

3.3.2 Number of research papers per teacher in the Journals notified on UGC website during the year (2021-2022)

Ans.: 46 papers during the year (2021-2022)

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COMPUTATIONAL BIOLOGY BOON FOR COMPLEX DISEASES: PREDICTIVE PRECISION MEDICINE

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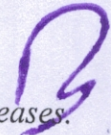
Abstract

Precision medicine states to all efforts to combines a data from molecular biology and medicine, from micro-biome, imaging, and electronic health records, to adapt treatment and prevention strategies to help people with various genetic characteristics. Precision medicine is an automated wide-range of knowledge base that performs pattern recognition of patient profiles. The arena of Machine Learning (ML) has perceptible progress over last decade's, programmed to predict patterns, rules and statistical reliance in large datasets. High dimensional feature selection, implications and data integrations are the current topics using ML tools to address many of the challenges to develop precision medicines. ML-based algorithms can be used to find ambiguous phenotypic or genotypic structures, predict disease risk, treatment responses, diagnosis, and outcomes in every patient based on individuality, and access multi-dimensional databases that capture certain phenotypic and genotypic variations.

In recent years, multivariate biological and clinical databases in predicting exposure risk in some cancers and complex diseases have become available by the combined efforts of the scientific community.

There are many ML based algorithms available such as the support vector, neural network, random forest, and an evolutionary algorithm for predicting disease characteristics. In this area, neural network-based machine learning and evolutionary algorithms were shown to have significant predictive potential for problem solving. The application of ML based algorithms will be significantly benefited from significant digitization exercise has helped in finding genotype-phenotype relationships for various genetically driven diseases and have the potential to understand various phenotypic relationships.

Keywords: ML based algorithms, Precision medicine, Cancer, Genetic diseases.


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Ethnomedicinal plants and isolated compounds against Snake venom activity: A review

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Snakebite is an occupational hazard that has affected the population in tropical and subtropical countries. Worldwide approximately 5.4 million bites, 2.7 million envenomations, and 81,000-1,38,000 deaths are observed per annum. The incidences are higher among farmers and plantation workers. Antivenom is the only treatment available and the production of the same is challenging due to geographical variation of snakes, storage conditions, and non-availability of venom for production. Antivenom therapy is associated with immediate or delayed hypersensitivity and does not prevent local tissue damage. Thus the search for medicinal plants by the scientific community has become relevant. The ethnobotanical studies on various plants have revealed their use to treat various ailments including snakebite. Hence, the review is aimed to amass the medicinal plants studied and also emphasize various components isolated that have shown promising results.

Keywords: Antivenom, *In-vitro*, *In-vivo*, Plant bioactive compounds, Snakebite.

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Introduction

Snakebite, an occupational and environmental hazard is a common occurrence in tropical and subtropical countries¹. It is common in agricultural countries affecting farmers and plantation workers leading to a significant increase in mortality and morbidity. In 2009, World Health Organization (WHO) has declared snakebites as a neglected tropical disease^{1,2}. The precise number of deaths due to snakebite is not properly established and it continues to be a public health problem in most countries.

Approximately, 5.4 million snake bites occur globally with 2.7 million envenomation and around 81000 - 1,38,000 deaths annually³. In 2008, Kasturiratne and colleagues⁴ reported 4,21,000 - 18,41,000 envenomings and 20,000-94,000 deaths. South and Southeast Asia, sub-Saharan Africa, Central and South America were found to have a high number of incidences; India reported the highest number of bites (81,000) and deaths (11,000) in a country⁴.

The most effective antagonist of snake venom is the anti-snake venom (ASV). It is the F(ab) fragments

of IgG purified from the serum or plasma of a horse, donkey, or sheep that has been immunized with the venom of one or more species of snakes. The serum antivenom invented by Albert Calmette's in 1895 was put to practice for treating envenomations with proper clinical trials. It neutralizes the toxicity of a particular species (monovalent/monospecific) or different species (polyvalent/polyspecific). The antibodies raised against the venom of a particular species may also neutralize the venom of a closely related species (para specific activity)².

The principal drawback of serum therapy is its specificity. The variation in species were found; there is a Russell's viper, four cobras and eight species of krait; two subspecies of saw-scaled viper. Moreover, Russell viper also exhibits regional variation. Hence, the composition variability and antigenic reactivity of the venom restricts the use of ASV^{5,6}.

The non-availability of venom has led to the decrease of antivenom production, the Wildlife Protection Act has indicated that snakes cannot be collected or venom cannot be extracted without permission from wildlife authorities. Therefore the authorities object to capturing snakes in large numbers⁵. Also, the side effects, storage, and logistic

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Inhibition of LDL Oxidation and Foam Cell Development of Tannin Methanol Extract from *Citrus limon* and Honey Formulation on Cell lines

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ABSTRACT

Background: *C. limon* rich in Vitamin C was shown to have many health benefits having therapeutic properties. Honey was considered as a natural sweetener said to be immune booster. Hence the formulation of *C. limon* and honey formulation was studied to prevent oxidation and foam cell inhibition. **Objectives:** The present study was aimed to isolate tannins from *Citrus limon* (*C. limon*) fruit juice with a honey mixture to evaluate the antilipidemic and antioxidant activity in cell lines. **Materials and Methods:** Tannins were isolated from *C. limon* fruit juice with a honey mixture with two different solvents, i.e., methanol and water and analysed for antioxidant and LDL oxidation inhibition activity. Further tested on RAW 264.7 and THP-1 cells by employing *in-vitro* assays for cytotoxicity, foam cell development, inhibiting proliferation and, apoptosis. The tannin methanol extract was characterized using HPLC and GC-MS. **Results:** The content of total tannins present was found to be 453.96 mg tannic acid equivalent (TAE)/g methanol extract, whereas 415.87 mgTAE/g in tannin aqueous extract. The highest antilipidemic and antioxidant activity were seen in tannin methanol extract. It was seen that 240 µg/mL tannin methanol extract efficiently inhibited oxidation of low-density lipoproteins (55.89% at 5 hr), thus preventing foam cell development, inhibiting proliferation and, apoptosis in cultured RAW 264.7 and THP-1 cells. GCMS revealed certain compounds. **Conclusion:** This study showed that *C. limon* with honey tannin methanol extract exhibits potential for antiatherosclerosis activity henceforth, considering the medicinal properties of the active phytochemicals, which can be used as a source of naturally occurring nutraceuticals, revealed the potential to prevent oxidation and foam cell formation. **Key words:** *Citrus limon*, Tannin methanol extract, Antioxidant activity, LDL oxidation inhibition, Foam cell inhibition.

INTRODUCTION

Oxidation of low-density lipoprotein (ox-LDL) is caused due to raised blood plasma LDL levels with increased cell permeability.^[1] The free radicals like superoxide and nitric oxide trigger ox-LDL.^[2] Circulating lipoproteins are taken up by macrophage, which in turn gets converted to foam cells by LDL oxidation.^[3,4] These foam cells accumulate in the arterial walls causing plaque formation leading to inflammation and narrowing of the arterial lumen in atherosclerosis by preventing the blood flow causing a heart attack.^[5] Therefore atherosclerosis is essentially caused because of free radicals and oxidized LDL.

Ayurveda and Siddha are the conventional and the oldest Indian system of medicine in the world, as reported.^[6] Some plants have anti-atherosclerotic effects, mentioned in Ayurveda, such as Guggulu, *Emblia officinalis*, *Allium sativum*, etc.^[7,8] Statins are used to treat atherosclerosis, but they have an

increased risk of toxic effects such as myotoxicity with muscle symptoms, hepatotoxicity,^[9] myopathy, type 2 diabetes mellitus, neurocognitive effects, renal toxicity.^[10] Medicines from plant sources have multiple treatment modes with enhanced suitability with lesser side effects. Also, fruits, vegetables, and phytochemicals are rich in antioxidants which can ameliorate cardiovascular diseases.^[11] Herbal medicine, rich in nutraceuticals, needs to be implemented for the treatment modules.^[12] Most research is aimed to search for natural products from plants possessing anti-atherosclerotic properties for the treatment of atherosclerosis.

Citrus limon (L.) tree belongs to the family Rutaceae, with evergreen leaves. The fruit is edible with a yellow color. Its natural fruit juice is a rich source of Vitamin C, has an impressive range of benefits and immense nutritional properties, and is also

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Article

Production and Purification of Pectinase from *Bacillus subtilis* 15A-B92 and Its Biotechnological Applications

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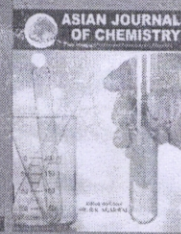
Abstract: Enzymes that degrade pectin are called pectinases. Pectinases of microbial origin are used in juice clarification as the process is cost-effective. This study screened a pectinase-producing bacterium isolated from soil and identified as *Bacillus subtilis* 15A-B92 based on the 16S rRNA molecular technique. The purified pectinase from the isolate showed 99.6 U/mg specific activity and 11.6-fold purity. The molecular weight of the purified bacterial pectinase was 14.41 ± 1 kD. Optimum pectinase activity was found at pH 4.5 and 50 °C, and the enzyme was 100% stable for 3.5 h in these conditions. No enzymatic inhibition or activation effect was seen with Fe²⁺, Ca²⁺, or Mg²⁺. However, a slight inhibition was seen with Cu²⁺, Mn²⁺, and Zn²⁺. Tween 20 and 80 slightly inhibited the pectinase, whereas iodoacetic acid (IAA), ethylenediaminetetraacetate (EDTA), urea, and sodium dodecyl sulfate (SDS) showed potent inhibition. The bacterial pectinase degraded citrus pectin (100%); however, it was inactive in the presence of galactose. With citrus pectin as the substrate, the Km and Vmax were calculated as 1.72 mg/mL and 1609 U/g, respectively. The high affinity of pectinase for its substrate makes the process cost-effective when utilized in food industries. The obtained pectinase was able to clarify orange and apple juices, justifying its application in the food industry.

Keywords: screening; citrus pectin; pectinase; *Bacillus subtilis* 15A-B92; purification; juices clarification

1. Introduction

Pectinases hydrolyze pectic compounds linked by α -1,4-glycosidic bonds and esterified with methyl groups. Pectins, protopectins, and pectinic acids or polygalacturonic acids are the main constituents of heterogenic pectic substances. Based on their mode of action, pectinases are classified as polygalacturonases that hydrolyze unesterified polygalacturonic acid substances, pectin esterases, pectin lyases that de-esterify pectin into pectate and methanol, and pectate lyases or polymethylgalacturonases that catalyze β -elimination, forming galacturonides. Polygalacturonases, pectin lyases

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Novel Heterocyclic Transition Metal Complexes: Synthesis, Characterization, Antimicrobial and Anticancer Activity

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A heterocyclic ligand, 5-(2-(4-chlorophenyl)-1H-benzo[d]imidazol-1-yl)quinolin-8-ol and its Co(II), Ni(II), Cu(II) and Zn(II) complexes were synthesized and characterized by elemental analysis and spectroscopic techniques. According to the spectral analysis, the ligand acts as a bidentate ligand and coordinating through the nitrogen and deprotonated oxygen atoms. For Cu(II) and Ni(II) complexes, spectral analysis reveals square planar geometry, whereas Co(II) and Zn(II) complexes have tetrahedral geometry. The antibacterial results show that Zn(II) complex is more effective than the other metal(II) complexes examined. The ligand and its metal complexes were tested for anticancer activity using the MTT assay with cisplatin as the reference drug against A549, MCF7, and HCT116 cancer cell lines. Results showed that the metal(II) complexes were shown to be more active than the ligand, especially Zn(II) complex being the most potent among this series.

Keywords: Metal(II) complex, Benzimidazole, Antimicrobial activity, Anticancer activity.

INTRODUCTION

Benzimidazole derivatives are a family of physiologically active compounds that have sparked the interest of medicinal chemists due to their diverse pharmacological characteristics [1-5] and prospective use as anticancer, antineoplastic, antiviral, and anti-inflammatory drugs [6-12]. Furthermore, due to their biological action, 5-chloro-8-hydroxyquinoline compounds are gaining popularity [13,14]. In addition, literature evidence shows that the heterocyclic-based ligands including N and O as donor atoms produce transition metal complexes [15]. The anticancer effects of the metal complexes are enhanced by their specific characteristics [15].

Metal capacity to generate positively charged ions in an aqueous solution, which can attach to negatively charged biological molecules, is an essential feature [16]. Complexes of the 3d-transition metal ions have lower toxicity and may easily permeate the cell membrane of microorganisms as compared to 4d- or 5d-metal complexes [17]. They also act as therapeutic agents in the treatment of a variety of diseases. Present work

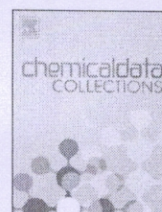
reports the synthesis of novel 5-(2-(4-chlorophenyl)-1H-benzo[d]imidazol-1-yl)quinolin-8-ol ligand and their Co(II), Ni(II), Cu(II) and Zn(II) complexes. Various analytical and spectroscopic techniques were used to characterize the novel ligand and its metal(II) complexes. Antibacterial and antifungal investigations were conducted on the synthesized ligand and its metal complexes. Furthermore, the cytotoxicity of these complexes was investigated with several human cancer cell lines.

EXPERIMENTAL

The chemicals viz. 1,2-phenylene diamine, 4-chlorobenzaldehyde, 5-chloro-8-hydroxyquinoline and tetrahydrofuran were purchased from Sigma-Aldrich and used without purification. The ¹H and ¹³C NMR spectra were recorded on Bruker Avance-400 and Bruker Avance-100 MHz NMR instrument, respectively using TMS as an internal solvent and DMSO (d₆) as a solvent. Mass spectra were recorded on Perkin-Elmer LC-MS PE Sciex API/65 Spectrophotometer. FT-IR spectra were

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Data Article

Novel transition metal complexes of 5-(2-phenyl-1H-benzo[d]imidazol-1-yl)quinolin-8-ol as active pharmacophore: Experimental and computational explorations

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ABSTRACT

A novel 5-(2-phenyl-1H-benzo[d]imidazol-1-yl)quinolin-8-ol ligand (PBIQ) ligand was used to synthesize a series of Mn(II), Co(II), Ni(II), Cu(II), and Zn(II) complexes. Elemental analysis, FTIR, ¹H NMR, UV-Visible and mass spectra were utilized to characterize the newly synthesized ligand and its transition metal complexes. The antimicrobial activity of the ligand and complexes were evaluated against four bacterial and one fungal strain using the minimum inhibitory concentration method (MIC). The minimum inhibition concentration observed was compared against the standard antibiotic rifampicin and the antifungal drug fluconazole. The studies revealed that Cu(II) and Zn(II) complexes are more effective against tested bacterial and fungal strains compared to the ligand and other complexes. Molecular docking techniques revealed that the Cu(II)-PBIQ complex associated with the target protein (PDB ID: 4HL2) had a greater binding affinity with π - σ , π -alkyl and hydrophobic interactions. Density function theory (DFT) calculations were applied to evaluate the optimized geometrical structures and to calculate the global reactivity descriptors of the more active Cu(II) and Zn(II) complexes. Besides, the in-silico pharmacokinetics showed that all the examined metal complexes compounds obeyed Lipinski's Rule of five with one violation.

Specifications Table

(continued on next page)

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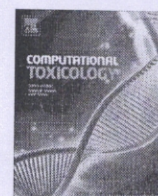
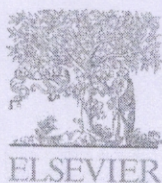
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Synthesis and characterization of novel thiazole derivatives as potential anticancer agents: Molecular docking and DFT studies

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ABSTRACT

New thiazole derivatives (2a-l) were synthesized via the reaction of 2-(3-cyano-4-isobutoxyphenyl)-4-methyl-thiazole-5-carboxylic acid with substituted phenyl amines. The anticancer activity of the synthesized thiazole derivatives was examined against MCF-7 (human breast), MDA-MB-231 (mammary carcinomas), HeLa (Cervical cancer), HT-29, HCT 116 (Colon cancer), and normal Chang liver cancer cell lines, whereas cisplatin was employed as a positive control. The anticancer mechanisms were studied via apoptosis assessments, as well as molecular docking. The molecular docking study of potent compounds was carried out against the human epidermal growth factor receptor (HER2, PDB ID: 3RCD) as a possible target for anticancer activity using Auto Dock vina. ADMET results indicated that tested compounds have significant results within the close agreement of Lipinski's rule of five. In addition, computational work employing density functional theory (DFT) was also carried out at the B3LYP/6-31G (d,p) level to investigate the electronic properties of the potent compounds. The frontier molecular orbital energy and atomic net charges were discussed.

1. Introduction

Cancer is a disease characterised by irregular uncontrollable cell cycle progression and rapid proliferation of normal cells. Cancer has been named the world's second leading cause of death, with an increasing number of new cases of cancer every year, preceded only by cardiovascular diseases. The rate of cancer-related mortality is rising at an unprecedented pace in many developing countries [1]. Cancer is not only a global health problem, but it is also a social and economic issue. In 2010, the annual economic cost of cancer was projected to be about \$1.16 trillion [2,3]. In the United States, the overall cost of cancer is expected to be about \$173 billion in 2020. Inheritance of mutated genes, somatic mutations, environmental factors, and lifestyles are primary factors leading to the development of cancer. Uncontrolled cell proliferation, angiogenesis, and metastasis are the hallmarks of cancer cells [4]. While a massive change in cancer treatment has occurred over the last decade, and a wide variety of new chemotherapeutics have been identified, such compounds are highly cytotoxic and can contribute to resistance, resulting in reduced drug efficacy. It is still a long way to go

with this deadly disease and it can be recognized as a significant area that should be investigated [5]. As a result, designing and developing new medicines for cancer therapeutics remains a significant and difficult challenge for medicinal chemists worldwide.

Thiazoles and their derivatives are a family of heterocyclic compounds with noteworthy biological properties and are well-known in medicinal chemistry as promising therapeutic candidates. Furthermore, thiazole compounds have a number of interesting pharmacological properties, including antibacterial [6], anticancer [7], and anti-proliferative [8]. Structural modification in accordance with the substitution pattern in terms of thiazole functionality leads to a significant difference in the bioactive screening for the site-specific molecules [9–11]. As a result, spontaneous techniques are being used in the field of medicinal chemistry in order to produce several classes of thiazole substances that are particularly promising in the battle against cancer cells [12]. Since various derivatives of thiazole tethered molecular scaffolds were mentioned in the literature specially for their anticancer properties. Hence, we envisioned that 2-(3-cyano-4-isobutoxyphenyl)-4-methyl-N-substituted thiazole-5-carboxamide is one of the prominent

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ANTIMICROBIAL AND ANTIOXIDANT ACTIVITY OF NEW TRANSITION METAL COMPLEXES DERIVED FROM 5-(2-(4-METHOXYPHENYL)-1H-BENZO [D] IMIDAZOL-1-YL) QUINOLIN-8-OL

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Keywords:

Metal complexes, Antimicrobial, Antioxidant, Benzimidazole

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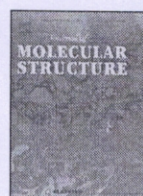
ABSTRACT: New pharmacologically active transition metal complexes of Co(II), Ni (II), Cu (II), and Zn(II) have been synthesized with the ligand 5-(2-(4-methoxyphenyl)-1H-benzo [d] imidazol-1-yl) quinolin-8-ol (2). Different analytical and spectroscopic tools were used to analyze the compounds, including elemental analysis, FTIR, ¹H-NMR, mass spectra, electronic spectra, magnetic measurement, and molar conductance techniques. FTIR confirmed that the ligand coordinates the metal ion to form a mononuclear complex via the oxygen and nitrogen atoms of the phenolic and quinoline rings. For Co(II) and Zn(II) complexes, tetrahedral geometry is recommended, whereas square-planar geometry is proposed for Ni(II) and Cu(II) complexes. The antibacterial activity of the ligand and its metal complexes were assessed using the disc diffusion method, and minimum inhibitory concentration (MIC) was determined in the broth dilution technique. The antimicrobial activity results showed that the metal complexes were shown to be more active than the free ligand. Besides, Cu(II) complex was shown to be the most potent antioxidant using the DPPH and hydroxyl radical scavenging methods, with IC₅₀ values of 17.3 and 21.5 µg/mL, respectively.

INTRODUCTION: In coordination chemistry, metal complexes with potentially bidentate ligands have sparked a lot of attention. Complexation of transition metals with heterocyclic ligands has played an important role in the development of

coordination chemistry¹. As a result, a significant number of heterocyclic-based ligands and their transition metal complexes have been studied dynamically, not only for their biological applications, thermal analysis, and spectral analysis but also for their fascinating coordination chemistry.

Because of their industrial and biological uses, several heterocyclic-based metal complexes have been investigated². Because of their diverse biological actions, benzimidazole core compounds have emerged as a popular study subject among

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Thunbergia mysorensis mediated nano silver oxide for enhanced antibacterial, antioxidant, anticancer potential and in vitro hemolysis evaluation

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SRB assay

ABSTRACT

Practicing the aqueous *Thunbergia mysorensis* stem and flower essences for obtaining the silver oxide nanoparticles (Ag₂O-NPs) advances over chemical and physical processes since the extracts fiddle a dualistic role as reducing and stabilizing agents. The UV-Visible, FTIR, TEM, SEM, and XRD were realized to validate and mark the green synthesized Ag₂O-NPs. TEM pictures exposed the quasi-spherical Ag₂O-NPs shape with average sizes 15 nm and 120 nm respectively for Ag₂O-NPs of flower (F-Ag₂O-NPs) and the stem extracts (S-Ag₂O-NPs). Antioxidant activity of Ag₂O-NPs investigated by DPPH, ABTS cation radical and ferric ion reduction routes manifest enhanced antioxidant activity with F-Ag₂O-NPs compared to S-Ag₂O-NPs. Hemolytic assay results elicited that S-Ag₂O-NPs and F-Ag₂O-NPs, respectively showed 1.4% and 1% hemolysis. Additionally, the synthesized F-Ag₂O-NPs showed potent antibacterial activity against Gram-negative and Gram-positive bacteria compared to S-Ag₂O-NPs and were effective against human MDA-MB-468-triple negative breast cancer cell lines with an IC₅₀ of 480 μM.

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1. Introduction

Nanoscience is at the vanguard of current research. It is in the possibility of new scientific revival which offers to investigate the applications of chemistry wherein highly efficient, innovative nano materials are synthesized with the use of less hazardous substances for health and the environment [1]. Nanotechnology is a fast mounting arena that is supported to produce a mixt array of integrated metal/ metal oxide nanoparticles (M₂O-NPs) which have exuberant biotechnical benefits in the domain of biomedicine, environmental bioremediation, data storage, drug delivery [2], optical and electronic fields [3], cancer therapeutics [4,5], biological

imaging and agriculture [6] etc. Deploying metal oxide nanoparticles as malignancy-destroying hyperthermia agents in cancer management has magnified the pharmacokinetics, subduing the systemic toxicities of chemotherapy regimen through judicious targeting and emancipation.

Silver oxide nanoparticles (Ag₂O-NPs) have fewer insalubrities and larger surface-area-to-volume ratios and consequently manifest novel properties on their massive counterpart [7]. It possesses the gamut of bactericidal, fungicidal activities besides being competent to coordinate with diverse ligands and macromolecules in the microbial cell. It has been widely employed as coatings to impede microbial infections contingent on medical equipment such as orthopedic and cardiovascular implants [8,9], catheters, and wound dressing. Ag₂O-NPs are also exercised as antiviral, antioxidant, anticancer agents, anti-diabetic agents [6] and ameliorating the immunogenicity of vaccines [10]. Green synthesis of Ag₂O-NPs has emerged out as a promising substitute against other synthetic methods such as coprecipitation, hydrothermal synthe-

Abbreviations: Ag₂O-NPs, silver oxide nanoparticles; F-Ag₂O-NPs, Flower mediated silver oxide nanoparticles; S-Ag₂O-NPs, Stem mediated silver oxide nanoparticles; TM-Ag₂O-NPs, *Thunbergia mysorensis* mediated silver oxide nanoparticles; TNBC, Triple negative breast cancer cell line.

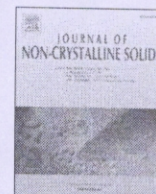
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Improved photoluminescence and spectroscopic features of Sm^{3+} -doped alkali borate glasses by embedding silver nanoparticles

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ABSTRACT

Influence of Ag nanoparticles (NPs) on the improvement in photoluminescence and spectroscopic features of Sm^{3+} -doped alkali borate glass synthesized by the melt quenching process was systematically studied and analyzed. The increasing particle size of Ag NPs with the increase of AgCl concentration (0.1 – 0.5 mol%) causes the surface plasmon resonance peak to shift to a higher wavelength (red-shift) side. Electron microscopic investigation confirmed the presence of silver NPs in the SmLAB-1 glass sample with a median size of 4.57 nm. A significant enhancement in emission was noticed for 0.1 mol% AgCl concentration. Such improved emission was attributed to the enhanced local electric field by metallic NPs in the vicinity of Sm^{3+} ions and efficient energy transfer between Sm^{3+} ions and silver NPs. The Judd–Ofelt parameter, Ω_2 decreased as the concentration of Ag NPs increases, indicating increased symmetry and ionicity between the trivalent samarium ions and their ligands. These prepared glass compositions could have applications in solid-state devices such as LEDs and display applications.

1. Introduction

In recent years, borate-based oxide glass family has received relatively more interest than other glass families owing to its cost-effectiveness, low melting point, better thermal and chemical stability, better rare earth (RE^{3+}) ion solubility, and excellent transparency in the ultraviolet (UV) and near infrared (NIR) wavelength ranges [1,2].

However, pure borate hosts are extremely hygroscopic in nature which exaggerated in the functioning of glasses [3]. The hygroscopic nature, chemical and mechanical stability increases when lanthanum and alkali oxides are incorporated into the borate glass network [4,5]. Thus, alkali borate glass hosts are regarded as one of the best candidates for photonic device applications [6,7]. RE^{3+} ion-activated inorganic glass hosts have been widely accepted in the design of optoelectronic devices such as

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Modeling bulk surface resistance and evaluation of evapotranspiration using remote sensing and MATLAB

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ABSTRACT

In developing countries, computation of actual evapotranspiration (AET) is challenging due to the lack of ground-based flux measurement data. The estimation of AET is crucial for water resources management involving the allocation of water for different land use/land cover (LULC) classes. The study's novelty was mapping pixel-by-pixel spatial variations of bulk surface resistance and evaluating the derived actual evapotranspiration in a sub-humid tropical river basin where flux tower data was lacking for validation. This study aimed to map bulk surface resistance and evaluate the estimated AET by global evapotranspiration data product (MOD16A2). Moderate Resolution Imaging Spectroradiometer (MODIS) data products, including land surface reflectance (LSR), land surface temperature (LST) and leaf area index (LAI) data, were used as input in MATLAB for mapping pixel-wise variations to analyze the seasonal variations in bulk surface resistance (r_s) and AET in pre-monsoon and post-monsoon seasons during the years 2019 and 2012. The years 2019 and 2012 were selected because 2019 experienced a relatively wet pre-monsoon and post-monsoon, whereas 2012 experienced the opposite conditions, which proved useful when interpreting variations that are influenced by wetness conditions. Overall, the results indicated significant variability in the r_s and AET for different LULC classes. MOD16A2 AET was determined to be slightly higher than the LULC classes' estimated AET. This study's MODIS satellite data products provided information on surface characteristics at a reasonable resolution. This permitted the identification of differences in LULC classes and changes in surface characteristics by season and wetness conditions, which are helpful when estimating AET.

Key words: actual evapotranspiration, bulk surface resistance, MATLAB, remote sensing

HIGHLIGHT

- The study's novelty was mapping pixel-by-pixel spatial variations of bulk surface resistance and evaluating the derived actual evapotranspiration in a sub-humid tropical river basin where flux tower data was deficient for validation.

LIST OF ACRONYMS

Abbreviation	Description
A	Available Energy Flux
c_p	Specific Heat of the Air
D_a	Vapor Pressure Deficit
D_{50}	Vapour Pressure Deficit at Which Stomatal Conductance Is Half
e_a	Actual Vapor Pressure
e_s	Saturation Vapour Pressure
f	Ratio of Evaporation from Soil to the Equilibrium Evaporation Rate
G	Soil Heat Flux
g_{sx}	Maximum Stomatal Conductance
G_a	Aerodynamic Conductance
G_c	Bulk Canopy Conductance
G_s	Surface Conductance
G_i	Climatological Conductance

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Response Surface Models for Optimal Concrete Designs



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Abstract The merits of response surface models in concrete construction need to be explored. These models have shown enormous use in the field of manufacturing and production. So in the present study, the application of response surface for concrete production is described. Their benefit in determining the results with minimum number of experiments is also discussed. The review summarizes the application of response surface models and shows that the statistical models provide additional support in analyzing the constrained targets. It reduces the test cases making the designs more economical compared to conventional methods.

Keywords Response surface · Concrete design · Statistical model · Construction · Experiments

1 Introduction

Construction of buildings and other essential requirements are evolved through civilization of mankind. Its progressive improvement is displayed at existing ancient temples, monuments, etc. Earlier, the construction practices and its combination for determining the hardened properties were tedious and time-consuming. For instance, the usage of statistical tools in determining the significant variables and its combination in achieving the targets are derived, developed, and practiced [1]. Many statistical models or tools exist and are used, among response surface (RS) models have gained much importance in modeling and determining the optimum values [2, 3]. The importance of statistical models in modern manufacturing and production process has been investigated [4].

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A Comprehensive Exploration on Spider with Fuzzy Decision Text-to-SQL Model

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Abstract— The challenge of natural language processing is from natural language to logical form (SQL). In this project, we present an fuzzy semantic to structured query language (F-SemtoSql) neural approach that is a fuzzy decision semantic deep network query model based on demand aggregation. It aims to address the problem of the complex and cross-domain text-to-SQL generation task. The corpus is trained as the input word vector of the model with LSTM and Word2Vec embedding technology.

Combined with the dependency graph method, the problem of SQL statement generation is converted to slot filling. Complex tasks are divided into four levels via F-SemtoSql and constructed by the need of aggregation. At the same time, to avoid the order problem in the traditional model effectively, we have adopted the attention mechanism and used a fuzzy decision mechanism to improve the model decision. On the challenging text-to-SQL benchmark Spider and the other three datasets, F-SemtoSql

achieves faster convergence and occupies the first position.

A Database is an organized collection of data. It is created to store large amount of data and retrieve it efficiently in less amount of time. To retrieve data from the database Structured Query Language (SQL) is used. SQL has its own syntax of query. To retrieve correct data from the database this query should be written in proper or correct syntax. Thus users should have sufficient knowledge of SQL to retrieve

data. In this project a light weight technique of converting a natural language statement into equivalent SQL statement is highlighted which when executed on database provides

us with the accurate results. The main advantage of this technique is the users which are unknown to the syntax of SQL can also use the system and retrieve data.

Introduction

With the improvement of advanced computer, network, communication, and storage technology, massive interactive cross-domain data are creasing with an exponential rate. However, users can intuitively perceive behavioral events in a single shallow semantic

parsing. And it does not address the need for users to deal with a large number of data events from deep

semantic parsing and cross-domain data sources. At the same time, with the development of artificial intelligence technology, people's requirement for natural language query is increasing.

It is no longer sufficient for simple data retrieval, but the system can respond quickly and efficiently to complex query retrieval requirements involving logic and semantics. The expression of natural language map to a machine-understandable structured query language by semantic parsing method, it has become a research hotspot. Text-to-SQL task is one of the most critical subtasks of semantic parsing in natural language processing (NLP).

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 devise an efficient approach to maximize energy efficiency, reliability and minimize latency with most significant and relevant design



Hybrid Feature Selection with Parallel Multi-Class Support Vector Machine for Land Use Classification

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Abstract: Land use classification in remote sensing is required in various applications like natural resource management, urban mapping and agriculture etc. Existing methods in the Land use classification which has the limitation of overfitting problem due to the improper feature selection in the method. In this research, the hybrid feature selection methods with Parallel Multi-Class Support Vector Machine (MSVM) is proposed to improve the land use classification performance. The UC Merced and AID datasets were applied to validate the performance of the hybrid feature selection method with the parallel MSVM method. The input images were applied in Histogram Equalization to enhance the image quality which removes the artifacts in the preprocessing stage. The Speeded Up Robust Feature (SURF), Local Ternary Pattern (LTP), Discrete Wavelet Transform (DWT) were applied for feature extraction. The extracted features are applied to hybrid feature selection of Particle Swarm Optimization (PSO) and Grey Wolf Optimization (GWO) method to select the relevant features. The hybrid feature selection method has the advantages of good convergence with higher efficiency in search analysis. The PSO model provided good search exploration to find better solution and GWO method has good convergence of local and global solution. The hybrid method has effective exploration and exploitation for the feature selection. The proposed hybrid features with the MSVM method have 99.15 % accuracy and the existing SVM has 94 % accuracy in land use classification.

Keywords: Grey wolf optimization (GWO), Land use classification, Parallel multi-class support vector machine (MSVM), Particle swarm optimization (PSO), Speeded up robust feature (SURF).

1. Introduction

Land cover is the pattern analysis of the human activities and ecological resources in various Earth's surface regions and this type of data supporting land management, and many environmental sciences at global, local and regional scales. Considering Land cover information is important in environmental sustainability research and global change, land cover datasets were created at various scales [1-3]. The classification of land cover like airport, residential, a wetland is challenging due to the presence of complex heterogeneous land cover [4]. This Land use classification provides a series of semantic classes that assist in the land cover information in remote sensing images. Land use classification is required in many applications like natural resource management,

precision agriculture, target detection, and urban mapping. Recently, various researches have been carried out in land use classification for feature representation and classification tasks for land use classification [5]. Remote sensing classification consists of two aspects, a feature extractor that provides discriminative feature vectors from the transform of spatial, spectral, and temporal data, and a classifier that labels each data based on feature representation [6-8].

Land use classification is based on low-level visual features to represent the region of interest in the images and low-level features are either global or local features. The global features are extracted from the images like shape, texture, color (spectral) features. Local features are extracted from the image patches based on the point of interest [9, 10]. Standard classification methods like Random Forest

Efficient Technique for Tagging and Archiving the Data Sets and Computation of Performance for Remote Sensing Data using Decision Tree.

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Abstract

Remote sensing satellites produce large sets or big data[2][4] of data which are difficult to archive in the traditional methods[1][3]. An efficient technique is required to tag the data sets of these satellites for archival and retrieval. Tools like MATLAB Parallel Computing Toolbox and Google Colab for archival of structured datasets and unstructured datasets[5] and also processing the data using python are made use of. The remote sensing data for classification and regression analysis can be analyzed through Decision Tree (DT) Algorithm. In this paper, Kepler Exoplanet Data is used for performance comparison through DT Algorithm. The performance measures like accuracy, precision, recall, confusion matrix etc are measured and the results through graphs are shown.

Keywords : Remote sensing, Decision Tree (DT) , Big Data.

Introduction

The method of detecting and tracking an area's physical features by analysing its reflected and transmitted radiation from a distance is known as remote sensing typically from satellite or an aircraft. The concept is used to describe the process of gathering knowledge about the Earth. Remote sensing is used in a variety of areas, including geography, land surveying, and many Earth science disciplines like geology, glaciology, oceanography, meteorology, hydrology and ecology as well as political, security, industrial, economic, planning, and humanitarian applications.

Support Vector Machines (SVM)

They are supervised learning models linked with data mining algorithms for classification and regression analysis. An SVM[6] maps teaching examples to points in space in order to maximize the distance between the two groups as far as possible. New examples are then mapped into the same space and classified according to which side of the distance they fall on. When data is unlabeled, supervised learning is impossible, so an unsupervised learning solution is necessary, in which the data is clustered naturally into groups and new data is

Automatic Web Page Classification System with Improved Accuracy

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Abstract

Nowadays, the Internet contains a wide variety of online documents, making finding useful information about a given subject impossible, as well as retrieving irrelevant pages. Web document and page recognition software is useful in a variety of fields, including news, medicine, and fitness, research, and information technology. To enhance search capability, a large number of web page classification methods have been proposed, especially for news web pages. Furthermore existing classification approaches seek to distinguish news web pages while still reducing the high dimensionality of features derived from these pages. Due to the lack of automated classification methods, this paper focuses on the classification of news web pages based on their scarcity and importance. This work will establish different models for the identification and classification of the web pages. The data sets used in this paper were collected from popular news websites. In the research work we have used BBC dataset that has five predefined categories. Initially the input source can be preprocessed and the errors can be eliminated. Then the features can be extracted depend upon the web page reviews using Term frequency-inverse document frequency vectorization. In the work 2225 documents are represented with the 15286 features, which represents the tf-idf score for different unigrams and bigrams. This type of the representation is not only used for classification task also helpful to analyze the dataset. Feature selection is done by using the chi-squared test which will be in the task of finding the terms that are most correlated with each of the categories. Then the pointed features can be selected using chi-squared test.



HYBRID MIXED BASIS VECTOR BASED DIRECTION OF ARRIVAL ESTIMATION USING SPARSE BAYESIAN LEARNING ALGORITHM

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ABSTRACT

Antenna with Non-uniform linear array is sophisticated for the reconfigurable antenna setup. This paper deals with the DOA estimation of signals with non-uniform linear array setup adopting the sparse representation based implementation. A Mixed basis vector based sparse representation is adopted in this paper to predict the DOA estimation. MATLAB based implementation is carried out for the DOA estimation for non-uniform linear array setup and estimation accuracy is analyzed for the proposed work. Estimation accuracy is found from different waveforms generated from the results which involve graphs like Signal to Noise Ratio versus Mean Square Error. The results thus obtained are compared with the traditional methods to validate the performance of the results obtained from the proposed method.

Keywords: mixed basis vector, direction of arrival, sparse representation, non-uniform linear array.

INTRODUCTION

The concept of smart antennas inspired by the fact that it can automatically detect the signal direction from the source that falls on the sensor which is usually the Uniform Linear Array (ULA) of antennas. The signal direction also known as Direction of Arrival (DOA) estimation without miscalculating the interference as the signal of interest, and detecting the DOA for the noise and other correlation issues in finding the signal direction. The accurate DOA estimation and novel methods to obtain this higher efficient DOA estimation is an important milestone to be obtained after continuous research on this topic. The signal processing algorithms decide the performance efficiency of the smart antenna in DOA estimation methods. Sparse representation is a new stream of signal processing algorithm that gives accurate DOA estimation implementation in the antenna arrays.

Important term meant for the DOA estimation is the target sparsity which is the ability of the algorithm to approximate the source using the basis vectors. This is also called as basis pursuit. The implementation involves creation of the manifold matrix which is the combination of the basis vector that would create the dictionary of signals that get represented with signal under study for it can be able to find the direction of the signal falling on the antenna.

The manifold matrix also known as the sparse matrix is the main component of the sparse representation implementation since the way this matrix varies depends how better the basis pursuit can occur. The following details would discuss about the basics of sparse representation and its applications in various fields of engineering. Representation of the higher dimensional data into effective and compressed way is a challenge which is a fast-growing research area in signal processing paradigm. The term for the above said representation is called Sparse Representation that combines the elementary components called as atoms to develop the signal models that are chosen from the dictionary. The dictionary is the set of all such combinations of vectors. Source Separation,

signal denoising, compressed sensing and signal recovery are few applications where Sparse Representation implementation is carried out. A deeper study of finding the over complete dictionaries and the best 'bases' for sparse representation is being investigated to adapt it to the signal under study. Compressed Sensing is one such application that got revolutionized due to the sparse representation technique. The sub sampling at very low rates that is evident in compressed sensing is advantageous to the conventional sampling method. The random projections that depict the dimensionality reduction on the signals conveys the sparsity of the algorithm. The assumptions that are meant for sparsity, if properly designed, is enough for the recovery of the signal with lesser error. Both sampling and compression comprises of the compressed sensing implementation. The fullest potential of this compressed sensing algorithm is not yet reached considering the amount of research work carried out with Sparse Representation. Although DOA estimation using sparse representation is researched by many researchers in the recent literatures publications the complete sparsity level is not utilized. Sparse representation is applied in applications including source separation in audio processing applications and other learning-based applications.

LITERATURE SURVEY

Orthogonal projection of the steering vector on both noise and the source subspace attributes to the knowledge that the noise and the source subspace are orthogonal components. This orthogonal concept is used in MUSIC algorithm that infers that the noise subspace does not contribute to the DOA estimation. The literature involves a novel noise subspace called the proper noise subspace for the MUSIC based DOA estimation algorithm. To attain it the oblique projector is used. The oblique projector projects the steering vector on the proper noise subspace along the signal subspace unlike the traditional MUSIC algorithm. The efficiency of the

Principal



Multikernel optimized beam forming using sparse representation for non-uniform linear array

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(Communicated by Madjid Eshaghi Gordji)

Abstract

Antenna communication uses the sophisticated algorithms for Direction of Arrival estimation in the non uniform-linear array topology. Radar applications uses the mathematical models for Direction of Arrival estimation of the approaching signals. Recent developments in Basis pursuit solver algorithm have led to better beam forming techniques for Direction of Arrival algorithms. Sparse representation of signal helps in better signal analysis. This paper examines how to compute the direction of arrival of non-uniform linear array using sparse computation. A comparison between traditional techniques and sparse representation to estimate the direction of arrival is also studied. A novel method is proposed based on basis pursuit denoising (BPDN) to estimate the Direction of arrival. Simulation results are verified with the formulation developed for direction of arrival. A advanced manifold matrix is developed using the cumulative basis vector as the building element of the manifold matrix. MATLAB based simulation is developed with the advanced basis vector based manifold matrix to get the Direction of Arrival from multiple sources.

Keywords: Sparse representation, Direction of arrival, Non-uniform linear array, Multi-kernel learning, Beam forming

2020 MSC: 65K10, 78M50

1 Introduction

Estimating the Direction of arrival of signal from an array of linear arrangement of antenna is accomplished through to variety of methods. One of the most popular method is the basis pursuit method. In this approach the incoming signal is decomposed into a superposition of dictionary elements. There are several constrains that are inherent in this scenario such as speed and sparsity. Speed is dependent on the representation order i.e. $O(n)$ or $O(n \log(n))$. Sparsity must be as sparse as possible in the representation. Several methods that have been proposed by previous researcher is discussed below. Mathematics involved in the sparse representation implementation is applied in radar applications. Authors discussed a modified method utilizing the multi invariance property of the signal to calculate the direction of arrival of the signal is discussed in [1]. This algorithm is a Modified version of Estimation of signal parameters via rotational invariance techniques (ESPRIT). The spatial distribution of the matrix is obtained by measuring the signal frequency and temporal variation from the uniform linear array. Estimating the DOA of a chirp signal using the MI-ESPRIT helps in faster detection and reducing the computational burden. Experimental results of DOA estimation

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Human Image Captioning using Deep Learning

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Abstract: In recent years, with the rapid improvement of AI, image captioning has slowly attracted the consideration of numerous analysts within the field of artificial intelligence and is an interesting task. Image caption, consequently generates normal language sentence based on the features observed in a picture, is an important portion of understanding, which combines the information of computer vision and processing of natural language. The application of picture caption is broad and significant, for an instance, the realization of human computer interaction. This paper summarizes the related strategies and centers on the attention mechanism, which plays an important part in computer vision and in the recent days it is widely used in tasks such as image caption. Besides, the advantages and the deficiencies of these strategies are examined, giving the commonly utilized datasets and assessment criteria in this field. Furthermore, the advantages and the shortcomings of these methods are discussed, providing the commonly used datasets and evaluation criteria in this field. Finally, this paper highlights some open challenges in the image caption task. For a computer to generate a text describing the image given as input takes a lot of effort in terms of computation, memory usage and processing minute details present in the image. Although great progress has been made in ML, artificial intelligence, deep learning, image processing, it is always a challenging task for a computer to generate a text describing an image accurately with semantically and grammatically correct sentence. **Keywords:** Image captioning, attention, convolutional neural network, deep learning.

1. Introduction

Given an image to a human being, he/she can easily describe it without a second thought provided he/she has seen the objects in the image before and is able to relate between the objects. This is a special capability which we possess due to our memory, cognitive ability, sequential linking and imagination. Same is the case with some animals like dogs. There are cases where police dogs have identified a person using his/her image. But for a computer to generate a text describing the image given as input takes a lot of effort in terms of computation, memory usage and processing minute details present in the image. Although great progress has been made in ML, artificial intelligence, deep learning, image processing, it is always a challenging task for a computer to generate a text describing an image accurately with semantically and grammatically correct sentence [1]. Problems exist in detection of the objects present in the image, identifying the relationship between the objects, attributes associated with the objects. Another problem is to map between the objects and the words [2]. The computer has to realize the context of the image before using the indented word. Joining words is not the only issue, combining the words with suitable conjunctives and making a semantically and grammatically correct sentence is also important for the user to understand the description. The below mentioned techniques have now become legacy. Retrieval based: Given an image as input, this method produces a description for that image through retrieving 1 or more set of sentences from the pool of set of already existing of sentences [3]. Template based: Set of visual concepts are detected first then a sentence is generated, based on the visual concepts obtained. Some of the applications of image captioning are images image indexing (i.e., indexing the image based on the keyword so that it can be retrieved in the lesser time.), in social media (to caption the images), for visually [4].

The application of picture caption is broad and critical, for case, the realization of human computer interaction. This paper summarizes the related strategies and centers on the consideration component, which plays an critical part in computer vision and is as of late broadly utilized in picture caption. For a computer to generate a text describing the image given as input takes a lot of effort in terms of computation, memory usage and processing minute details present in the image. Although great progress has been made in ML, artificial intelligence, deep learning, image processing, it is always a challenging task for a computer

A Blind Stick Navigator with Obstacle Detection for Visually and Hearing Impaired Persons

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Abstract: Communication plays a vital role in expressing one's feeling to another. There are certain unique languages available for the deaf-blind people which includes tactile signing, Braille, moon etc. Among these methods, the most commonly preferred means of communication is Braille. Braille is a system developed to assist the visually and hearing-impaired person by creating arrangements of dots which form letters, numbers and Punctuation marks. This device converts any alphanumeric English text to its corresponding Braille format that can be read by a Deaf Blind person. An abled person can send a message to a Deaf-Blind person from his mobile phone. Once the message is received by the device, it starts converting the letters in the message to Braille format. This involves into developing a wireless Blind walking stick and interfacing it along with this Text to Braille converter unit, so that it becomes a standalone device performing two-way communication between the deaf-blind people and non-disabled people.

Keywords: Braille Display, Braille Dots, Text to Braille, Converter, Braille, Braille language.

1. Introduction

Louis Braille (4 January 1809- 6 January 1852) was a French educator and an inventor of a system of reading and writing for use by the visually impaired, his system remains known worldwide simply as Braille. Braille system was introduced by Louis Braille in 1821, who was also blind. Braille is a system that enables blind and visually impaired people to read and write through touch. A deaf-blind person is one with impaired senses of hearing and sight [1]. The dim sighted people need help to carry out their daily activities and especially navigation. When such people are in new or unknown places, the most importantly knowing the road surfaces, obstacle in their path, to enable secure and safe navigation. Some of these people use dogs or humans as a guidance. But they are difficult to maintain. Dependence on other humans is highly demanding and constraining in many ways [2]. A multitasking device with wireless map navigation, water detection, and obstacle detector along with Braille display in a wireless manner is designed. To focus on the requirements of blind and deaf people to provide a efficient device which helps them to overcome their problems. The stick is integrated with Braille display unit along with various sensors ultrasonic sensors, infrared sensors and water sensor etc. Braille unit consists of raised dots and used in the form of cells, the call is made up of 6 dots, that fit under the fingertips, arranged in 2 columns with 3 dots each, that each represent a letter, number, combination of words, numerical, punctuation marks etc. [3]. The numbers and arrangements of these dots distinguish one character from another character and the pattern will be of raised bumps or dots that can be read with the help of fingers by blinds. The average unemployment rate of blind and partially sighted persons of working age is over 75 percent [4].

We have used following sensors, Infrared sensor: Infrared sensors recognize small obstacles but with less accuracy than laser sensors. However, using laser sensors is costly which contradicts our aim in obtaining affordable aiding devices. They perform almost the same within 2 meters. The infrared sensor chosen has a detection range distance that goes from 20 to 200 cm, a resolution of 0.5 cm, a frequency of 26.3 Hz, and an analogical output that goes from 0 to 5 V. We use the infrared sensor to detect upward and downstairs because the sensor spot is roughly 6 cm. This feature enables the user to identify precisely, any kind of stairs in front of him. Ultrasonic sensor: Ultrasonic sensor works well for close obstacles unlike laser one when an object is so close the laser sensor (less than 15 cm) can't get an accurate reading. It should also be noted that radar sensors

SMART ADVERTISING SYSTEM IN MODERN PUBLIC TRANSPORT

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Abstract: Advertisement is the one of the largest industries and it has turn over in billions, in this project presenting a smarter way of advertise in moving vehicle like local city buses, cabs, auto rickshaw etc. System consists of suitable display, embedded system, GSM modem and GPS receiver. With the help of GPS receiver location of the vehicle can be known and can feed the display with the relevant advertise for that particular area, which affects the user positively, And the gsm modem in the system is used, which enable to remotely update and program the advertisements. Along with the advertisements display some useful information like next bus stop information, gold prices, cricket scores, latest news etc. So that passengers will be interested in seeing display.

Keywords: Location based advertisements, services, Public Transport system Embedded systems, microcontrollers, GPS, GSM.

1. Introduction

Location-based advertising is a new type of advertising that combines mobile advertising and based on location's services. The technique is used to pinpoint a passenger's location in order to deliver location's specific advertising. And it is a type of direct marketing, LBA allows to reach out the business and specific target populations by giving advertisement. LBA improves the ability to reach people in far more focused ways than previously feasible. And LBA allows customers to choose what, when, where, and how they get advertisements, it gives them with the proper information and present offers in this the project public transport companies can earn good amount and even customers are also benefited as our system in not purely ad oriented it also shows next bus stop information, local news, cricket scores, stock market etc. system is not limited for buses can be used in cabs or even in autorickshaw too. Just we need appropriate display and our GPS enable system with GSM communication module. All these are controlled and interface to embedded board, a standard coding technique has to be followed in this project as are adding lots of features with every feature code complexity is added. But all of this is possible with general purpose microcontroller. And hence system cost never exceeds 5000INR except display and its driver cost. Although the h/w investment cost can be recovered with one or two months from advertisers. Technology has impacted every aspect of our life, providing us with better services at every turn. Location based service L is a new beginning of technological advancement in which the user's location is used to improve the quality of services. This technology has been exploited on mobile phones, particularly smart phones, and in this project, it brought this technology to the common man by presenting it into public transportation. One common location-based service that are using in this project is location-based advertising.

2. Literature Survey

Perceived effectiveness of text vs. multimedia location-based advertising messaging [1] proposes that advertisers and marketers have access to entirely new advertising channels due to mobile communication and positioning technologies. Advertising is based on where you were and focusing on locations ads, Despite the increased focus on LBA, little is known about the differences in the effects of text and multimedia advertising formats on mobile consumer perceptions and behavior. In a simulated LBA system, this observational research study explores the impacts of multimedia ads versus text-based ads on user perceptions and behaviors. These effects on customer perceptions of enjoyment, informativeness, and irritation were analyzed using a structural model. The research indicates the multimedia LBA texts create a more positive outlook, improve the profitability of using the LBA systems, and have a huge impact on the purchasing impulse.

IOT Based Gas Leakage Detection and Automatic Gas Cylinder Booking System

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Abstract: Technology has advanced rapidly in recent years, making life easier for humans in a variety of ways. LPG (Liquefied Petroleum Gas) is a necessity in every home, however domestic gas leaks cause many accidents each year, therefore it should be utilised with caution. People in our daily lives are unaware of the condition of LPG gas completion, which causes trouble. This project is focusing on the use of the Internet of Things to measure and show the gasoline content in residential LPG cylinders, which aids in the automatic bookings of new LPG cylinders and the detection of gas leaks. The quantity of LPG is detected with a load cell, and the sensor's output is coupled to an Arduino R3. The information is provided to the user through Text messages and automatically booking is done by contacting the registration gas booking number, thanks to the GSM (Global system in mobile communication) Module. The gas leak is then detected by a gas sensor (MQ-6). Windows are opened using a DC motor, and an gas regulator is turned off with a servo motor. The weight of the cylinder is continuously measured by a load cell sensor, and when it falls below a specific level, a notification is delivered to the user through IOT(internet of things), indicating that cylinders booking is required, and an automatic booking request message is sent to the service provider. Which was before and an late booking can be avoided as a result of this. Then, by monitoring the gas leak, LPG gas burst mishaps in the home can be avoided.

Keywords: Arduino, GSM Modem, Gas sensor, Fire sensor, Load cell.

1. Introduction

LPG cylinders play an important role in everyday life. The primary use of LPG is to replace chlorofluorocarbons, which are known to cause significant damage to the earth. Despite being one of the most commonly used fuels, it has an explosive range of one. According to the weight of the Gas within the cylinder, the 8 percent to 9.5 percent gas volume in air is divided into three classes: social unit, business, and industrial. LPG cylinders are classified as social units because they contain 14.2 kilo LPG. Similarly, LPG cylinders in the industrial and business classes possess nineteen and thirty-five kg of LPG, respectively. Due to the increased demand for LPG, customers must be required to pre-order their cylinder at least a month before it is delivered. Most of the time, consumers find it hard to understand how so much Gas is left at various intervals throughout the cylinder, which causes them a great deal of frustration. In this situation, an effective method of measuring the level of LPG with in cylinder is required, so that users are aware of the Gas point at time frames the cylinder. Automatic booking of a new LPG cylinder after detection of a gas leak and indeed the level of cylinder. This sensor offers a high sensitivity as well as a quick reaction time. Other gases, such as cigarette smoke, are detected by the gas sensor. Whenever the gas is detected, the sensor's output is communicated to the microcontroller, and the buzzer is activated; whenever the weight measured by the load sensor falls below a particular level, the user is notified, and a new LPG cylinder is ordered. The major purpose of this proposed approach is to address issues such as consumer delays and pre-booking of LPG cylinders.

2. Literature Survey

Laser SPEcks: Laser SPEctroscopic Trace-Gas Sensor Networks - Sensor Integration and Applications [1] suggest a system in which electrical blockage increases as the gas grouping increases at intervals. The resistance varies depending on the dopants in the polyaniline, such as metal oxides, bi - metallic oxides (ceramics), and so on. The fluctuation in resistivity of the sensor is caused by atmospherically active substances on the sensor and/or direct reactions of lattice or gap substances with the checking gases that make up the gas sensors mechanism. The gas sensor characteristic of polyaniline and conducting polymers salt composites is discussed thoroughly.

Intelligent Gas Booking and Leakage System using Wireless Sensor Networks [2] if gas is transported from one pipe or another containers of natural gas or the other gas product, there may be percent leaks. These leaks are highly hazardous since even a small leak can gradually generate an explosive concentration gas. This paper offered a method for efficient gas bookings and leak detection.

Wireless Detection of Gas Leakage and Booking using Iot [3] in the current system, and the new system is implemented. The suggested system will monitor gas leakage and send the results to a

IMPLEMENTATION OF IMAGE ENHANCEMENT USING XILINX VIVADO ON FPGA

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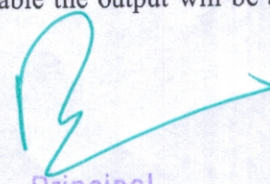
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Abstract: This paper includes the implementation of image enhancement on FPGA using Xilinx vivado, Matlab, and pycharm. image enhancement is one of the challenging tasks nowadays, is related to image processing. this paper includes the implementation of this task using high-level language python for frame conversion and Verilog for hardware implementation. The main aim of this paper is to implementation of different image enhancement techniques on hardware. Task carried out in the spatial domain to perform different image enhancement techniques. This paper includes image enhancement implementation on FPGA using Xilinx and Matlab.

Keywords: Image enhancement, Xilinx Vivado, Matlab, FPGA

1. INTRODUCTION

Enhancement is a process of improving the quality and information content of the original image. Sometimes the images will not be clear and we try to alter the image by varying its brightness and contrast this process is called image enhancement. Common practices include contrast enhancement, spatial filtering, density slicing, and FCC. If the captured image is not of good quality, then it needs to be enhanced. And quality degradation may be because of the noise, poor brightness, contrast, and blur effects. Therefore image enhancement is required for image processing so image analysis can be done accurately. Image enhancement can be done in two domains either frequency or spatial domain. Enhancement domains are the procedures that are directly applied to the pixels of the image. Image enhancement is a technique where the noise of the particular pixel of the image gets altered according to the need. Through the image enhancement, the resolution of the image gets higher and the quality will be more. compare to the input image, the output will be noise-free. The image will undergo several processes to achieve a higher resolution which intends to need a high-level language such as python for frame conversion and Verilog for implementation on hardware and also software Matlab and Xilinx. The need to deal with the picture progressively is tedious what's more, prompts the main technique for carrying out the calculation at the equipment level. With FPGA executions, the rationale expected by an application is carried out by building separate equipment for each capability. Additionally, FPGAs are intrinsically equal; this gives the speed to those continuous applications while holding the programmable adaptability of programming for a generally minimal price. This paper plans to carry out picture handling calculations utilizing Xilinx Vivado. The equipment execution of the calculations on FPGAs is finished utilizing a model-based plan approach. In this paper, we aim to implement an enhancement technique on real-time images. We start our process with Matlab code for resizing the image and .m file. Using python, pixels will be converted into frames. Using Xilinx vivado we obtain bitstream code. Once the bitstream is completed there will be a necessity to implement it to an FPGA Zynq 7000 board and using a VGA cable the output will be available in the monitor.



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DISTRIBUTION NETWORK RECONFIGURATION AND RECONSTRUCTION FOR POWER LOSS MINIMIZATION USING GENEROUS TRANSFORMATIVE OPTIMIZATION STRATEGY

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ABSTRACT

The power loss in a distribution system is substantially larger than in a high voltage transmission system because to lower voltage, higher reactive current, and radial construction. One of the most common solutions to reduce power loss in the distribution system and improve the voltage profile is grid reconfiguration. The main purpose of this research is to develop a methodology for efficient network reconfiguration in radial distribution systems in order to reduce real power losses and increase bus bar voltages. In a distribution system, network reconfiguration is a common approach to reduce power loss and improve the voltage profile. This research aims to use a Generous Transformative Optimization Algorithm to decrease power loss in radial distribution networks. The approach's performance is evaluated using typical 33-bus system configurations. The results were compared to prior Particle Swarm Optimization and Genetic Algorithm results in the literature, indicating that the combinatorial technique is beneficial in loss reduction, voltage augmentation, and cost reduction.

Key words: power loss, voltage profile, network reconfiguration, radial distribution.

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<https://iaeme.com/Home/issue/IJEET?Volume=12&Issue=12>

POWER QUALITY IMPROVEMENT OF DISTRIBUTION NETWORK RECONFIGURATION USING DYNAMIC RULE SOFT SWITCHING OPTIMIZATION METHOD

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Sapthagiri Engineering College

Dr. R Prakash

Sunil Kumar AV

Keywords: Reconfiguration, Distribution network, Dynamic Rule Soft Switching Optimization (DRSSO), Network Power Loss

ABSTRACT

The Dynamic Rule Soft Switching Optimization algorithm is used to suggest a reconfiguration distribution network plan with Distribution Generation for power quality improvement. Through network structure simplification and branch grouping, network loss was chosen as the objective function, and enhanced Dynamic Rule Soft Switching Optimization was used in branch group search. To boost search efficiency and avoid early maturity, the suggested Optimization approach was used to search within the group. On the IEEE-33 bus distribution power framework, the recommended method was compared to other current Genetic Algorithms and Particle Swarm Optimization methods. The impact of the distribution network's capacity on the power flow of Distribution Generation was explored. According to the simulation results, the suggested technique may be implemented due to optimal setup, resulting in a significant reduction in system energy loss and a rapid convergence rate. To operate the smart grid, simulation analyses the model's validity by reconstructing a model using a dual Dynamic Rule Soft Switching Optimization technique. At the same time, the proposed Dynamic Rule Soft Switching Optimization based network reconfiguration and optimization can effectively reduce network loss and improve resource quality.

AN ENHANCED DATA ANONYMIZATION APPROACH FOR PRIVACY PRESERVING DATA PUBLISHING IN CLOUD COMPUTING BASED ON GENETIC-CHIMP OPTIMIZATION

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ABSTRACT

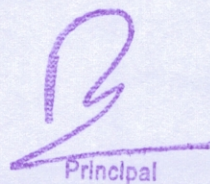
An important characteristic of the information stored in the cloud platform is data privacy. It is the biggest challenge in the medical field to share and publish sensitive information about an individual to the cloud infrastructure. Therefore, it is essential to protect the patients' information with high security and more data privacy. In this paper, a novel technique based on Mondrian based k -anonymization incorporated with Genetic-Chimp Optimization Algorithm is proposed to protect the privacy of the patients. The optimization algorithm employs average equivalence value and generalized information loss for the calculation of fitness value. Moreover, DNA-Genetic algorithm based encryption technique is also implemented after the anonymization process to give extra protection to the anonymized database. The experimental results shows that the proposed approach shows better results and it is efficient to preserve the privacy of medical databases when compared to other techniques.

Keywords: Privacy preservation, Mondrian K-anonymity, Utility, Privacy, Data Security, Encryption.

1. INTRODUCTION

Cloud Computing is a modern computing archetype to store, manage and retrieve information such as individual data, medical records, financial transactions, and so on. The cloud environment is utilized among millions of people all over the world (Zhan et al., 2015). It contains sensitive information about individuals like personal information such as quasi-identifiers (QI), name, date of birth, address, contact number, zip code, passwords, emails, health, finance, treatment details, medical records, etc., (Kundalwal et al., 2019). The privacy of the individuals is at risk when publishing the data with such sensitive information. While preserving data privacy, data can be published using Privacy preserving data publishing (PPDP) technique. Many data anonymization techniques are proposed for PPDP (Lokesh and Ranganatha, 2019; Romanou, 2018; Arava and Lingamgunta, 2019; Andrew et al., 2019; Ashkouti et al., 2020).

The sensitive information excluding processed data records to be protected before publishing in the cloud is known as data anonymization (Romanou, 2018). The k -anonymization is one of the most popular anonymization methods that guarantees each data record is unidentifiable from minimum $k-1$ other data records (Arava and Lingamgunta, 2019). Suppression and Generalization are the two main operations of the k -anonymization process. Though this technique shows better performance in individual privacy preservation, the performance is



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FACTORS CONSIDERED FOR SELECTING AN INSTITUTION FOR HIGHER EDUCATION IN BANGALORE AMONG STUDENTS FROM RURAL

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Principal, Sapthagiri College of Engineering, Bangalore.

Abstract

This study provides a comprehensive assessment of various factors that influence a student's decision on which institution to attend and the sources of information when it comes to choosing a university for their higher education. This study is conducted among the students of two leading Engineering Institutions in Bangalore city and specifically among students who are with rural background. The data required for this study was collected using a structured questionnaire administered in both English as well as local language, i.e. Kannada. Resulting from the literature review, nine factors have been identified, which were used Researchers have successfully tested and retested the instrument to improve their reliability. The researcher interviewed 154 respondents who were in their first year of engineering course. Descriptive statistics, ANOVA, Regression Analysis and Garrett Ranking Method were used as statistical tools to achieve the objectives. The results suggest that Institutions of Higher Education may focus their efforts to meet the expectations of the students and also to enhance other factors like learning resources, learning ambience, improve the quality of teaching and create visibility so that opinion of the parents, students and the general public be enhanced. The management should also stress upon the importance of extracurricular activities and awareness creating programmes to attract students from rural areas.

Keywords: Assessment, Higher Education, Expectations, Ambience, Extracurricular Activities.

INTRODUCTION

Different people have different expectations about what higher education means. For some, it means getting a higher education through the teaching-learning process in higher educational institutions. Higher education provides students with the knowledge and skills necessary to excel in today's world. It also serves as an opportunity for individuals to develop their personal development through a flexible education model (1).

Higher Education System in India:

India's higher education system, which is mainly focused on providing quality education, is the third largest in the global rankings. After gaining independence, it has become a massive growth opportunity (3). In India, higher education begins after the 10+2 education. There are various types of institutions involved in this field, such as universities, colleges, and polytechnics. Central universities are also involved in higher education (11). Through an act of



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Research article

Comparative study of three stochastic future weather forecast approaches: a case study



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ARTICLE INFO

Keywords:

Big data

KNN

Statistical downscaling

SWAT

Machine learning

ABSTRACT

Weather forecasting is an essential component of different hydrological studies. This article compares the weather prediction performance of various machine learning models like k-nearest neighbours (KNN), Soil and Water Assessment Tools (SWAT), and Representative Concentration Pathway (RCP). KNN is more resistant to noisy data set and provides more reliable performance than RCP and SWAT models. We simulate temperature, precipitation, and wind speed using KNN, SWAT and RCP weather generators, and we compare the results with observed data. The analyses compare WP-KNN with state-of-the-art classification and prediction models. We also suggest a systematic forecasting methodology that uses an updated version of the KNN classification. Our extensive experimental modelling findings show that the proposed technique is much more effective in a noisy dataset.

1. Introduction

The creation of stochastic weather models is an important activity for many practical applications in hydrology and water resource management. These models are also used for impact assessment studies that involve stochastically generated weather sequences as inputs. Initially, parametric weather generators are concentrated on independent precipitation creation (Nickles and Harp, 1980), but the rest of the variables are usually modeled on rainfall. Daily precipitation amounts are produced using the Markov first-order two-state model from the assumed probability distribution to the observed values (Fodorovic and Woolhiser, 1975). The model has blended a first-order Markov daily precipitation model with an exponential distribution statistical model for daily, non-zero precipitation (Buishand, 1977; Katz, 1977; Stern and Coe, 1981) and used a two-parameter gamma distribution to describe the event of precipitation on rainy days.

The characterization of precipitation levels during wet days (Smith and Schreiber, 1974; Wilks, 1999; Woolhiser and Roldan, 1982) matched a three-parameter mixed exponential distribution. In addition to precipitation (Richardson, 1981), an exponential model was provided for the Markov chain to provide more weather variables.

One goal of statistical analysis for data sequences is to make inferences about the population's attributes. Therefore, the forecast of

future findings is based on stochastic process concepts and corresponding models.

Herein, we use an autoregressive approach to analyse the errors incurred in predicted data sets, including the root mean squared error (RMSE) and the coefficient of variance R^2 . Statistical weather generators, as suggested by Richardson (1981), are typically referred to as weather generators (WGEN), as in Richardson and Wright (1984). Williams et al. (1996) introduced WXGEN, an improved version of WGEN that took into account non-linear or skewed distributions of wind speed and relative humidity.

In Generation of Weather Elements for Multiple Applications (GEM) Weather Generator (Hanson and Johnson, 1998), the variables wind speed and dewpoint are used to calculate relative humidity (Parlange and Katz, 2000), further expanded WGEN to include average daily wind speed and dewpoint in the model (Wilks and Wilby, 1999), which provided an outstanding analysis of stochastic weather models.

The present research aimed mainly at simulating meteorological data at Basel (Fig. 1), Switzerland, using three models: KNN, SWAT, and the Community Climate System Model (CCSM)-Representative Concentration Pathway (RCP). Here we intended to generate synthetic weather sequences that could be used as inputs into hydrological models. The generated weather data were then validated against observed data. An RMSE criterion based on a confidence interval of 95% was used to determine which model was the most efficient.

Peer review under responsibility of Xi'an Jiaotong University.

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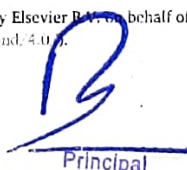
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Dynamic mechanical behavior of natural fibers reinforced polymer matrix composites – A review

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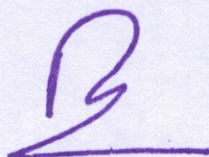
Abstract

The environmental awareness and rapid development in the area of material science attracted the researchers into natural based materials on account of their chemical resistance, ease of fabrication, low density, specific strength, inexpensiveness and favourable mechanical properties. However, some cellulose fibres extracted from natural sources have somewhat high mechanical properties nearer to those of synthetic fibres. Composites using natural fibres as reinforcement have shown favourable results. These natural fiber reinforced composites often considered as high performance reinforcements in polymer composites. DMA had become important for both industry and academia. DMA is an effective thermal analysis tool for the determination of elastic nature of a composite material with respect to of time, frequency, temperature and combination of these. A dynamic mechanical analysis utilizes applied force and deformation data to evaluate the stiffness changes in a material under varied temperatures. DMA measures elastic nature with reference to storage modulus (E'), loss modulus (E''), damping factor ($\tan \delta$) and glass transition temperature (T_g). These properties will be very helpful to measure the performance characteristics of polymer composite materials including both thermosets and thermoplastics. Now a days, most effective and flexible DMA instruments under different modes are available. Dynamic Mechanical Analysis (DMA) is currently used by rubber manufacturers to study the performance of their materials. For the purposes of industrial testing as well as for research and development, DMA is recognized as a highly informative characterisation technique. DMA curves depicts variation of dynamic moduli and damping in glassy or rubbery regions. The current review studies the effect of natural fibres on dynamic mechanical properties of polymer composites. Many results exhibited that inclusion of natural fibres with polymers tends to increase the elastic nature of the polymer matrix.

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
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Keywords





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Dynamic mechanical analysis of graphene and nano silica reinforced hybrid epoxy composites under dual cantilever mode

P.R. Anilkumar^a , L.H. Manjunatha^b, T. Venkatesgowda^c

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
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
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Abstract

This paper presents Dynamic mechanical behaviour of polymer Nano composites reinforced with various weight percentages of polymer and Nano particles and effect of Nano particles with polymer. The Graphene and Nano silica were used as fillers with epoxy resin. The Nano composite plates were prepared using cold compression moulding technique. Finally, the prepared composite plates were sized in laser cutting according to ASTM standards and subjected to DMA test. A series of dynamic mechanical tests were performed for prepared composites over a range of testing temperatures. Test frequency was kept constant. The dynamic mechanical properties of prepared Nano composites were studied by recording storage modulus, loss modulus, $\tan \delta$ and glass transition temperature (T_g). It was found that the storage modulus (E') recorded was decreasing with increasing temperature. The loss modulus (E'') and damping peaks ($\tan \delta$) values were found to be increased with increasing in temperature up to certain value and beyond certain temperature it was found to be decreased. Also, the loss modulus (E'') and damping peaks ($\tan \delta$) values were found to be reduced with increasing reinforcements whereas T_g decreases as reinforcements increase.

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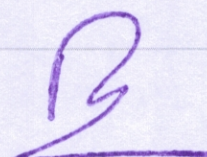
Keywords

Graphene; Nano silica; Epoxy; Storage modulus; Loss modulus; Damping

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


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Optimization of machining conditions with D type cutting tools using Taguchi technique

T.S. Siddaligaprasad ^a  , H.S. Shivashankar ^a, T.M. Chandrashekharaiah ^b, Basavaraj Ganiger ^c 

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
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Abstract

In the present study a commercial grade D2, D3 and HSS steel tool materials have been forged and heat treated to induce better hardness. The microstructures of the forged and heat treated tools were seen using metallurgical optical microscopy. The hardness of the cutting tools was recorded with the OMNITECH micro Vickers hardness tester. The D2 tool with 20% forged & heat treated, D3 tool with 20% forged & heat treated and HSS tool exhibited the VHN 629, 610 and 846 respectively. The machining of brass, aluminum and aluminum metal matrix composites were observed with respect to chip generation and materials surface roughness. The machining was carried out at different conditions of work piece rotational speed (300, 540 & 720 m/min), cutting tool feed rate (0.1 & 0.15 mm/rev) and depth of cut (0.3, 0.5 & 1 mm). As Taguchi technique helps in simplifying experimental design, data analysis, and prediction of optimum results, it has been employed for the optimization of machining parameters. It is noticed that lower cutting speed resulted discontinuous and segmented chips and larger surface roughness. The larger cutting speeds resulted semi continuous chips with saw toothed tip and comparatively good surface roughness.

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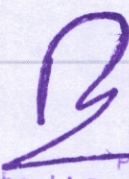
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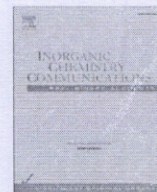
Keywords

D2 & D3 steel tool; Aluminum; Cutting speed; Surface roughness; Worn surfaces; Optical microscopy; Chip formation; Hardness

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Short communication

Dy³⁺ ions activated CaAl₂O₄ nanophosphors: Photoluminescent and photometric properties prompted manifold applicationsB.S. Shashikala^{a,b}, H.B. Premkumar^{c,*}, S.C. Sharma^{d,e,f}, H. Nagabhushana^g, B. Daruka Prasad^h, G.P. Darshan^c^a Department of Physics, Sapthagiri College of Engineering, Bengaluru 560 057, India^b Visvesvaraya Technological University, RRC, Bengaluru 560 091, India^c Department of Physics, Faculty of Mathematical and Physical Sciences, M.S. Ramaiah University of Applied Sciences, Bengaluru 560 054, India^d National Assessment and Accreditation Council, Bengaluru 560 072, India^e Honorary Professor, Jain University, Bengaluru 562 112, India^f Distinguished Professor, Centre for Energy, Indian Institute of Technology, Guwahati 781 039, India^g Prof. C.N.R. Rao Centre for Advanced Materials, Tumkur University, Tumkur 572 103, India^h Department of Physics, BMS Institute of Technology, VTU-affiliated, Bengaluru 560 064, India

ARTICLE INFO

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Ultrasonication

Photoluminescence

Photometric properties: Latent fingerprints

ABSTRACT

A systematic design and fabrication of material with multi-directional applications was in high demand. Hence, the present work demonstrates Dy³⁺ (1–11 mol %) activated CaAl₂O₄ nanophosphors fabricated via ultrasonication method using fresh lemon juice as a bio-surfactant for multimodal applications. The X-ray diffraction studies of the prepared nanophosphors confirm the monoclinic phase. The morphological study of the prepared nanophosphor reveals irregular-shaped particles with an average size of ~ 26 nm. The energy bandgap of the nanophosphors was estimated and found to be ~ 3.017–3.126 eV. Photoluminescence emission spectra of the nanophosphors show intensive and sharp peaks centered at ~ 483, 572, and 636 nm, which are attributed to ⁴F_{9/2}–⁶H_{15/2}, ⁴F_{9/2}–⁶H_{13/2}, and ⁴F_{9/2}–⁶H_{11/2} transitions of Dy³⁺ ions, respectively. The photometric properties (i.e., chromaticity coordinates, color temperature, and color purity) of the nanophosphor reveal warm white light emission with a color purity of ~ 34.26 %. The optimized sample was utilized for visualization and revelation of authenticated ridge details of latent fingerprints. The above results enriched that the prepared nanophosphor was considered to be an excellent candidate for multi-directional applications.

1. Introduction

Fingerprints (FPs) constituting typical ridges and furrows characteristics provide unique evidence for personal identification. FPs are the most evidential data available during crime investigation and the intern helps investigators to track a criminal's record. Most of the FPs available in a crime spot are latent (invisible) and making them visualize is a challenging task [1–4]. Till date, several efforts are employed to visualize latent fingerprints (LFPs), including powder dusting (magnetic, metallic, and fluorescent), iodine fuming, ninhydrin spraying, silver nitrate soaking, cyanoacrylate fuming, etc. However, these techniques have suffered from severe drawbacks, such as high background hindrance, low visualization sensitivity, toxic nature, and complex operation [5–9]. Among these, the powder dusting method has been the most

widely utilized approach in crime investigation due to its convenience and broad applicability [10–11]. Regular and metallic powders are the mostly used FPs powders. The regular powders normally contains resinous polymers (starch, rosin, silica gel, etc.) and colorants, which have impotent to develop LFPs on the complicated surfaces; however, hazardous components present in metallic powders was harmful to human health [12–14]. To overcome these issues, luminescent nanomaterials are considered to be the most efficient materials to visualize LFPs due to their small size (almost 10³–10⁴ times smaller than FPs ridge-width), which ensures high sensitivity, low background hindrance, high spatial resolution [15–16]. Recently, various rare-earth (RE³⁺) doped luminescent nanomaterials are successfully employed to visualize LFPs on various forensic related surfaces using external light stimuli (UV light source). Table 1 showcases the various nanomaterials

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DC conductivity of heavy metal oxide (Bi_2O_3) boro-tellurite glasses: Effect of Eu_2O_3

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Boro-bismuth-tellurite glass;
Scanning electron
Microstructure;
DC conductivity;
Arrhenius behavior

Abstract

A novel investigation on structural and DC conductivity of Eu_2O_3 activated heavy metal oxide boro-tellurite (BBTE) glasses were analyzed. The boro-bismuth-tellurite glass samples doped with europium trioxide were fabricated by the conventional melt quenching method. The microstructural and structural studies of the glasses have been done by scanning electron microscope (SEM) and X-ray diffraction (XRD), respectively. The DC conductivity of the BBTE samples has been studied at the frequency range 40Hz-6MHz and in the temperature range 303-453K. The XRD and SEM, confirm the non-crystalline and homogeneous properties of prepared glasses. The DC conductivity of glasses obeys Arrhenius behavior and DC conductivity decreases with increasing Eu_2O_3 concentration. A very less amount of DC conductivity was noticed in glasses with various temperatures and it is due to less availability of oxide ions.

1. Introduction

Due to their high conductivity and high thermal stability, a significant number of investigations were committed to develop many types of transition metal ions (TMIs) based on fast ion conducting (FIC) materials. Therefore FIC compounds exhibit potential applications in solid-state ionic batteries, fuel cells, sensors, capacitors as electrolyte materials [1,2]. Glass modifiers such as Ag_2O , Cu_2O , and Ag_2S give strong exothermic chemical reactions when mixed with glasses [1-5]. Glasses having heavy metal oxides (HMO*) like PbO , Bi_2O_3 retain outstanding and appreciated physical and chemical properties. Hence these glasses find applications in optoelectronics, optical devices, photonics [6-9]. For example; Bi_2O_3 and PbO can form stable glasses upto 85% with B_2O_3 , P_2O_5 , and SiO_2 because these two HMOs behave like either network modifiers (BiO_6 , PbO_6) or network formers (BiO_3 , PbO_4) [6-9]. In addition, glasses containing bismuth oxide are strongly suggested for significant application in thermal sensors, mechanical sensors, high energy physics, scintillation detectors for reflective windows [10,11], and more recently bone applications as bioactive glasses. [12]. Borate glasses possessing HMOs and transition metal oxides (TMO*) reveal technological applications in mechanical sensors, optical-electronic devices, reflecting windows, thermal sensors [13-16]. Commonly, glasses containing TMO* exhibited greater semiconducting properties [15-21]. Therefore, such glasses show important applications in modern optical and electronic devices [15,21] and electrode materials in batteries [22,23]. The TeO_2 , in its pure form, cannot give glasses directly due to its conditional glass nature. But tellurite based glasses show good chemical durability, low melting point, better optical properties, and good mechanical strengths. Glass forming ability of TeO_2

can be enhanced by adding other glass formers, and among all available glass formers, boron oxide is well suited to TeO_2 due to its low melting, high thermal stability, and high glass-forming ability even with regular quenching rates [24-28]. Additionally, TeO_2 -based glasses [12,13], unlike the transition metal ions (TMI), have been measured to have higher electrical conductivity than silicate, phosphate, and borate samples. Several electrical studies on glass materials have revealed that glasses do not necessarily have to be insulators but in some cases super-ionic conductors [29-31]. TeO_2 glass systems have been explored for diverse conduction studies [32,33]. The presence of a weak hopping method in glass materials containing HMOs was shown by Mogus-Milankovic *et al* [34]. Moustafa reported the conduction process and electrical properties of semiconducting iron bismuth glasses [35]. Recently, the Effect of temperature and frequency on mixed transitions metals doped semiconducting bismuth-phosphate glasses was reported by Nanao Ningthemcha *et al* [36]. They reported that the DC conductivity was is described with Mott and Greaves VRH models shows reduction of DC conductivity with the increases in MoO_3 concentration. Sunil Dhankhar *et al* reported electronic transport and relaxation studies in bismuth-modified zinc boro-tellurite glasses [37]. The effect of silver ion on transport properties were explored in boro-tellurite samples [38]. Dielectric properties were practically investigated on boro-tellurite glasses, $(\text{B}_2\text{O}_3)_{0.2}(\text{TeO}_2)_{0.3}(\text{CoO})_x(\text{Li}_2\text{O})_{0.5-x}$ ($x=0.05-0.5$) [39]. The effect of mixed glass has been studied in a set of lithium oxide doped boro-tellurite samples [40]. The polaronic conductivity and ionic conduction outcomes were studied for alkali boro-tellurite glasses [41] and Bi_2O_3 - B_2O_3 - TeO_2 [42] respectively. The eminent level application in optical fiber amplifiers, diffractometer display monitors, and planar waveguides [43,44] was reported on oxide glasses



Elastic properties of boro-tellurite glasses doped with europium oxide

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Abstract

The glass series of $x\text{Eu}_2\text{O}_3\text{-}5\text{PbO-}25\text{TeO}_2\text{-(}70\text{-}x\text{) B}_2\text{O}_3$, where $x=0.1$ mol% to 0.6 mol% were prepared by employing the conventional melt quenching method. The non-crystallinity of prepared BTE glasses was examined by the X-ray diffraction method. The very important mechanical properties such as elastic moduli, Debye temperature, Poisson's ratio, fractional bond connectivity, softening temperature, acoustic impedance, and the thermal expansion coefficient of the BTE glasses have been studied by measuring ultrasonic velocity. The experimental results indicate that the calculated parameters strongly depend on increasing Eu_2O_3 concentration. The elastic moduli of the prepared samples were found to decrease with Eu_2O_3 concentration and this increases the discontinuity in the glass network.

1. Introduction

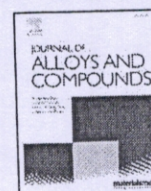
The ultrasonic non-destructive method is one of the best methods for evaluating mechanical properties, phase changes, and elastic moduli [1-4]. The elastic properties of solid materials are of considerable importance in the various experimental methods available to study structure-property relationships [5]. The transmission of ultrasonic waves in glass-like solids gives information about the solid-state motion of an object. Acoustic wave transmission in bulk glasses is of great attention to understand the mechanical properties [6]. Many physical parameters of the glasses, which are subjective to elastic moduli can be determined by using ultrasonic velocity [6-9]. Consequently, the choice of the most appropriate material for a specific application needs awareness of its mechanical properties [9-11].

Glasses having divalent ions such as Te^{2+} , Pb^{2+} play a significant role in the modification of property [12-14]. It is perceived that the incorporation of metal oxides like PbO , ZnO into the boro-tellurite glass matrix could do changes in the densities and molar volume of the glasses [14-6]. It is reported that tellurite (TeO_2) converts TeO_4 into TeO_{3+1} and TeO_3 units when B_2O_3 is added to the TeO_2 glass network and it also improves the ability of glass formation with TeO_2 [17,18]. The addition of B_2O_3 decreases B-O coordination and increases B_2O_3 concentration in boro-tellurite glasses. Boron oxide is an exceptional material for blending with tellurium oxide, which improves the quality of glass in terms of glass stability, transparency,

and hardness of rare-earth ions solubility. Borate-based specimens find widespread applications in all fields due to their various physical-chemical properties [19-21]. Additionally, it is shown that the elastic properties associated with acoustic properties are most useful due to their preferred applications in a few devices like light modulators and solid-state sensors [1-3,16,21,22].

Glasses embedded with rare-earth ions have great interest due to their broad range of applications such as temperature sensors, memory devices, solid-state lasers, infrared to visible up-converters, bulk lasers, planar waveguides, optical fiber amplifiers, high-density memory devices, flat plane displays, field emission displays, electroluminescent devices, optical data storage devices, color display devices [23-27]. The europium consists of energy level with simple structure and non-degenerate ground state $^7\text{F}_0$ and emits $^5\text{D}_0$ states. Hence the substitution of Eu^{3+} ions into the glass network is relatively advantageous to the study of disordered materials [28,29]. As per the literature survey, there is insufficient information regarding the effect of the addition of Eu^{3+} ions to the boro-tellurite matrix on mechanical properties. Therefore it is very motivating to discover the relation between the significant changes in the glass structure, the density, and mechanical properties of Eu^{3+} ions in boro-tellurite glasses.

In the current work, detailed information on the influence of europium oxide on density and elastic properties of boro-tellurite glasses were deliberated, and it also examined the structural conversion of the boro-tellurite system induced by the addition of Eu_2O_3 .



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

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ABSTRACT

Six glass samples composed of the $(70-y) \text{B}_2\text{O}_3-15\text{TeO}_2-10\text{Na}_2\text{O}-5\text{PbO}-y\text{Eu}_2\text{O}_3$, 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 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

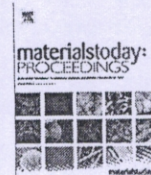
The optimistic and attractive studies on borate-based glasses have been carried out since few decades due to their high-quality and desirable properties such as high rare-earth ions solubility, easy to prepare, good transparency, low melting point and low phonon energy. These properties of borate-based 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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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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Structural, conductivity and dielectric properties of europium trioxide doped lead boro-tellurite glasses



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ABSTRACT

A very rare set of glasses having chemical compositions of B_2O_3 - TeO_2 - Na_2O - PbO , doped with europium trioxide were obtained by the conventional melt quenching procedure. An X-ray diffractometer was run to confirm the non-crystalline nature of the structural studies. The AC conductivity and dielectric properties of glasses were studied in the temperature range 343–483 K with a 40 Hz to 6 MHz frequency range. The Almond–West model of power-law suggests, the well-fitting of found AC conductivity values and conductivity is due to translational motions of carriers. AC conductivity decreases with increasing concentration of Eu_2O_3 . The non-Debye type of relaxations was predicted by AC conductivity plots. The dielectric constant and dielectric loss of complex permittivity was measured and obtained values suggested that the phenomenon of dielectric relaxation is mainly subjected to the frequency-dependent polarization mechanism. The obtained power-law exponent values indicate the AC conductivity mechanism and follow the CBH model.

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1. Introduction

The oxide glasses containing heavy metal oxides and rare earth oxides have gained remarkable attention because of their complex conductivity. This type of glasses finds a wide range of applications in mobile communication systems, electrical devices, good performance capacitors, and cathode coating lithium batteries [1,2]. The alkali oxides embedded in glassy material also showed added attention owing to their ionic electrical conductivity and these glasses are well known as suitable glass materials in the field of solid-state devices [3,4]. Though the glasses show less conductivity with respect to Nobel metal ions doped glasses, these glasses are appropriate and best identified as ionic conducting materials and the relatively high electropositive characteristic behavior of alkali ions ensures applications of solid-state batteries [5]. The glass formers PbO , B_2O_3 and conditional glass former TeO_2 draw a good ionic conductivity [6,7]. The boro-tellurite were studied relatively more due to their

significant and typical properties like good rare-earth ions solubility, the possibility of wide varying glass composition, and easy glass-forming abilities [8–13]. The hygroscopic nature of borate glasses made limitations on experimental studies. It is reported that the insertion of tellurium and lead oxide into the borate-based glasses improves the chemical durability, rigidity, thermal stability, optical properties and mechanical strengths [14–18]. Also, the tellurite activated glasses show relatively high electrical conductivity and dielectric constant with respect to additional existing oxide glasses owing to an unshared couple of electrons in TeO_4 units, because it does not involve in the bonding with $Te-O-Te$ structure [19]. The rare earth elements are well known in the periodic table because of their technical uses in the wide variety of ferroelectric applications, optical materials, phosphors, and high-temperature superconductors [20]. The rare-earth ions show special properties such as relatively high, chemically active and stable. The study of the chemical activity of rare earth ions is quite important to study as the impact of their filled $5s^2$, $5p^6$ electron shell, and partially $4f$ shell [21]. Among the different trivalent rare-earth (RE^{3+}) ions, Eu^{3+} ions doped glasses are the best candidates for optical device and optoelectronic applications, due to its unique properties like narrow fluorescence band,

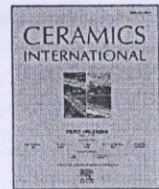
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Optical properties of bismuth tellurite glasses doped with holmium oxide

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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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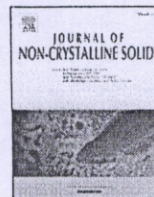
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Experimental and theoretical elastic studies on neodymium-doped zinc tellurite glasses

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ABSTRACT

The melt-quenching method was used to synthesize a series of neodymium-doped zinc tellurite glass systems. The ultrasonic velocities, elastic moduli and other elastic parameters of the prepared glasses showed non-linear variations with an increase of Nd₂O₃ in the glass system. The non-linear variation is associated with the presence of non-bridging and bridging oxygen caused by the network modifier of Nd₂O₃. Theoretical data sets for the elastic properties of the glass systems were obtained by using the Makishima and Mackenzie theory and the Rocherulle, bond compression and ring deformation models. The values retrieved for the elastic moduli by using the Makishima and Mackenzie, and Rocherulle models are in great agreement with the corresponding experimental data. The recorded bond compression model data for the glass has much higher values for elastic moduli when compared to the corresponding experimental values. Therefore, in this glass system, only the bond compression model is not favoured.

1. Introduction

Glass is a material made from the molten of a mixture of inorganic oxides through rapid cooling. The molten inorganic oxide solidified into a rigid, transparent and non-crystalline glass material state that are well-known all over the world [1,2]. Glass formation can only happen with the presence of a sufficient amount of glass former such as SiO₂, B₂O₃, TeO₂, P₂O₅ in the chemical composition of a glass [3–6].

Nowadays, glass has been discovered beneficial to be used in recent technological applications and the potential conditional glass former is tellurium oxide. Tellurite glass has been introduced due to its unique properties. Tellurite glasses possess some of the greatest advantages such as high malleability, low temperature of processing, good mechanical strength relatively with other oxide glasses such as phosphate and germanium [7]. Tellurium atom in tellurite-based glasses possesses

a lone pair of 5s orbit electrons with a high hyper polarity. This property makes the tellurite based glass an excellent candidate with the greatest potential for nonlinear optical glasses applications. In tellurite based glasses, the weak Te-O bond can be broken easily during the glass formation process that grants the tellurite based glasses the ability to accommodate heavy metal and rare earth ions [8].

The addition of a large amount of the rare earth dopants will either make the fabricated glass become extremely fragile or eventually discourage the formation of glass. Thus, rare earth (RE) oxides are seldom introduced at a high concentration into any glass system. The amount and concentration of rare earth oxides incorporated into a glass material depend on the glass material applications. The applications could be for photonic devices, optical data transmission or even the detection and sensing to laser technologies [9]. The choice of RE ions depends on the relationship between the radiative or non-radiative RE

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Manganese ferrite—polyaniline nanocomposites for microwave absorbers in X band

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ABSTRACT

From the past few decades, ferrite is well-known noble material due to its prominent properties like structural, electrical and magnetic properties. With these advantages, ferrites have been used as a substance to incorporate various kinds of functional materials. Among all the ferrites, MnFe_2O_4 -based polyaniline nanocomposites have attracted a great deal of interest due to their enhanced performance due to low cost, strong environmental stability and intriguing electroactivity. In the present work, MnFe_2O_4 is prepared by sole-gel auto-combustion method and MnFe_2O_4 @PANI nanocomposites were synthesised by mechanical mixing method with various wt% (from 10 to 50%). The as-prepared nanocomposites were characterised by the XRD, and TEM and VSM are used to study the properties like structural and magnetic behaviour of the ferrite-mixed PANI composite. In the 8 GHz–12 GHz range, the complex permittivity and permeability of composite samples were calculated. The values of permittivity were observed to increase as ferrite volume concentration increased, while permittivity decreased as PANI increased. As a result, polyaniline-based nanocomposites specifically demonstrate that they can be used as EMI shielding materials. These nanocomposites are used in microwave absorbers in X band applications.

1 Introduction

In recent years, synthesis of magnetic nanostructures has been investigated for various applications due to their unique structural, electrical and magnetic properties [1–3]. Electronic instruments have become


more compact as a result of tremendous innovation, and the density of electrical segments and working frequency has increased dramatically, resulting in a new kind of problem known as electromagnetic interference (EMI). This article examines the CPF (conducting polymer-ferrite) nanocomposites in


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Structural, microstructural and temperature dependent magnetic properties of Mg–Ni doped CoCr_2O_4 ceramics

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ABSTRACT

In the present work, $[\text{Co}_{(1-(x+y))}\text{Mg}_x\text{Ni}_y][\text{Cr}_2]\text{O}_4$ (CMNCR) (where, $x = y = 0, 0.10, 0.20$) NPs are examined in detail by using experimental results. Solution combustion method is adopted to prepare the CMNCR NPs. Experimental results were studied to understand structure (using XRD), microstructure (using SEM) and magnetic behaviour (using SQUID). The structural analysis was confirmed a single-phase spinel cubic structure with singular structural distortions associated with Mg–Ni doping and the generation of metal vacancies. SEM micrographs of all samples reveal their highly porous nature. EDS was utilized to examine the elemental analysis of the samples. The formation of spinel cubic structure without impurity were also confirmed by Fourier-transform infrared (FTIR) spectroscopy and the same tool is used to investigate the absorption bands related to the A-site and B-site. For all samples, paramagnetic phase to ferrimagnetic phase transition observed at T_C and conical spiral spin order transition observed at T_S . The Curie temperature is found to be 98 K, 89 K, and 85 K for $[\text{Co}][\text{Cr}_2]\text{O}_4$, $[\text{Co}_{0.8}\text{Mg}_{0.1}\text{Ni}_{0.1}][\text{Cr}_2]\text{O}_4$ and $[\text{Co}_{0.6}\text{Mg}_{0.2}\text{Ni}_{0.2}][\text{Cr}_2]\text{O}_4$ samples, respectively. The spiral transition temperature is found to be 26 K, 14 K and 8 K for $[\text{Co}][\text{Cr}_2]\text{O}_4$, $[\text{Co}_{0.8}\text{Mg}_{0.1}\text{Ni}_{0.1}][\text{Cr}_2]\text{O}_4$ and $[\text{Co}_{0.6}\text{Mg}_{0.2}\text{Ni}_{0.2}][\text{Cr}_2]\text{O}_4$ samples, respectively. All of the samples exhibit paramagnetic behaviour above T_C . The negative magnetization effect were observed in $[\text{Co}_{0.6}\text{Mg}_{0.2}\text{Ni}_{0.2}][\text{Cr}_2]\text{O}_4$ NPs. 20% of Mg and 20% of Ni substitution to Co site in $[\text{Co}][\text{Cr}_2]\text{O}_4$ leads to the evident magnetization reversal at the compensation temperature with an applied magnetic field of 100 Oe. The $M-H$ loop at 10 K exhibits large coercivity due to the spiral spin ordering. This phenomenon of negative magnetization in the material results in a stable state of magnetization in the material, which has significant applications in the field of magnetic storage devices.

1. Introduction

Magnetic nanoparticles (NPs) have been the focus of intensive research for several decades because of their role in understanding the fundamentals of magnetism and their applications in a variety of important domains, including catalysis, spintronic systems, biomedicine and magnetic seals [1–3]. The intriguing physical and chemical properties of ferroic materials with spinel type structures have attracted extraordinary consideration, with potential applications in catalysis, high-temperature ceramics, biomedical materials and electrochemical

sensors [3–7]. Spinel chromites have the general formula AB_2O_4 , where A describe the tetrahedral and B describe the octahedral sites. In chromites, Cr^{3+} ions are situated at B-site, whereas divalent metal ions ($\text{M}^{2+} = \text{Co}^{2+}, \text{Mg}^{2+}, \text{Ni}^{2+}$) are situated at A sites [8]. The cationic distribution over the interstitial sites determines the physical properties of chromites.

Néel predicted in 1948 that such ferrimagnetic materials would display spontaneous magnetization changes as a function of magnetic field or temperature [9]. Numerous magnetic materials, like chromites, vanadates, and ferrites, have recently shown negative magnetization

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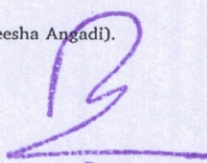
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
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The effect of Gd as a dopant in crystal structure and on its electrical and humidity sensing behaviour of $\text{Co}^{2+}\text{Cr}_2^{3+}\text{O}_4$ for possible application in sensors

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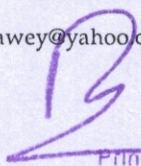
ABSTRACT


In this paper, we presented structural, Fourier infrared spectroscopic, and dielectric analysis of cobalt chromate ($\text{Co}^{2+}\text{Cr}_2^{3+}\text{O}_4$) with various percent gadolinium (Gd^{3+}) rare-earth metal additions under humidity and non-humidity circumstances. The major goal of this research is to develop more robust and sensitive humidity sensor materials. The Gd^{3+} -doped $\text{Co}^{2+}\text{Cr}_2^{3+}\text{O}_4$ samples are produced using a modified solution combustion process and sintered for 2 h at 650 °C to demonstrate the influence of Gd^{3+} on structural, Fourier Infrared spectroscopic, dielectric with constant frequency and presence of humidity characteristics. X-ray powder diffraction (XRD) analysis provides the detailed formation of the $\text{Co}^{2+}\text{Cr}_2^{3+}\text{O}_4$ phase. Furthermore, the average crystallite sizes are 7 to 9 nm for Gd^{3+} -doped $\text{Co}^{2+}\text{Cr}_2^{3+}\text{O}_4$. The general nature of ferrite materials is revealed via FTIR analysis. Our research focus on the properties of permittivity and electrical conductivity with Gd^{3+} addition, constant frequency, and humidity. We studied the relevant conductivity of the samples, the response time of the capacitive sensor, and the humidity influence, at the constant frequency level, on the characteristics of the relative permittivity at a constant frequency range of $f = 1$ kHz. Our results suggest that the Gd^{3+} doped $\text{Co}^{2+}\text{Cr}_2^{3+}\text{O}_4$ can be used as an active material for humidity sensor applications.

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Study of the electronic structure of LuFeO_3 and $\text{Lu}(\text{YFe})\text{O}_3$ nanoparticles by X-ray photoelectron spectroscopy and Mossbauer spectra

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ABSTRACT

It's indeed critical to improve our understanding of how functional materials work in order to design the next generation of materials in their domains. We chose LuFeO_3 and $\text{Lu}(\text{YFe})\text{O}_3$ to study the electronic structural and spectroscopic properties using X-ray photoelectron spectroscopy and Mössbauer spectra to accomplish this. LuFeO_3 and $\text{Lu}_{0.2}\text{Y}_{0.8}\text{FeO}_3$ were prepared by the solution combustion method using carbamide and glucose as fuel. As-synthesized samples sintered at 1250 °C to get single phase. X-ray diffraction patterns of LuFeO_3 nanoparticles confirm the *orthorhombic* structure and $\text{Lu}_{0.2}\text{Y}_{0.8}\text{FeO}_3$ nanoparticles confirm the major *orthorhombic* structure and minor hexagonal structure. Crystallite size decreases after the substitution of Y^{3+} on LuFeO_3 . X-ray photoelectron spectra were excited with a monochromatized AlK α -line radiation. Absolute resolved energy interval was 0.6 eV, which was determined with the Ag3d $_{5/2}$ line. The diameter of the X-ray spot on a sample was 500 μm ; it was small enough to study the samples obtained. The sample of the composition $\text{Lu}_{0.2}\text{Y}_{0.8}\text{FeO}_3$ contains approximately 10 times less LuFeO_3 . The spectra are split into components that correspond to the valence locations of Y3d, Fe3d, and Lu 4f states in yttrium, iron, and lutetium, respectively. It can be seen that the addition of yttrium does not strongly displace the valence band components related to the densities of Y3d, Fe3d, and Lu 4f states in the $\text{Lu}_{0.2}\text{Y}_{0.8}\text{FeO}_3$ sample

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Structural, Microstructural, Infrared, and Mössbauer Spectroscopy Study of LuFeO_3 Prepared by Solution Combustion Method

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Abstract

In the present work, we investigate the electronic structural microstructure and spectroscopic characteristics of LuFeO_3 . Sample is prepared by the solution combustion method. X-ray diffraction patterns of LuFeO_3 nanoparticles confirm the *orthorhombic* structure crystallite size found in nano range. X-ray photoelectron spectra were excited with a monochromatized AlK-line radiation. Absolute resolved energy interval was 0.6 eV, which was determined with the $\text{Ag}3d_{5/2}$ line. The diameter of the X-ray spot on a sample was 500 μm ; it was small enough to study the samples obtained Mössbauer spectra of LuFeO_3 were collected in the temperature range of 13–700 K. At 700 K, the spectra of both samples are paramagnetic doublets with similar parameters. At the lowest temperature (14 K), the spectra of both samples are magnetically split sextets. The isomer shift values of the sextets and doublets are typical for Fe^{3+} ions in oxygen octahedron. Morphology study and elemental analysis results reveal that the particle morphology and size is highly dependent on the reaction temperature, synthesis method, and fuel. Further, the active vibrational bands in these spectra correlate to the functional groups found in the examined system.

Keywords XPS · Powdered XRD · FTIR · SEM · Mössbauer spectroscopy · LuFeO_3

1 Introduction

The most stable orthorhombic structure- LuFeO_3 and the metastable hexagonal structure- LuFeO_3 are both found in Lu-ferrite [1, 2]. Because of its meta-stability, experimental studies of bulk hexagonal structure- LuFeO_3 multiferroicity are difficult and consequently uncommon [3–5]. Furthermore, because hexagonal structure- LuFeO_3 has a greater unit cell capacity than o- LuFeO_3 , high pressure synthesis is unlikely to work for it. Although hexagonal structure- LuFeO_3 films may be stabilized on various substrates, strain effects, interface/surface effects, and widely present flaws in films can all have a significant impact on their inherent physical characteristics [6]. As a result, it is critical to conduct experiments with high-quality bulk samples. However, unlike RMnO_3 , where the hexagonal phase takes precedence over the orthorhombic when R^{3+} is low, the orthorhombic phase in RFeO_3 is always stable since Lu^{3+} is already the smallest rare earth ion. Scandium (Sc) substituted LuFeO_3 has recently been found to have a stable hexagonal structure [6]. Three intriguing questions have arisen as a result of this research. First, why does the addition of Sc maintain the hexagonal structure,

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Influence of SiO₂ on Structural and Morphological Properties of Cobalt and Tin Embedded Calcium Nano-Ferrites

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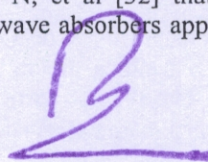
Abstract: A series of cobalt and tin substituted calcium nano-ferrite samples having chemical composition $\text{Ca}(\text{Co-Sn})\text{Fe}_{2-x}\text{O}_3+\text{SiO}_{2x}$ ($x = \text{wt}\%$) has been synthesized by sol-gel microwave auto combustion technique with different ratios of SiO₂. The structural depiction of prepared samples is conceded by an X-ray diffractometer (XRD). The Z-type tetragonal crystal structure and crystal planes of the samples were confirmed by XRD studies. The morphological properties of ready samples were carried by Scanning Electron Microscope (SEM). The SEM measurement gives an idea of the presence of nano ferrites with a particle size of 33 to 74 nm. The EDS studies reveal the absence of impurity elements. The fundamental composition of materials was identified by "Energy Dispersive X-Ray analysis technique (EDS). The average particle size in powder samples was found in the range of 41 -57 nm.

Keywords: Calcium nano-ferrite; Aloe Vera; Agglomeration; Z-type tetragonal crystal.

1. INTRODUCTION

The novel ferrites are ferromagnetic materials comprising of large oxides of iron along with other oxides namely barium, cadmium, strontium, nickel, manganese, zinc, cobalt, lithium, tin and calcium [1-8]. The ferrites with the chemical formula MFe_2O_4 (where M is divalent metal ion) exhibited potential in technological applications owing to their unique magnetic, electrical, mechanical and optical properties [1,4]. Therefore ferrites have been recognized for a wide range of desired applications like magnetic recording media, magnetic resonance imaging (MRI) augmentation, catalysis, magnetic fluids in the storage or retrieval of data sensors and pigment [1,2,7,8]. The structure of the spinal-type of ferrites involves a closely packed oxygen array wherein 32 oxygen ions form a unit cell. Many methods like hydrothermal[9] chemical co-precipitation[10], combustion[11], sol-gel [12,13], conventional ceramic process[14-18] and RF-sputtering [9,10,18] are available for synthesis of ferrite nanoparticle. The simple and cost-effective methods to prepare nano-ferrites with the lowest cost for utilization, nontoxic and environmentally caring precursors are quite important among all recognized methods. However, in the present article, the sol-gel microwave auto combustion method has been used to prepare calcium nano-ferrites. Recent research has reported the use of various plant extracts for the synthesis of nanoparticles with a particle size of 5-50 nm [19,20].

Aloe Vera is one of the boons to researchers because i) It contains 99.5% of water in its leaves and the rest is solid content, ii) The solid material of Aloe Vera possesses over 75 diverse ingredients, namely salicylic acid, sugars, minerals, enzymes, sterols, vitamins, amino acids, saponins, etc., iii) It is a natural plant and easily available in India and many other countries, iv) Aloe Vera gel is mainly used in cosmetics products such as sun lotions, lip balm, face creams, healing ointments, hydrating elements in liquids. v) Further, it is also used in pharmacology for anti-inflammatory, and burn treatment[21]. Aloe Vera is a good reducing agent and it can reduce the particle size to nanometers [22,23]. The effect of various diamagnetic-paramagnetic cations on the nanostructure and magnetic properties of M-type hexaferrite has been reported to be important for use in technical applications [24-31]. It is stated by Preksha N, et al [32] that, the $\text{Sr}_3\text{Co}_2\text{-xGa}_x\text{Fe}_{24}\text{O}_{41}$ hexaferrite materials can be used for microwave absorbers applications. The



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