dy \quad (5)$$

where, ϵ_x and ϵ_y are x and y components of the dielectric constant. u is the electric potential.

In the condition of isometric permittivity distribution by

substituting $\epsilon = \epsilon_x = \epsilon_y$,

Equation (5) can be reformed as

$$F(u) = \frac{1}{2} \int_D \epsilon \left[\left(\frac{du}{dx} \right)^2 + \left(\frac{du}{dy} \right)^2 \right] dx dy \quad (6)$$

$$F^*(u) = \frac{1}{2} \int_D \omega \epsilon_0 (\epsilon - j \epsilon \cdot \tan \delta) \left[\left(\frac{du}{dx} \right)^2 + \left(\frac{du}{dy} \right)^2 \right] dx dy \quad (7)$$

ω - angular frequency,

ϵ_0 - permittivity of free space

$\tan \delta$ - tangent of dielectric loss angle

u^* - complex potential

A linear variation of electric potential is assumed as shows below,

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Low light image denoising solution with contrast enhancement in curvelet domain using Gaussian mixture adaptation model

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Images captured under low light are noisy and consist of unidentifiable features. Low light noise problem occurs in imaging devices because of smaller sensor size or insufficient exposure. Low light image denoising is an exacting task in many image processing applications. This paper proposes a patch-based image denoising method for low light images in the curvelet domain with contrast enhancement. Curvelet transform is a directional transform and it gives the best sparse representation for images with edges. Here the Expectation-Maximization (EM) algorithm, based on the Gaussian mixture adaptation method is performed in the curvelet domain for denoising. EM Algorithm helps in computing the Gaussian mixture model (GMM) parameters from the patches which are used in maximum *a posteriori* estimation to update them. GMM parameters and patches are updated periodically until a satisfactory result is achieved. Simulation is performed on standard test data set, and then extended to natural low light noisy images. The results of the proposed technique are then compared using quality metrics such as Peak Signal to Noise Ratio and Structural Similarity Index. It is observed that the use of curvelet transform in denoising process helps to restore the structural information satisfactorily.

Keywords: Expectation maximization; curvelet transform; Gaussian mixture model; image denoising; maximum *a posteriori* estimation.

AMS Subject Classification 2020: 68U10, 91A08

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A NOVEL CHARACTERISTIC MECHANISM FOR DIFFERENT MICROSTRIP PATCH ANTENNA (MPA)

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ABSTRACT

Recent research is giving more interest in designing a high-performance antenna for different applications like satellite, missiles, spacecraft, etc. These antennas are low profile antennas operating at transverse magnetic (TM)-02 modes. Due to the minimum cost, simple fabrication process, configuration, and compatible features of microstrip patch antennas (MPA), the antenna designers are focusing on modifying these antennas to acquire even more improvement in wireless communication performance. However, MPA is impacted by low impedance bandwidth characteristics. Hence, various forms of researches have suggested incorporating U-slot in the MPA. This manuscript aims to present a novel characteristic mechanism for different microstrip patch antennas (MPA), including probe fed U-slot (i.e., single-slot, double slot, triple-slot) MPA as researches on this antenna are limited even though they are good at impedance bandwidth enhancement. The performance analysis of the single, double, and triple U-slot patch antenna is performed to achieve wideband characteristics for wireless communications. The proposed probe feed antenna is simple and doesn't involve any complications in the fabrication process. These antennas offer wideband characteristics without stacking and offering a bandwidth of nearly about 10 dB bandwidth.

Keywords: Bandwidth, Characterization, Microstrip patch antenna (MPA), probe fed MPA, Symmetrically located MPA, and U-Slot MPA.

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Review on Privacy Preservation Methods in Cloud Computing

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Abstract

Cloud computing is a pattern that procures contingent way of accessing the network and data is shared to a wide pool of gauge resources where entire infrastructure has shared by millions of users worldwide according to their demand. Even though upgrading in cloud computing technology organizations are slow in accepting it because of security issues which makes the cloud environment to be a origin of data breaching. Privacy is the major obstruction which prevents the adoption of public cloud infrastructure in a company. Some encryption techniques are proposed by many researches to ensure the privacy at some level in cloud. Many encryption methods are designed by researches to achieve privacy in cloud. In today's world the survey made by researches states that, in today's world no particular technique is successful in achieving complete privacy. This paper discuss various privacy preserving schemes in cloud and their comparative study where it gives the clarity on issues related to privacy and several methods to store and access data in cloud.

Keywords: Anonymization, Cloud , Data splitting, Privacy,

I. INTRODUCTION

Cloud computing is resistant to security risk [4], because it does not promote backup media, un bound connection to hijack. Cloud computing offers various model for information technology. This technology shares different resources like hardware's, software's and huge amount of information on cloud. As the user shares the information on the cloud, achieving privacy and confidentiality and is the major challenge in the cloud. The data or information published on the cloud contains much sensitive information about many people. The database may be hospital database, bank database. Several public and private firms share their organizational database on the cloud for many different purposes. This database may help many hospitals to track the patient's database, bank database to monitor their customers. All these database contains people sensitive information which should not be disclosed. It is very much essential to conserve the users and data preservation in cloud. As there is a huge rise in the technology of cloud computing the concern for preserving the privacy is also increasing. The data privacy must be achieved when sharing the information with third party and storing the same data over a cloud for long duration of time. There are many different mechanisms like encryption techniques, data anonymization, access control etc[20]. are available to resolve many privacy preserving issues in multi tenancy support, identity management of cloud users to reduce the privacy risk. Several privacy preserving techniques are discussed in this Survey to show how the privacy is preserved and what are all the methods involved in preserving the privacy.

Evaluation of Supervised Machine Learning Algorithms for Intrusion Detection in Wireless Network using KDDCUP'99 and NSLKDD datasets

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Abstract

The Security of computers is a fundamental part of present-day life. The security principles remain the same whether a computer is a single node or a stand-alone system in a large corporate network. Since the nature of wireless networks is to communicate with unknown devices it presents unique security challenges and, they are more vulnerable to attackers. If this property of wireless networks is disabled by completely nullifying the amount of flexibility provided by this communication medium then no new hosts can join the network. Intrusion Detection System (IDS) becomes an interesting topic in research and particularly in the machine learning field for computer network communities. The quality of the data collected from the network traffic is an important aspect of this research area. Most importantly the majority of current IDS are data-driven. The intrusion detection experiments for this paper are conducted using the most popular datasets KDDCUP'99 and its derivative NSL-KDD, to improve the existing classification methods. Various Machine Learning (ML) classifiers are trained using these two datasets and their performance is recorded to conduct a vigorous collation of both.

Keywords: KDDCUP'99, NSL-KDD, Naïve Bayes (NB), Random Forest (RF), Support Vector Machine (SVM), K-Nearest Neighbor (KNN), True positive (TP), False Negative (FN), False Positive (FP), True Negative (TN), Intrusion Detection System (IDS).

1. Introduction

Wireless networking systems are quick, simple, and their deployment cost is less and hence they are getting universal. They are invading in every aspect of our lives and are widely used to transfer critical information, like e-mails, social network credentials, banking accounts, credit cards, etc. The more wireless technology becomes unavoidable, the more significant its security issue will be. Network security is the degree of protection given to any network or system. The main objectives of any security system are Integrity, confidentiality, and availability of data over the network[1]. Network attacks are growing exponentially and are extremely dangerous in this modern era which is referred to as Intrusions. A large number of companies, national governments, and clients that use the internet are at risk of cyberattacks. Subsequently, one of the challenging issues in cybersecurity research is creating sophisticated advanced techniques to identify novel intrusions on the network. Cybersecurity is a set of technologies and procedures intended to secure computers, networks, programs, and data from attacks and to protect from unauthorized access, alteration and destruction. There started an exponential growth in the number of users who access the Internet through different networks for various activities with the introduction of the World Wide Web and E-Commerce giants. In the long run, this prompted privacy and security issues. Intrusion can lead to information inferiority in cyberwar by compromising the IT critical infrastructure and can also cause huge losses financially. Hence, intrusion detection is very supreme in any networking system and its prevention is also obligatory. IDS continuously monitor the system and helps in resisting external attacks.

The wireless networking landscape is experiencing a significant revolution. It might be computationally expensive for a hacker to hack a modern wireless network, but the task is by no means impossible. The smartphone-centric networks that desegregate a heterogeneous collection of wireless-enabled devices which include sensors, wearables, smartphones, connected vehicles, virtual reality devices, and drones are gradually adapting into an Internet of Things (IoT) ecosystem [2]. This revolution in the

Machine Learning Technique for Identifying Ambiguities of in Software Requirements

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Abstract

Generally most of the requirements are expressed in Natural Language. Walkthroughs, reviews and inspections are the methods currently used in the industries to identify ambiguities, inconsistencies. We have difficulties identifying ambiguities and have the tendency to overlook inconsistencies in large Natural Language requirements. A reviewer may ignore some errors while going through the requirements because he might assume that the first interpretation of the software requirements document that understood by him is the intended interpretation, unaware of the other possible understanding. He unconsciously disambiguates an ambiguous requirement. Currently most of the automation tools are in the nasal stage. Options are open for research as to how to reduce ambiguities in software requirements. The proposed method is to identify the number of ambiguities in software requirements during software analysis using Machine Learning, which in turn reduces errors and leads to a better product. It also helps to ease the job of the software analysts.

Keywords: Ambiguities, Machine Learning, Natural Language, Software Requirements

1. Introduction

Software have become a part of day to day life. The errors in the software lead to low quality software. To develop high quality software, the ambiguities in the software must be removed. The basic step is to start the removal of ambiguities in starting phase of software development. Removal of errors in the requirements analysis phase will reduce the propagation of errors to the later stages of the software development. These errors can be reduced by using various methods[14]. Unfortunately most of the methods are time consuming.

If there are ambiguities in the requirements, it leads to misinterpretation of the requirements and hence leads to low quality software products. Sometimes it may also lead to wrong products. Such requirements cause wrong design and wrong implementation of the product [2]. To develop high quality software these ambiguities must be reduced or removed. The software must satisfy the quality attributes [15].

2. Problem Statement

The software requirements are the ones which determine the software that should be developed. Software requirements analysis is the initial step in the software production. Requirements are collected from the stakeholders of the product; therefore, they are in natural language format. There are different methods for reviewing the contents of the software requirement. Most of these methods are manual[16]. Very few methods are automated but are in nasal state.

Lot of research must be done to reduce ambiguities in software requirements [12]. The motivation is to have high quality software in lesser time by having high quality software requirements. In this paper we have introduced a method to identify the ambiguities which are present in the requirements, so that the ambiguities can be removed to have good quality software requirements to develop the software.

3. Literature Survey

Understanding the software requirements plays a significant role the software development. The ambiguities in the software requirements need skilled Business analysts and hence they have to update their skillsets very often. [13].

The prototype developed by Ashima Rani [1] automatically detects different types of ambiguities. This algorithm detects different types of ambiguities. It is used to find the ambiguities of various types in the SRS.

The prototype developed by M. Q. Riaz [2] refers to the preprocessing stage that consists of finding ambiguous requirements in the Software Requirements Specification. It removes requirements which are ambiguous and leads to more suitable requirements. It cannot handle sentences which are Compound and complicated phrases in the natural language requirements.

The method suggested by Mohd Hafeez Osman [3] is finds ambiguous software requirements. Text mining and machine learning are used to remove ambiguity. Dataset is extracted by using Text mining. The training-set, is used by this approach to detect ambiguities in SRS. An approach was developed by them for finding ambiguous requirements.

ARTICLES

Determination of Solifenacin Succinate in Pure and Pharmaceutical Dosage Forms by Spectrophotometry

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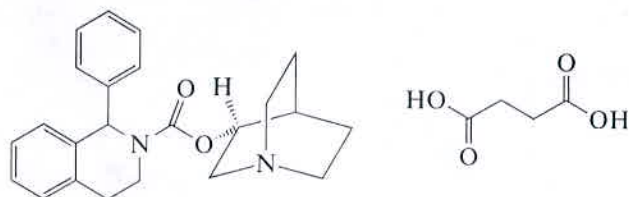
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Abstract—Four simple, precise and sensitive visible spectrophotometric methods were developed for the determination of solifenacin succinate in pure and pharmaceutical dosage forms. The proposed methods were based on the estimation of unreacted N-bromosuccinimide (NBS) with four dyes, namely, amaranth, safranin, aniline blue and rhodamine B, by the drug oxidation by known excess of NBS at laboratory temperature. Beer-Lambert's law revealed good correlation in the concentration ranges of 10–70, 20–80, 30–80, and 10–50 µg/mL for methods A, B, C and D, respectively. The developed methods were successfully applied to the determination of solifenacin succinate in commercially available dosage forms. Statistical comparison of the results showed insignificant difference between the proposed methods and reference method. The proposed methods offered the advantages of simplicity and economy that can be applied without the need for expensive instrumentation and reagents in quality control analysis.

Keywords: NBS, Vesicare, pharmaceuticals, spectrophotometric determination, drug quantification

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Solifenacin succinate (SFS), a well-known muscarinic receptor antagonist, belongs to the class of anticholinergics used for the treatment of overactive bladder [1–5] such as urinary urgency, urinary incontinence and high urinary frequency in patients. It acts as a selective M3 receptor antagonist used to prevent urgent or uncontrolled urination by relaxing the bladder muscles. Solifenacin succinate is available in the market under the brand name Vesicare. Chemically, solifenacin succinate is butanedioic acid compounded with (1S)-(3R)-1-azabicyclo[2.2.2]oct-3-yl-3,4-dihydro-1-phenyl-2(1H)-iso-quinolinecarboxylate. The structure of the drug is given in Scheme 1.



Vesicare (SFS)

Scheme 1. Chemical structure of solifenacin succinate.

The literature survey has revealed that very few methods were developed for the quantification of the cited drug such as liquid chromatography-electro spray ionization tandem mass spectrometry [6, 7] in human plasma, HPLC methods [8–16], high performance thin-layer chromatography [17, 18], derivative spectrophotometry [19], derivative synchronous emission spectroscopy [20], UV spectroscopy [21] and spectrophotometry [22–24]. However, the reported methods are time consuming, require expensive chemicals, well equipped sophisticated instruments which are not easily accessible in all quality control laboratories, and the reported spectrophotometric methods suffer from such disadvantages as extraction, extended time required for the reaction to complete, narrow range of determination and lack of sensitivity. Spectrophotometric methods are the most suitable techniques because of their intrinsic simplicity, high sensitivity, high degree of accuracy and precision, lower cost and extensive availability in quality control laboratories. Therefore, the development and validation of new spectrophotometric methods for the determination of solifenacin succinate that can overcome the disadvantages of the existing methods is essential.