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Criteria 3

Research, Innovations and Extension

Metric 3.4.5	Number of research papers per teacher in the Journals notified on UGC website during the last five years
3.4.5.1	Number of research papers in the Journals notified on UGC website during the last five years

Supporting Documents

1	List of research papers by title, author, department, name and year of publication **(Year : 2016)**

Faculty of Technology & Engineering

Nipun D. Gosai and Anand Y. Joshi*

Experimental Investigation and Optimization of Process Parameters Used in the Silicon Powder Mixed Electro Discharge Machining of Ti-6Al-4V Alloy Using Response Surface Methodology

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Abstract: Ti-6Al-4V is extensively used as a piece of the avionics, auto, and biomedical fields; however is a difficult to machine material. Electro Discharge machining (EDM) is seen as one of the most ideal approaches to manage machining Ti-6Al-4V combination, since it is a noncontact electro-thermal machining method, and it is self-ruling from the mechanical properties of the readied material. In EDM, dielectric plays important role in machining operation. In present paper silicon powder suspended plus kerosene is used as dielectric to explore the effect of these dielectrics on the execution criteria such as material removal rate (MRR) and roughness (Ra) in the midst of machining of titanium combination (Ti-6Al-4V). Peak current, pulse on time, pulse off time and powder included into dielectric liquid of EDM were picked as methodology parameters to think about the PMEDM execution with respect to MRR and Ra. The examinations were finished in organizing mode on an exceptionally made exploratory set up developed in laboratory. The ideal qualities for execution parameter were found by performing analysis and suggested ideal conditions have been verified by conducting confirmation experiments.

Keywords: EDM, powder mixed electro discharge machining (PMEDM), Ti-6Al-4V alloy, response surface methodology

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1 Introduction

The recent trend of research in the precision manufacturing world is the machining of Ti-6Al-4V because of its excellent properties of high corrosion resistant, high temperature resistant, high strength to weight proportion and its different scopes of utilizations in a various fields of designing going from turbines, inkjet spouts of printers, aviation, vehicles to biomedical, and so on. However, Ti-6Al-4V super combination is a hard to-cut material, displays poor machinability for the vast majority of the traditional machining procedures, particularly amid the boring of cavities and through gaps. Subsequently, machining of titanium super amalgam utilizing non-customary machining procedures, for example, electro release machining (EDM) has been distinguished to be most fitting machining strategy since there is no contribution of mechanical forces during machining [1–3]. EDM is a noncontact sort electro-thermo erosive procedure and there is no immediate contact between the electrode and workpiece. Consequently, the nonattendance of machining forces to bring no deformation of either workpiece or tool is an advantage. The material is evacuated by pulsed park discharges produced at the inter electrode gap between two electrically conductive electrodes. In this manner, this procedure can be used to machine any electrically directing materials independent of their quality, hardness and sturdiness. Moreover, the surface roughness of the machined surface is great. Restrictions of EDM are Low material removal rates, Lead time is expected to deliver particular, consumable anode shapes, and the work-piece must be electrically conductive. High particular energy utilization, thermal stresses are prompted in the work-piece surface because of thermal socks. So to overcome confinements of EDM a few examinations have been completed to enhance the electrical discharge machining (EDM) execution by adjusting the EDM process without changing its working standard. The adjustment of the framework incorporates powder blended with dielectric EDM, dry EDM, ultrasonic EDM. This study concentrated on powder blended dielectric EDM (PMEDM). PMEDM technique includes the utilization of distinctive sorts of powder, for

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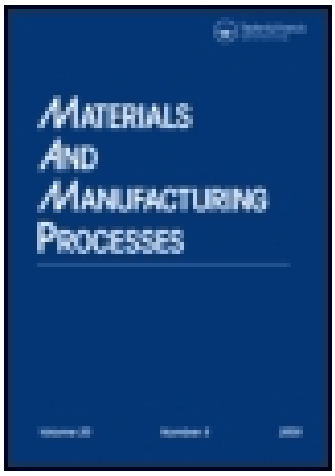

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Investigations on Drilling of Bi-Directional Cotton Polyester Composite

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Micro Small and Medium Scale Foundries in India: The Challenges

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Abstract

In India Micro, Small and Medium Enterprises (MSME) have been considerable percent of the manufacturing output and percentage of the exports for several years. Ferrous castings MSME is vital for the growth and development of the engineering industry in Asia.
Most of the MSME foundries do not have International Quality Accreditation. Almost all the MSME foundries use conventional technologies. This industry is facing numerous challenges in terms of cost as well as quality issues. Current research paper identifies various challenges pertaining to MSME foundry sector in India through case study by conducting a survey.

Keywords: MSME Foundry; Challenges; Best available Technology

1. Introduction

Micro, Small and Medium Enterprises (MSME) has 8 percent of the country's GDP, 45 percent of the manufacturing output and 40 percent of the exports. They also satisfy the needs of local as well as Global Markets (MSME .GOI, 2015). Small and Medium Enterprises (SMEs) are main part of the Indian economy. And has contributed a considerable amount to the economy in terms of employment and rural development, but they are still traditionally operated (Narasimha, C., & Nagesha, N., 2013). The Indian foundry industries manufacturers have a turnover of approx. USD 15 billion with export approx. USD 2 billion. There are approx 4500 units out of which 85% classified as Small Scale units & 10% as Medium & 5% as Large Scale units (Foundry Informatics centre, 2015). Developments in the foundry industry in recent years are rapid due to the technical innovations in the globalization and the changes in the foundry industries (Roland,2006). Globalisation, competition and the growth in the top ten casting producing countries have created threats and indeed opportunities for the establishment of the foundry Industries. The main share was of ferrous foundry (Modern Casting, 2015). Several small and medium-sized foundries across the India have been forced to stop production, owing to a demand slump. Industry insiders say that most of these units cater to automotive manufacturers and ancillaries, and that 10-15 per cent of them have either closed down or stopped production temporarily (Sohini Das, 2014). There has not been any kind of important research work done in this sector that has

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Influence of Gas Ratio on Tribological Properties of Magnetron Sputtered TiZrN Coatings

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Abstract

Titanium zirconium nitride (TiZrN) coatings deposited by magnetron sputtering techniques using argon as inert gas and nitrogen as reactive gas. The sputtering power of titanium (Ti) target and zirconium (Zr) target was kept constant at 275W, whereas nitrogen:argon (N_2:Ar) gas ratio was varied 08:32,08:12,10:10,08:02 and 08:00. The evolution of (111) and (200) peaks for TiZrN coatings were observed only when the N_2:Ar gas ratio values were 08:12 and 08:00.The structural morphology of TiZrN coatings were done by X-ray diffraction (XRD) and scanning electron microscopy (SEM). Tribological characterisation of TiZrN coatings such as coefficient of friction and wear were studied by pin on disc tribometer.

Keywords: Titanium Zirconium Nitride; TiZrN; Sputtering; Friction; Wear; Tribology

1. Introduction

A fast development of hard coatings has made it possible to use them in many industrial applications, during the last few years [1,2,3].

The binary titanium nitride wear resistance coating systems not only have been improved, but multicomponent coatings are also being successfully developed using different physical vapour deposition (PVD) technologies [4,5].

Recently, zirconium nitride (ZrN) films have attracted increasing interests for various applications such as diffusion barrier, cryogenic thermometers, decorative coating, hard coatings, because of their high mechanical properties, better corrosion and wear resistance and exhibiting

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Numerical Investigations of Heat Transfer Potential in Nanofluids as a Coolant for Automotive Radiators

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Abstract

The numerical investigation of a 3-D laminar flow of Aluminium Oxide (Al_2O_3) in base carrier Mono-Ethylene Glycol and Water (50:50) mixture nanofluids passing through car radiator flat tube is done to evaluate its heat transfer potential over the base fluid. The experiment was performed with water as a radiator coolant to validate the numerical results. For the simulation the Reynolds number, nanoparticle volume fraction, and nanofluids inlet temperature has been used in the range of 100-2000, 0-3% and 343-353K respectively. The numerical results clearly show that heat transfer performance of car radiator with nanofluids is enhanced than the base fluid.

Keywords: Radiator, Aluminium Oxide/Mono-Ethylene Glycol and Water nanofluids, Convective heat transfer enhancement.

1. Introduction

As today's scenario of competition all automobile manufacturer try to design the vehicle to enhance the efficiency. One way to increase the efficiency of car is, to enhance the effectiveness of radiator car by using efficient coolant. Use of efficient coolant can also make possible to design compact radiator.

In the past two decades many researcher studied the behavior of nanofluids, which is suspended colloidal solution of a very small volume fraction of nanoparticle, nano-fibers, in a base fluid and has proven its superiority as a heat transfer fluid than conventional fluid like water, oil, ethylene glycol etc.

NOMENCLATURE			
A_s	Coolant tube surface area	**Subscripts**	
C_p	Specific heat	a	Air
D_h	Hydraulic Diameter	bf	Base fluid
MEG	Mono Ethylene Glycol	C	Coolant
h	Convective heat transfer coefficient	nf	Nanofluids
k	Thermal Conductivity	P	Nanoparticle
$\dot{m}$	Coolant flow rate in kg/s		
Nu	Nusselt number		
P	Pressure		

Experimental Investigation of Overall Heat Transfer Coefficient of Al_2O_3/Water–Mono Ethylene Glycol Nanofluids in an Automotive Radiator

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In this research, the overall heat transfer coefficient of Al_2O_3/water–mono ethylene glycol (MEG) nanofluids is investigated experimentally in a car radiator under laminar flow conditions. The experimental rig developed is similar to the automotive cooling system. The stable nanofluid used is prepared by a two-step method. Ultrasonication is done for proper dispersion of 20 nm Al_2O_3 nanoparticle in carrier fluid water and MEG mixture with 50:50 proportions by volume. The experimental study showed that use of a nanofluid enhances the overall heat transfer coefficient as compared to the base fluid. In this study as the nanoparticle volume fraction increases from 0% to 0.8%, the overall heat transfer coefficient also increases. It was observed that as the nanofluid inlet temperature increased from 65 °C to 85 °C, the overall heat transfer coefficient decreased. It was found that using a 0.2% volume fraction Al_2O_3/water–MEG nanofluid can enable a 36.69 % reduction in surface area of the radiator. © 2016 Wiley Periodicals, Inc. Heat Trans Asian Res, 00(0): 1–15, 2016; Published online in Wiley Online Library (wileyonlinelibrary.com/journal/htj). DOI 10.1002/htj.21247

Key words: nanofluids, car radiator, overall heat transfer coefficient, frontal area

1. Introduction

Nanofluids are a new class of nanotechnology-based fluid which enhances thermal properties than the base fluids. Nanometer size particles have a large surface area as compared to microsize powder which enhances heat transfer rate. Choi [1] proposed the concept of adding the nanometer-sized, that is, less than 100 nm solid particles to a conventional heat transfer fluid and by preparing a stable fluid can enhance the heat transfer characteristics which he named nanofluids at Argonne National Laboratory in the United States. Many researchers have experimentally observed the enhancement in thermal conductivity of nanofluids as compared to the base fluid [2–10]. Due to novel properties of the nanofluid, it can be used in various thermal applications. Some of the thermal system applications where nanofluids can be used are electronic cooling, transportation, military weapons cooling, nuclear system, transformer cooling, and so on. [11]. Many researchers have worked in the

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Effect of Strain Rate on Tensile Strength of Natural Fibers

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Abstract

Natural fibers are the good alternative to synthetic fibers because they are environmentally more efficient and beneficial. Fibers are load-carrying member in natural fiber composites. Hence, it is required to study the behavior of fiber against different strain rate. In the present study, an attempt has been made to observe the behavior of natural fibers by varying the strain rate and observing its effect on tensile strength. For this purpose, natural fibers like bamboo fiber yarn, banana fiber and cotton fiber yarn were procured and characterized to measure tensile strength by varying strain rate in the range of 1 mm/min to 20 mm/min. The fiber samples were tested on the universal testing machine. Moreover, it was observed that the bamboo fiber yarn has higher tensile strength than banana fiber and cotton fiber yarn. Furthermore, the mathematical models based on exponential, linear, logarithmic, polynomial and power models were proposed which may be useful to predict the tensile strength with different strain rates. The proposed models were compared with experimental results. Through the comparison, it is suggested to prefer the polynomial model, power model and exponential model primarily to predict the tensile strength at different strain rates.

Keywords: Natural fibers, Strain rate, Tensile strength, Mathematical model, Comparison

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Friction and Wear Studies of Uncoated and TiZrN Coated Brass Substrates

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Abstract

Objectives: Investigation of enhancement in tribological properties of TiZrN coated brass substrate. **Methods/Statistical Analysis:** The magnetron sputtering was used to develop TiZrN coating on brass substrate by varying titanium (Ti) target power. X-ray diffraction (XRD) and Scanning Electron Microscopy (SEM) was used to do structural characterization of TiZrN coatings. Tribological properties of TiZrN coatings such as friction and wear were investigated by a pin on disc tribometer. **Findings:** The evolution of well intense (200) and (311) peaks of TiZrN coatings was observed with rise in power of titanium target. Increase of titanium power has a negligible effect on average crystallite size of TiZrN coatings and average crystallite size is around 4-5nm. TiZrN coatings are uniform, smooth and crack free as observed from SEM images for all samples. Tribological properties of TiZrN coatings were examined with testing parameters such as load and sliding distance. **Application/Improvements:** This coating may be useful for applications where low friction and wear is required such as gears, bearings, and electrical applications.

Keywords: Friction, Sputtering, TiZrN, Tribology, Wear

1. Introduction

Modern developments in coating technologies now make possible the deposition of coating with enhanced tribological properties, which were not possible a decade ago. These modern deposition methods motivates the people to use different materials with improved surface properties[1]. There are several reports about the effects of metal ion implantation on the wear, friction and microstructure of TiN coatings with many implanted ions such as Zr, W, Ti, Al[2–4]. However, similarly to titanium, its tribological properties might limit its application. For this cause, several studies have been performed to develop wear-resistant zirconium and titanium-based alloys[5]. It was found that researchers attracted towards use of ZrN coatings for cryogenic thermometers, hard coatings, decorative film, diffusion barrier, improved mechanical properties, better wear, corrosion resistance and attractive golden colour as compared to TiN films. During drilling test Zirconium Nitride deposited tools have good performance over Titanium Nitride coated tools[6]. The characterization of samples was done by scanning electron microscope and X-ray diffraction method[7,8].

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Influence of power and temperature on properties of sputtered AZO films

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ABSTRACT

Aluminum-doped zinc oxide films (AZO) were deposited on glass substrates by magnetron sputtering. The effect of RF power and deposition temperature on wettability and optical properties of AZO films are studied in detail. The increase of RF power from 60 W to 180 W (power density from 1.54 to 4.62 W/m^2) leads to evolution of (100), (002) and (101) textures of zinc oxide. The XRD results shows increased preferred orientation of (002) plane along c-axis for deposited AZO films. The grain size increases from 14 nm to 23 nm with increase of RF power from 60 W to 180 W and from 17 nm to 25 nm with increase in deposition temperature from 200 °C to 600 °C. The static and dynamic contact angle formed by water and ethylene glycol varies as a function of RF power and deposition temperature. AZO films with an optical transmission 80% to 60%, refractive index 1.49 to 1.51 and band gap values from 3.29 eV to 3.21 eV were obtained in the wavelength range of 350–800 nm. The electric resistivity varies from 3.9×10^{-2} to 1.1×10^{-2} Ω·cm depending upon variation of RF power and deposition temperature.

1. Introduction

The transparent conducting oxide (TCO) thin films have low resistivity, high transmittance in the visible region and high thermal/chemical stability. Due to these properties TCO are broadly used in solar cell, organic light emitting diodes (OLED), touch panel, liquid crystal (LC) flat panel display, plasma display panel (PDP) as well as low-E glass. The TCOs based on zinc oxide (ZnO) has excellent electro-optical performance. Aluminum-doped zinc oxide (AZO, ZnO:Al) thin films are intensively researched to replace indium tin oxide (ITO), because the materials consist of cheap and abundant elements, friendly and nontoxic alternative to the other ZnO-based TCO materials [1–7].

ITO, ZnO:X, SnO_2:X (where 'X' is a dopant) and IZO based TCO films have gained extensive consideration because of their higher energy bandgap (more than 3 eV), which permits for uses in the near-ultraviolet spectral and visible range and also have low resistivity of around $10^{-3}\Omega\cdot$cm. The possible substitutes for ITO and TCO materials are metal films that are very thin in combination with appropriate oxide films like ITO, ZnO or SnO_2 [8]. It was reported that the superior solar cell performances can be obtained using a front contact layer zinc oxide gallium doped (ZGO), which imparts solar cells with efficiencies around 9%, beyond in addition to 28% efficiencies achieved in other TCOs [9].

ZnO based thin films are investigated due to its easy availability in large quantity, safe to be used by human and in any environment. ZnO films can be developed with much naiver crystal-growth technology, subsequently leading to a possibly lower cost for ZnO based devices. ZnO based thin films can be deposited by doping with various elements using spray pyrolysis (SP) technique [10].

ZnO has band energy of more than 3.37 eV and more than 60 meV of exciton binding energy. Zinc oxide (ZnO) is versatile for numerous commercial applications, for example as an additive in various industrial products ranging from plastics, ceramics, glass, cement, rubber, lubricants, paints, ointments, adhesives, sealants, pigments, foods, batteries, first aid tapes, etc. In addition, ZnO has been attractive as an alternative window material for solar cells and thermoelectric element for thermoelectric generators. These devices have been recognized as promising technologies for clean energy production [11]. Currently, there is more curiosity in substituting glass with polymer substrates, mostly in flat-panel display technology, where lower volume, light weight and robustness are important. The investigation of various properties for aluminum-doped zinc oxide (ZnO:Al) thin films produced by RF magnetron sputtering on polymeric substrates observed an increase in electrical resistance depending on number of cracks, as well as the crack width that in turn depended on the film thickness [12].

Wettability has substantiated to be an important property of solid surfaces and has subsequently growing research interest in the last few years. Wetting properties can be modified by deploying the morphology and chemistry of any substrate. By controlling the wettability of surface we can modify the surface behavior between hydrophilicity

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0040-6090/

Characterization of zinc oxide films deposited in helium-oxygen and argon-helium-oxygen atmospheres by sputtering

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Characterization of zinc oxide films deposited in helium-oxygen and argon-helium-oxygen atmospheres by sputtering

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Abstract:

Zinc oxide (ZnO) thin films were deposited onto glass substrates by radio frequency (RF) magnetron sputtering using a metallic zinc target. Zinc oxide films were prepared in two different gas atmospheres; in the first set, helium and oxygen gas flow ratio (He:O_2) was varied from 87.5% to 37.5%. In the second set of experiment, oxygen flow rate was kept constant at 2.5sccm while argon and helium gas flow ratio (Ar:He) was varied from 9.0% to 87.5%. The -ray diffractometry (XRD), contact angle measuring system and UV-vis-NIR spectrophotometer. The XRD results show increased preferred orientation along (002) plane for deposited ZnO films in

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ARTICLE

Exploration of Wettability and Optical Aspects of ZnO Nano Thin Films Synthesized by Radio Frequency Magnetron Sputtering

Regular Paper

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Abstract

This paper aims to explore structural, optical and wettability aspects of zinc oxide (ZnO) nano thin films prepared by radio frequency (RF) magnetron sputtering. The deposition time is varied from 10 to 50 minutes and sputtering pressure from 0.5 to 8.0 Pa. The increase of deposition time from 10 to 50 minutes leads to formation of a single (002) peak for ZnO films; (100), (101) and (110) peaks are not observed under these conditions. The intensity for (100), (002), (101) and (110) peaks decreases with a sputtering pressure value of 3.5 Pa and above. The optical transmission and band gaps are measured by a UV-Vis-NIR spectrophotometer. The wettability and contact-angle hysteresis (CAH) for deposited ZnO nano thin films are investigated for water, ethylene glycol, sunflower oil and formamide using a contact-angle goniometer.

Keywords Contact-Angle Hysteresis, Optical Property, Sputtering, Wettability, Zinc Oxide

1. Introduction

Zinc oxide (ZnO) nano thin film has been comprehensively investigated over the last few decades for its use in various industries and technologies such as laser diodes, surface-acoustic-wave devices, light-emitting diodes, and transparent electrodes for solar cells and displays [1,2,3]. ZnO has emerged as one of the most promising materials in these areas due to its optical properties associated with high chemical and mechanical stability [4]. By monitoring the size, shape and crystallinity of ZnO nano thin film, we can optimize its various properties.

The wettability of solid surfaces is a very important property, and is determined by the geometric structures as well as the chemical composition of surfaces [5]. Knowledge of the wetting behaviour and surface energy of nano thin films is important for various industrial processes and applications such as cleaning, coating, printing, paints, and textiles [6]. ZnO is an auspicious alternative for hydrophobic applications in optofluidic devices due to its photo-

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ENERGY EFFICIENCY IN SMALL AND MEDIUM SCALE FOUNDRY INDUSTRY

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In this paper, the research results of surveys which were conducted in an Indian foundry cluster which are potential members of such sectors are presented. These results indicate that there is an enough potential improvement in the energy use. The use of energy efficient practices can result in their energy use effectively as well as cost reduction. The key findings about the energy pattern are a lack of energy efficient practices. The suggested recommendations can contribute to an increase in energy efficiency in such cluster.

Key words: foundry, energy, cost reduction, efficiency

INTRODUCTION

In the world the small and medium scale enterprise plays a crucial role. It manufactures vast range and energy efficiency is much more important for them [1]. The Indian foundry industry manufacturer's metal cast components for applications in auto, tractor, railways, machine tools, defense, earth moving / textile/ cement/ electrical / power machinery, pumps/ valves etc. Foundry Industry has a turnover of approx. USD 15 billion with exports approx. USD 2 billion. The Indian Metal Casting [Foundry Industry] is well established & producing estimated 9,344 Million MT of different grades of Castings as per International standards [2, 3]. The different sorts of castings which are created are ferrous, non ferrous, aluminum alloy, graded cast iron, malleable iron, Steel etc. As well as for application in automobiles, railways, pumps compressors and valves, diesel engines, cement/ electrical/ textile Machinery, aero and sanitary funnels and fittings and castings for extraordinary applications. However, gray iron castings have the significant offer that is approx 68 % of total castings created. There are approx 5000 units out of which 85 % can be named medium and small Scale units & 10 % as Medium & 5 % as Large Scale units. Ahmadabad, located in the state of Gujarat, is an important foundry cluster in Western India. There are about 500 foundry units. The cluster came-up mainly to cater to the casting requirements of the local diesel engine industry [3]. The significant issues in medium and small foundries are old technology, poor administration practices, constrained accessibility of stores, and uneducated labour. It was watched that this area remarkably expanded their utilization of power and raw materials to increase the production to adjust the market demand. The need towards cleaner creation through change in technology is must. But implementation of newer technology is not adopted due to economic justification [4]. Factor that needs to be controlled in order to save energy during induction melting is cycle time and many factors play an important role [5, 6, 7]. The estimation of the energy efficiency of a process or systems is a vital step towards the control of the energy utilization and energy costs, the energy audit may starts from a straightforward stroll through the study at different stages. It additionally gives a intend to viably impart energy data industries [5, 6, 7, 8].

METHDOLOGY

In this paper a study on energy management in small scale industries is carried. Surveys were carried out within a selected group of small and medium companies. The survey involved 100 foundries. This gave a complete idea of the current energy utilization of the foundries, which contrasted with as well as recommendations used to implement it by economic justification. Energy consumption and process details were collected by visiting foundries for a period of two years. This study had been limited to small and medium scale sectors. The collection of data has made use of metering facilities for energy consumption in different sections / equipments.

RESULTS AND DISCUSSIONS

The real goal of the foundry case study is to show energy efficient practices in medium and small scale foundry industries contrasted with the best foundry unit in the sector. These outcomes are taking into account the energy audits completed in a company in different locations where there is a scope for improvements exist.

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Recent Advances In Nano Science And Technology 2015 (RAINSAT2015)

Review on electrochromic property for WO_3thin films usingdifferent deposition techniques

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Abstract

Thin film technology plays an important role in technological development and recent research in engineering. Recent developments in the synthesis of transition metal oxides in the form of porous thin films have opened up opportunities in the construction of electrochromic devices with enhanced properties. The general applications of thin films are in the field of optoelectronics, microelectronics, etc. There are numbers of different techniques used for the deposition of stable thin films of oxide materials. The transition metal oxides like WO_3 and MoO_3 have good electrochromic properties and these oxides can also change their optical properties when the voltage pulse applied. These electrochromic materials are used for displays, rear-view mirrors and smart windows for energy saving and gas sensors. Tungsten Oxide (WO_3) is the best suited material for energy conservation applications due to its better coloration efficiency. Thin films of WO_3 are deposited by various techniques like physical vapour deposition, chemical vapour deposition, sol-gel method, magnetron sputtering methods. Out of this some methods like magnetron sputtering method offers good flexibility for deposition and allow to fabricate required topographical, physical, crystallographic, desired geometrical and metallurgical structures. This paper is aimed to summarize applications of WO3 thin films as electrochromic material and the effect of various deposition techniques on electrochromic and optical properties of WO3 thin films.

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Advances and Applications in Fluid Mechanics

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EXPERIMENTAL INVESTIGATION ON THERMAL CONDUCTIVITY AND VISCOSITY OF Al_2O_3/MONO ETHYLENE GLYCOL AND WATER MIXTURE NANOFLUIDS AS A CAR RADIATOR COOLANT

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Abstract

Synthesis of stable nanofluids as efficient heat transfer fluid and exact model for thermo physical properties is the most thrust area of research in the recent years. Two-step method is used to disperse the Al_2O_3 nanoparticles (20nm) in Mono Ethylene Glycol and water mixture (MEG/Water 50:50% by volume). To achieve stable nanofluids with different volume fraction (0.2%-0.8%) of Al_2O_3,

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Effect of Gas Ratio on Tribological Properties of Sputter Deposited TiN Coatings

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Abstract. Titanium nitride (TiN) coatings were deposited on Si, corning glass, pins of mild steel (MS, ϕ3mm), aluminium (Al, ϕ4mm) and brass (ϕ6mm) substratesby DC magnetron sputtering. The argon and nitrogen (Ar:N_2)gas ratio was precisely controlled by Mass Flow Controller (MFC) and was varied systematically at diffract values of 10:10,12:08, 16:04 and 18:02sccm. The structural properties of TiN coatings were characterized by X-ray diffraction (XRD) and its surface topography was studied using field emission scanning electron microscopy (FE-SEM). The tribological properties of TiN coatings were investigated using pin-on-disc tribometer.

Key Word: TiN; sputtering; Gas ratio; Tribology

INTRODUCTION

Various transition metal nitrides such as TiN thin films have attracted considerable attention from researchers spanning the spectrum of physical sciences. This is a testament to the myriad of potential applications that the TiN system affords because of its unique properties. They have been used as wear-resistant coatings on high-speed cutting tools [1-4], as infrared filtering coatings on windows [4,5] and as inexpensive decorative coatings on pens, watch dials, and so on [4,6] because of their golden luster. TiN thin films have also been used as microelectronic contacts [4,7], resistors [4,8], and because of their high-chemical stability, as diffusion barriers [4,9,10] between interconnects of microchips. A most recent application makes use of their biocompatibility and hemocompatability [4,11,12], as they have been integrated as surface layers within orthopaedic prostheses and cardiac valves [4,13,14].

TiN thin films have been produced by various techniques, all derivatives of those used in semiconductor processing such as electroplating [4,15], laser ablation [4,16,17], chemical vapor deposition (CVD) [4,18] as well as physical vapor deposition (PVD) techniques of evaporation and sputtering, reactive or otherwise [4,19-23]. Much of the problem associated with their production has been the need for high voltages and temperatures, which limit their integration within CMOS process flows. As of late, however, the commercial availability of TiN sputtering targets has facilitated their use within certain scenarios, where sputtering thin films is an option.

From the sets of references and referring literatures, majority of TiN coatings are deposited on substrates such as glass, silicon and stainless steel by DC magnetron sputtering process. Generally a metallic target of titanium is used and TiN coatings are deposited by introducing nitrogen(N_2) as reactive gas along with argon(Ar) that is used as inert gas in the vacuum chamber for generating plasma. The structural properties of TiN coatings depend upon the flow rate of these gases used during the process.

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TECHNICAL NOTE

Durability Study of M_{70} Grade Structural Concrete

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Abstract The scientists are mainly concentrating to develop the specialized concretes, to enhance the service life of the buildings and to provide satisfactory performance under aggressive environments. With the powerful dispersion capability and flexibility in molecular design, PC admixtures enable the production of concrete at low water–cement ratio with high workability. The durability problems of reinforced cement–concrete structures and the increasing use of concrete in exposure like sea water and acidic environment are creating new demands on the concrete material. This research work intended to develop M_{70} grade structural concrete using chemical admixture only. M_{70} grade structural concrete was casted, cured and tested by performing experiments like compression test (150-mm-diameter and 300-mm-height cylinders and on 150 mm × 150 mm × 150 mm size cubes), ultrasonic pulse velocity test and flexural strength test (150 mm × 150 mm × 700 mm size beams), split tensile test (150 mm diameter × 300 mm height cylinders), sorptivity test (100-mm-diameter, 50-mm-thickness specimen), sea water and acid attack test (150 mm × 150 mm × 150 mm size cubes) and accelerated corrosion test (100-mm-diameter and 200-mm-height cylinders). Results showed that M_{70} grade structural concrete possesses better durability properties and can be better improved by suitable addition of mineral admixture/admixtures.

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Keywords Durability · Sea water · Sorptivity · Accelerated corrosion · Mineral admixtures

1 Introduction and Literature Review

According to ACI Committee 201, durability of Portland cement concrete is defined as its ability to resist weathering action, chemical attack, abrasion, or any other process of deterioration; that is, durable concrete will retain its original form, quality and serviceability when exposed to its environment. Concrete, however, is a porous media, and penetration of undesired substances can cause progressive damage to it. A material is assumed to reach the end of service life when its properties under given conditions of use have deteriorated to an extent that the continuing use of the material is ruled either unsafe or uneconomical. Deterioration of concrete is also promoted when it is exposed to aggressive environments like balcony slab, parking garages and industrial plant structures. Embedded reinforcement and exposed concrete surface will suffer long-term deterioration. The ability of concrete to resist weathering action, chemical attack or any process of deterioration is called durability of concrete. Sulphate attack, acid attack and corrosion of steel are common durability related problems in concrete, and therefore, in recent years more emphasis has been put on the durability issue of concrete. This is discussed in IS 456:2000, Sect. 8 (Sengupta and Menon 2012). Percentage decrease in compressive strength increases with the age of acid immersion. With the age of acid immersion percentage decrease in compressive strength increases and maximum percentage decrease in compressive strength is found at 90 days age of acid immersion (Sashidhar and Sudarsana Rao 2010). High performance concrete mixes are prepared (Shannag and Shaia 2003) with W/B ratio = 0.35 containing

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Mining Big Data Using Modified Induction Tree Approach

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Abstract: Data Mining techniques are broadly utilized crosswise over numerous orders to recognize hidden patents, rules or relationships among gigantic volumes of information. Induction Tree, for example, C4.5 is the most favored technique since it functions well under any dataset set being utilized. Exponential ascent in the utilization of the internet because of informal organizations began to get enormous volume of information crosswise over various areas in brief timeframe. These attributes by which the colossal measures of informal organization information are produced make them to order as Big Data. When adapting to huge information (Big Data), the greater part of the current discretization methodologies won't be very productive with respect to implementation. The most effective method to separate significant data from huge information has been a famous open issue. In this paper, we are proposing new algorithm of decision tree in big data. At last, we have shown some result using weka.

Keywords: Big Data Analytics; Classification; Data Mining; Distributed Computing; Induction Tree; Scalability.

1. Introduction

Information is all over the place! The account of how information turned out to be huge begins numerous prior years. Seventy years prior, we run over the main endeavor to measure the increase rate in the volume of data or the term which was known as the "information explosion" (a term initially utilized as a part of 1941). The resulting are the real developments in the historical backdrop of estimating information volumes in the advancement of the possibility of "enormous information" and understanding relating to information or data blast. Different sources [12] of big data are appeared in figure 1.

21st century is the period driven DATA, led by DATA. Present economy is known as DATA economy because of exponential development and digitization of information. According to our thought, Big Data is a gigantic measure of organized/unstructured information gathered from heterogeneous/complex systems. Huge Data is really blend of 7 V's i.e. VOLUME (measure of information), VELOCITY (pace of information era and development), VARIETY (sorts of information), VERACITY (dependability of information), VALUE (estimation of information), Variability (constant changing data) and VISUALIZATION (presentation of data). The term machine learning signifies that, the framework is made to learn by giving important inputs and deliberately analyzing the achieved outputs. Machines can learn under diverse circumstances to be specific, Supervised, Unsupervised furthermore, Reinforcement [1].

Machine Learning algorithms help us to make powerful predictions taking into account enormous information. Different machine learning tasks are Classification, Clustering, Association Rule Mining, Regression, Multivariate querying. Density estimation. Dimension reduction etc. The utilizations of machine learning are as assorted as the utilizations of big data. Bio Informatics, Information Retrieval, fraud detection, Telemedicine [2], Natural Language Processing, Internet of Things are the current applications of machine learning.

Indian Sign Language Translator Using Kinect

Pratik H. Suvagiya, Chintan M. Bhatt and Ritesh P. Patel

Abstract Though Indian sign language (ISL) translation remained under examination for numerous years, still it is very difficult to implement in real-time systems. The background and brightness disturb the skeleton tracing and make the ISL translation very hard. Microsoft Kinect Xbox 360 is capable of giving in-depth vision image and color vision image of everything in front of it, created on which the skeleton body action can be tracked more precise and easier to get depth coordinate of the skeleton. So that nearest matrix matching algorithm of each ISL word is coordinated and matched among input data to get the result.

Keywords Kinect · Sign language · SimpleOpenNI · Indian sign language translator · Sign language translator

1 Introduction

In this world many people live, while some of them are differently abled people, they cannot speak and hear. Also, they have different language to communicate with others, known as sign language.

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Internet of Things (IoT): In a Way of Smart World

Malay Bhayani, Mehul Patel and Chintan Bhatt

Abstract Internet of things-"IoT" is an interconnection of exclusively identifiable embedded computing devices where all devices are made equipped with communication and data capture capabilities so that they can use the ubiquitous internet to transmit or exchange data and other controlling purposes. IoT is expected to bring a huge leap in the field of global interconnectivity of networks. Here we are going to draw an attention on the topics which have attracted the researchers and industrialists such as remote excavation, remote mining, etc.

Keywords Internet of things · Radio frequency identification (RFID) · Long-range wireless IoT protocol (LoRa) · Lezi · Zigbee · WINEPI

1 Introduction

The popularity of IoT has been increasing greatly in the recent years due to much higher affordability and simplicity through smart devices [1]. IoT, a platform where variant networks and mass of sensors that function together and interoperate with common set of protocols. It has espoused the world through various applications like home automation, ZigBee, Big-data, and auto-id such as RFID.

Many technical communities are vigorously pursuing research topics that contribute to IoT. One of the upcoming applications is Smart ATM that can perform all the operation on user account by authenticating the user by its retina and voice. Some other embryo staged IoT applications are smart air conditioners, 3D traffic, smart building, and smart health support service. Internet of things is connecting

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Comparison of Different Techniques of Camera Autofocusing

Dippal Israni, Sandip Patel and Arpita Shah

Abstract Automatic focusing has become essential part of imaging system as the image quality matters. There have been many researches carried out for autofocusing. Autofocusing gives the benefit of high-contrast image capturing even while the scene or imaging system is moving. The mechanism adjusts focal point of imaging system so that it gives the high contrast image. Need of different autofocusing technique arises as a single autofocusing mechanism cannot serve all the application. Autofocusing is divided into (i) Active and (ii) Passive autofocusing. Active autofocusing is good choice for SLRs, but it cannot be used when using an independent light source is not possible. Passive autofocusing is the best solution in such cases which captures the scene and analyzes to determine focus and is fractioned into two sub categories (i) Contrast (ii) Phase. This paper concludes the different autofocusing techniques and its applications.

Keywords Autofocus · Phase based autofocusing · Contrast based autofocusing · Contrast measures · Focus measures · Coarse focusing · Fine focusing

1 Introduction

Autofocusing has covered a huge part in image capturing in recent days. Traditional imaging systems were using fixed focus mechanism in image capturing. While capturing an image using conventional imaging system, image may happen to be

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Journal of Computer Sciences

Original Research Paper

Optimized Energy Efficient Virtual Machine Placement Algorithm and Techniques for Cloud Data Centers

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Abstract: Cloud computing is an internet based computing technology that provide on demand computing for end users. Normally, data centers allocation for application on statically based. But today so many data centers have a problem how to reduce energy consumption? Due to increase use of cloud services and infrastructure by various cloud providers, uses of energy day by day increase that's why energy consumption increase lots. Large numbers of data centers that consume lots of energy which increase the level of co2. Hence there is need for green computing and for energy efficient management of cloud data center resources besides meeting the QoS constraints. Within a data center, maximum energy is consumed by cooling systems and ICT Infrastructure, particularly, the servers. So it is of utmost importance to optimize energy utilization in datac enter servers. In order to achieve this, we can leverage the power of virtualization which is intrinsic in Cloud Computing. Virtualization opens the doors for VM consolidation by allowing dynamic migration of virtual machines across physical machines. In this study, the problem of VM consolidation has been formulated as a mathematical optimization problem.

Keywords: Cloud Computing, Virtualization, Allocation of Virtual Machines, Quality of Service (QoS), Energy Aware VM Allocation, Social Networking

Introduction

Cloud technology aims to provide pay per use service, reliable, Specified resources and QoS services for the consumers and end users. There are several companies provide cloud computing services to the end users (Feller *et al*., 2011).

Using several fundamental models cloud providers offers various services for the users according to their requirements:

- Software as a service (SaaS)
- Platform as a service (PaaS)
- Infrastructure as a service (IaaS)

There are four deployments in cloud in Fig. 1 (Mell and Grance, 2014):

- Public cloud
- Private cloud
- Community cloud
- Hybrid cloud

Why Energy-Aware Cloud Computing for Social Networking?

"As per McKinsey report data centers approximate energy bill in 2010 is $ 11.5 billion. Also this costs double every five years" (Buyya *et al*., 2010).

- Energy Efficient: Energy efficient in virtualized data centers provides QoS and also reduces the operational cost for the companies
- Energy Saving: As per current utilization of resources, topologies of network and thermal computing nodes achieved energy saving using VM migration and VM consolidation algorithms (Buyya *et al*., 2010)

The demand for Cloud infrastructure has expanded with rapid growth of computing applications and data. Hence more and more servers and disks are required to process them fast enough within the given time limit. Data centers are expensive to maintain and hostile to the environment. Over 90% of a data center's electricity is consumed by the IT equipment (server, storage and network) and cooling equipment (Minas and Ellison, 2009).

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EuDiC SVM: A novel support vector machine classification algorithm

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Abstract. The Support Vector Machine (SVM) is a powerful technique for data classification. For linearly separable data points, the SVM constructs an optimal separating hyper-plane as a decision surface, to divide the data points of different categories in the vector space. For the non-linearly separable data points, the Kernel functions are used to extend the concept of the optimal separating hyper-plane so that the data can be linearly separable. The different kernel functions have different characteristics and hence the performance of the SVM is highly influenced by the selection of kernel functions. This paper presents the classification algorithm that uses the SVM in the training phase and the Mahalanobis distance in the testing phase, in order to design a classifier which has low impact of kernel function on the classification accuracy, positively. The Mahalanobis distance is used to replace the optimal separating hyper-plane as the classification decision making function in the SVM. The proposed approach is compared with Euclidean-SVM, which uses Euclidean distance function to replace the optimal separating hyper-plane as the classification boundary. It has also been evaluated against conventional SVM too. The experimental results show that the accuracy of the EuDiC (Euclidean Distance towards the Center of data) SVM classifier has a low impact on the implementation of kernel functions. The EuDiC SVM also achieves the drastic reduction in the classification time since it only depends on the mean of Support Vectors (SVs) of each category for classification. To prove its effectiveness on other types of data, the time series data have also been used. Due to robust design of the EuDiC, it also performs well for time series data too.

Keywords: Classification, Euclidean distance, kernel function, Mahalanobis distance, optimal hyper-plane, support vector machine, support vector

1. Introduction

Support Vector Machine (SVM) classification technique has attracted a great deal of attention in the last decade and is being used profoundly in various domain applications. SVMs are also used for regression or ranking function and have been proved more accurate as compared to other classification algorithms like Decision Tree Induction, Bayesian Network, Neural Network, K-nearest neighbors [16,19,33,36]. SVMs are based on statistical learning theory and structural risk minimization principle with the aim of determining the location of decision boundaries, also known as hyper-plane, that produce the optimal separation among the classes [3,9,10,20].

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Techniques and Challenges in Building Intelligent Systems: Anomaly Detection in Camera Surveillance

Dinesh Kumar Saini, Dikshika Ahir and Amit Ganatra

Abstract Security is tedious, complex and tough job in today's digitized world. An attempt is made to study and propose an intelligent system for surveillance. Surveillance camera systems are used for monitoring and controlling the security. Anomaly detection techniques are proposed for designing the intelligent control system. In the paper challenges in detection and processing of anomaly in surveillance systems are discussed and analyzed. Major components related to an anomaly detection technique of camera control system are proposed in the paper. Surveillance data is generated through camera, and then this data is transmitted over the network to the storage. Processing is to be done on real time basis and if there is any anomaly detected, the system must produce an alert. This paper is an attempt to study soft computing approaches for anomaly detection.

Keywords Surveillance · Systems · Camera · Control · Anomaly · Detection

1 Introduction

Surveillance cameras are used extensively for security purposes. Access and control of these cameras through a remote computer over the web improves the security aspects of the system. The camera control system consists of a set of cameras located at different locations and the cameras are controlled remotely. Multimedia is

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Comparative Analysis of Motion base Image Segmentation using Machine Learning Techniques

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Abstract

Objectives: In the computer vision task, motion based image segmentation is the foremost step which warrants for further research. Several progressive techniques are being created for motion base image segmentation. Machine learning methods are implemented and analyzed in this paper. **Methods:** Motion is one of the useful characteristics to segment object from the image as it provides a classification of pixel in motion or motionless type. Machine learning methods are giving promising result in classification type problems. Machine learning methods reduce the execution time. In this type of technique a training is required in beginning after that all processes are performed automatically. This paper presents two machine learning technique SVM and LS-SVM. The Segmentation of image can be done by selecting image feature. In proposed method intensity change basis of motion is used as texture feature. **Findings:** Both of techniques classify pixels of an image between two types, 1. Appropriate to a motion and 2. Not appropriate to motion. Results obtained using this approach shows that machine learning methods are very promising techniques for this type of area. **Application/Improvement:** LS-SVM method is very promising with enhancement in execution time and segmented object result quality as compared to SVM.

Keywords: Classification, Image Segmentation, LS-SVM, Machine Learning, SVM

1. Introduction

Motion base image segmentation subdivides an image into its constituent regions or objects in motion or immobile, for further analysis in video surveillance, traffic analysis etc. Motion base image segmentation can also define as the process of classification of pixel in foreground and background. In image objects like weaving tree, flag, intensity changes due to sunlight forms dynamic background, these pixels having similar brightness, color or texture but having very less movement. These properties are used to define different

regions of image. In segmentation process the image pixels are classifies into two or more classes. Each class represents some region of image. Motion segmentation is the grouping of pixels associated with a smooth and uniform motion profile. In the current years, many researchers are undertaking intensive works of moving object segmentation and proposed variety of very remarkable and pioneering methods.

In past years many image segmentation techniques are proposed and developed and these techniques are classified into following five major categories[1,2].

- Statistical - Region based
- Absolute difference - Edge based
- Threshold based
- Recursive - Feature based clustering
- Graph based

1.1 Statistical -Region based[3,4]

The region-based segmentation method classifies the image in number of classes or regions. These regions

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Improving efficiency of heterogeneous multi relational classification by choosing efficient classifiers using ratio of success rate and time

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ABSTRACT

Traditional data mining algorithms will not work efficiently for most of the real world applications where the data is stored in relational format. Useful patterns can certainly be extracted from multiple relations using an existing traditional learning algorithm of data mining, but it would involve a lot of complexity. So there is a need of a multi relational classification, which analyzes relational data and predicts unknown patterns automatically. Moreover the performances of existing relational classifiers are limited, because the existing algorithms are not able to use different classifiers based on characteristics of different relations. The goal of the proposed approach is to select appropriate classifiers based on characteristics of different relations in the relational database to improve the overall performance without affecting the running time. So multi criteria classifier selection function based on ratio of accuracy and running time is used to select the most efficient classifier using Meta Learning. In the proposed classifier selection function, accuracy is used as a measure of benefit and running time is used as a measure of cost and their ratio is taken to ensure that the efficient classifier is selected. The experimental results show that the performance of proposed relational classification is better in terms of efficiency when compared to all other existing algorithms available in the literature. We are able to achieve best results by selecting an efficient algorithm for every relation contributing in the relational classification.

KEYWORDS

Multi Relational Data Mining; Relational classification; Meta Learning

1. Introduction

The primary objective of any data mining activity is to check the given database for patterns that may give better understanding for a given task (Hand, Mannila, & Smyth, 2001). Unfortunately, the widespread application of data mining has been limited by an assumption that all data resides in a single table (Arno Jan Knobbe, 2004). There is clearly a large class of data mining problems that cannot be successfully addressed using a single table as a representational setting. These problems, which can be characterized by the presence of internal structure within the individuals they deal with, can successfully be addressed by the multi-relational techniques (Arno Jan Knobbe, 2004). Most of the data mining algorithms, which are currently available are based on single table setting, which allows the analysis of fairly simple objects. To be able to represent more complex and structured objects, one has to deal with the structural information that occurs in relational databases.

Multi relational classification method searches for relevant features both from a target relation and relations related to the target, to better classify the unknown tuples. There are basically two approaches available in the literature to classify multi relational data. The first approach known as propositional data mining, typically employ some form of propositional logic to identify subgroups (Lavrač, Džeroski, & Grobelnik, 1991). In this approach, Relational databases have to be converted to a single table format, so that propositional data mining algorithms will be able to work with the relational database. Methods such as RELAGGS (Krogel & Wrobel, 2001) and Polka (Knobbe, De Haas, & Siebes, 2001) have been developed to perform this translation. These results in generation of more data at the cost of losing structural information about the data. Many large industrial databases are simply too complex to analyze with a propositional algorithm without ignoring important information. So rather than working with individuals, one has to deal with structured objects that consist of parts that may be connected in a variety of ways. The class of techniques that support the analysis of structured objects is known as Structured Data Mining (Arno Jan Knobbe, 2004). In order to learn from a relational database, structured data mining "upgrades" traditional learning algorithms to deal with the relational presentation known as upgrading approach. Table 1 shows the summary of two major families of approaches used in Multi relational classification.

From the above comparative analysis it is observed that existing structured approaches are not able to incorporate advanced techniques of data mining. They cannot support the different learning algorithm for different relations used in the relational databases when dealing with complex database schemas and also gives unsatisfactory predictive performance while handling noisy or numeric values in real-world applications. However, propositional approaches tend to require considerable time and effort for the data transformation, resulting losing the compact representations of the normalized databases, and produce an extremely large table with huge numbers of additional attributes and numerous NULL values (missing values).

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A Novel Approach for Making Recommendation using Skyline Query based on user Location and Preference

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Abstract

Objectives: To propose a method to handle large number of user and to improve the accuracy and quality of recommendation system. **Methods/Statistical Analysis:** This paper presents an effective method to identify user location based on his/her preference using Skyline query outline Dominated object. Dominance object suggests that an object falls under good or better in all dimension or good at least one dimension. Skyline query using Recommendation system has increased in recent years. Skyline query using recommendation system mainly used location-based services to find the nearest location, based on user preference. Location-based Services are information services and have a number of uses in social networking. Location-based Service finds the nearest location based on user preferences but not provide location based on similarity and rating. So, the user is not satisfied by the given result. **Findings:** To resolve above problem, the collaborative filtering technique, K-nearest neighbor algorithm and Ranking Scheme being used by us. Using Collaborative filtering technique, we find the similarity and rating of an item. Using K-nearest neighbor approach finds the nearest distance of the similar item and ranking technique being used by us, to choose the most nearest location. In this paper we take temporary dataset and mathematically evaluate our proposed system. **Application/Improvements:** In future, we will develop web tool which identify location and display result on map. We will also check user s' past movement history based on content based recommendation system. Skyline query using recommendation system is use various domain i.e. House Rent/buying, travel and tourism business.

Keywords: Collaborative Filtering Technique, Dominated Object, K-Nearest Neighbor, Recommendation System, Skyline Query

1. Introduction

Data mining[1,2] is outlined as "The nontrivial extraction of implicit, previously unknown, and doubtless helpful data from knowledge" . Data mining typically referred to as knowledge or data discovery that aims whatever knowledge is obtainable that knowledge finds some conclusions within the style of rules. Data mining are often think about as economical and efficient way to discover or to remodel the invisible to visible knowledge.

Now a day, Skyline query and Recommendation System[3] are trendier in database and data mining field. Skyline query is sorting out interesting point based on dominance relationship. It's outlined dominated object. Dominated object means those objects which are good in all dimensions and it is also good in at least one dimension[4-6]. Recommendation Systems are now pervasive in consumers' lives. They aim to assist users to find things that they might wish to purchase or think about supported vast amounts of information collected. Parsing a large quantity of information to predict a user's choice or his or her similarity with an alternative cluster of users is that the core of a recommendation system. Based on this Characteristics skyline query and Recommendation are more fashionable in Multi-Criteria decision-making System.

Skyline query and Recommendation[7,8] for the user is an important sub-topic especially Location based service. Location based mostly services use in real time Geo-Spatial knowledge to produce data, diversion or security.

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A Review of Soft Computing Techniques for Time Series Forecasting

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Abstract

Objectives: This paper gives a brief survey analysis on time series forecasting models developed so far and how soft computing techniques are becoming popular for time series forecasting. **Statistical Analysis:** This paper gives an introductory study on time series models develop in literature so far. First all traditional models were developed among them ARIMA became popular but only for linear data. Then after Soft Computing models came into picture like ANN and it was proved to be best for nonlinear forecasting. But none of the individual models are capable to handle all types of datasets as real data is a mixture of linear and nonlinear both. So there arises a need for hybridization. **Findings:** Many traditional methods have been developed since last few decades for time series forecasting, however their performance is not up to the mark till today. Recent trends have proven that soft computing techniques like neural network, support vector machine are good alternatives to conventional methods. The accuracy of time series model is very important and difficult task to achieve, and individual models are not able to perform well for all types of time series data. So, hybridization of models is better to achieve good accurate forecasting results. **Application/Improvements:** Implementation of a hybrid model using soft computing techniques which can give better accurate results as real data are made linear and nonlinear both. This hybrid model can be used in applications like weather forecasting, exchange rate forecasting, etc.

Keywords: ARIMA, Artificial Neural Network, Hybrid Model, Soft Computing Techniques, Time Series, Time Series Forecasting

1. Introduction

Time series forecasting is a remarkable and difficult active analysis issue with growing attention to numerous areas. The inspiration of forecasting as from[1] is to explore out potential useful relationships and discover connected applied math regularities for the observations of an underlying time series in order that helpful deciding is created prior to. Nonetheless, correct and reliable forecasting for the long run trend is ordinarily intense and backbreaking in true issues[1–3].

Forecasting future is best exploitation time series forecasting. With the time series prediction, past knowledge assortment of constant variable are analyzed to develop a model which might predict the longer term availableness of constant. Then established model is employed so as to extrapolate the time series into the future. This modeling approach is especially helpful once very little information is offered concerning past variables and no alternative things is known[3–7].

Our purpose in this paper is to do a comparative study of all the models of Time series forecasting and how soft computing is used for time series. The detail paper is organized as follows. Section 2 describes traditional model ARIMA of time series. Section 3 describes regarding soft computing approach models for time series like ANN and SVM. Section 4 tells regarding how hybrid models are used today to boost accuracy of your time series prediction then concludes this work by Section 5.

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Improved Data Integrity Proofs using Additive Homomorphic Encryption for Remote Storage

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Abstract

Background/Objectives: Remote data storage becomes the hype nowadays as various organizations provide free access of the application. Security and efficiency are the major concerns while using such kind of application. Hence solution related to data integrity verification needs to be focused to achieve reliability. **Methods/Statistical Analysis:** Despite of all the hype surrounding the storage and security solutions, clients are still hesitant to deploy their business in the cloud. As security is the major concerns which may become the hindrance as clients are more concern about data privacy and data protection. In proposed work we have provided solution of efficiency and security related to remote data storage using additive homomorphic encryption. **Findings:** Solution to this can be provided using some of the data integrity proofs techniques. The advent of an advanced model of the security to provide the solution should not negotiate with the required efficiency and reliability present in the current solutions. Additive homomorphic encryption has been proven to efficient compared to multiplicative homomorphic encryption. Additive homomorphic encryption is efficient compare to multiplicative homomorphic encryption which provides better efficiency. **Applications/Improvements:** Methodology given could be useful for remote file storage applications. Proposed algorithm has been implemented and tested. The results shows that it gives improvement over the existing solution in terms of tag generation and verification.

Keywords: Additive Homomorphism, Data Integrity Proof, Encryption, Efficiency, Remote Storage

1. Introduction

Storage outsourcing causes a number of challenges[1]. To verify that the file or data has been stored on server entrusted to it by the client should be verifiable. The server may not be trustworthy in terms of security and reliability, e.g., it may maliciously or accidentally erase the data or migrate it onto thearchives. Worsening the problems are factors such as restricted network bandwidth and limited computing power. This problem is considered as data integrity issue which can be solved using various data integrity proofs mechanism.

Verifying integrity of the data, huge amount of data need to be downloaded, which incurs network overhead. The basic problem is that the client required to access whole fileto perform verification, and the client maybe constrained for verification due to a priory bound. In addition, there are also three problems like public verifiability, data updates and privacy against third party auditors.

In the proposed work we have tried to provide solution related to remote data integrity verification using additive homomorphic tags[2], which is quite efficient compared to existing solutions.

Rest of the sections of paper are organized as follows: Section 2 gives the information of related work done so far. Section 3 describes various cryptographic assessment and overview of proposed scheme. Section 4 gives the details about the proposed algorithm. Implementation and experimental results are given in Section 5. Conclusion is given in Section 6 and which also gives the future enhancement related to proposed work.

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An Enhanced Approach of Detection and Prevention of Black Hole Attack on AODV over MANET

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ABSTRACT
Mobile Ad-hoc network is a situate of portable nodes that correspond with wireless links and communication acknowledged out without any central control or fixed communication. The dynamic topology of MANETs allows nodes to join and leave the network at any point of time .this generic characteristic of MANET has rendered it vulnerable to security attacks. The black hole attack is one of such security risks. In this attack, a malicious node fallaciously advertise shortest path to the destination node with an intension to disrupt the communication In this paper, we intend a solution to the black hole attack in one of the most prominent routing algorithm, ad-hoc on demand distance vector (AODV) routing, for the MANETs. The anticipated scheme uses Watchdog mechanism to detect malicious node with usage of local information of intermediate node and propagates the information of black hole node to all other node in network the simulation results show the efficiency of anticipated scheme in presences of black hole node.

Keywords
ad hoc networks, black hole , AODV, security, routing.

1. INTRODUCTION
A mobile ad hoc network is a set of wireless mobile nodes that dynamically establishes the network in the absence of fixed communication. One of the individual features of MANET is, each node must be able to find out the optimal path to forward a packet. MANETs provide talented technology for civilian and military applications. One of the important research areas in MANET is starting and maintaining ad hoc network through the use of routing protocols. The increasing development in wireless local area networks has opened new limits in the field of telecommunication. MANET a composed of nodes that can communicate with each other without knowing their position [4]. There is no base station in these networks and nodes communicate in multi-hop pattern. These networks are needed in conditions where short-lived connectivity is required [4].

There are two well known secured-initiated on demand routing protocols include AODV and DSR. These protocols are based on plan of finding valid paths once they are needed by the source node. This procedure, known as route discovery engage the route request phase (RREQ) and route reply phase (RREP). All of these protocols construct a single-path route between a source node and a destination node. Whenever communication link breaks on the active route, each protocol has to raise a route discovery process can cause the performance badly. Single path protocols learn. Routes and select a single best route to reach each destination [1].

2. OVERVIEW OF AD HOC ON-DEMAND DISTANCE VECTOR ROUTING PROTOCOL
AODV stands for ad hoc on-demand distance vector routing protocol. AODV is a reactive protocol. AODV is a single path distance vector routing protocol in ad hoc wireless networks. This protocol mixes the route discovery mechanism in DSR with the approach of destination sequence number in DSDV [4]. Basically when there is one node that wants to communicate with another node that is not in range, it finds a route through the other nodes. It minimizes the number of broadcasts by creating rotes on-demand as oppose to all possible routes as in DSDV. AODV is a loop- free, single path, distance vector protocol based on hop-by-hop routing approach. There are two main procedures in AODV:

1. Route discovery
2. Route maintenance

1. Route Discovery
When source node wants to communicate with destination and if path is not available to destination then source node rebroadcast to its entire neighbor in the network. When intermediate node receives RREQ, they create link to previous node. They first of all check whether valid route to destination or present. If valid route is present then another condition is hold, i.e. intermediate node's sequence number Should be at least as great as destination sequence number in RREQ packet. If both condition hold then that node generate RREP packet. If valid route is not present then RREQ is further forwarded. RREP contains IP address of source node as well as destination and destination sequence number once the node

Creates the forwarded route entry. If forwarded the RREP to destination node. The RREP is thus forwarded hop-by-hop to the source node. Once receives the RREP. It can utilize the path for the transmission of data packet [3].

2. Route Maintenance
As MANET is dynamic i.e. mobility and topology of nodes always change, link break occurs, when path breaks both nodes informs their end nodes about link failure who were using path by sending RERR. End nodes delete their entry from route table as path is no longer useful. If source nodes still want to communication with destination. If reinitiate RREQ broadcasting or path finding process or repair broken link [3]

Performance comparison of ZRP Bordercasting using Multiple Unicasting vs Broadcasting

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ABSTRACT
MANET (Mobile Ad hoc Networking) is an ad hoc network formed by wireless mobile nodes without any fixed infrastructure. Each node can send, receive and forward data from other nodes. The volatile nature of wireless medium and mobility of nodes pose a great challenge for efficient routing in MANET. There are several routing protocols developed for MANET. ZRP (Zone Routing Protocol) is one of the hybrid MANET routing protocols. It combines proactive and reactive routing approaches for better scalability. In ZRP, the nodes build overlapping zones and maintain topology information of the nodes within their zone. The zone size is decided by zone radius which is defined as no. of hops. Proactive routing is used within the zone and reactive routing is used outside zone. ZRP uses bordercasting to efficiently control the flooding of reactive route queries in outward regions. Each forwarding node propagates the query to selected neighbors which lead to uncovered border nodes of the zone. Ad hoc networks commonly use single channel network. While using single channel network in ZRP, bordercasting can be done either using multiple unicasting or broadcasting.

This paper analyses and compares the impact of using multiple unicasting vs broadcasting on routing performance of ZRP, in single channel wireless network. Networking Simulator 2 (NS2) has been used for the simulations. The Qos parameters used for routing performance measurement were Packet delivery ratio (PDR), Average end-to-end delay, throughput and Normalized routing load (NRL). The simulation was done at high mobility by varying network size from small to large network. While using broadcasting, QD2 query control method was used to further control flooding of route queries to uncovered regions. The simulation results conclude that broadcasting is more performance efficient than multiple unicasting for bordercasting in ZRP.

General Terms
MANET, Mobile Ad hoc networking, ZRP, Zone routing.

Keywords
ZRP; Zone routing; MANET; Bordercasting; multiple unicasting; broadcasting; QD2; performance comparison.

1. INTRODUCTION
MANET (Mobile Ad hoc Networking) is an ad hoc network formed by mobile wireless nodes.

It does not require setting up any infrastructure. It is self-organizing and it can be set up spontaneously. Hence it is used widely in situations where prompt, ad hoc network is required.

The common applications of MANET include battlefield operations, disaster relief, habitat monitoring, vehicular area networks and social community networks [1] [2] [3].

Its connectivity varies over time. The mobility of nodes, limited energy and dynamic network conditions of wireless medium makes it challenging to perform efficient routing in MANET. Different kinds of MANET routing protocols have been developed for different scenarios and requirements.

Based on the routing approach, MANET routing protocols can be broadly classified as reactive, proactive and hybrid, as shown in Fig. 1 [1][2][3].

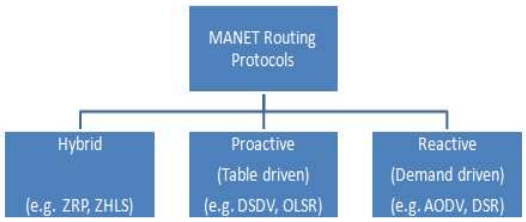

Figure 1: MANET routing protocols classification

1.1 Proactive protocols
These protocols proactively maintain routes to every other node by periodic/triggered routing updates, regardless of need for the given route now or in future. Each node maintains the complete picture of network topology. The updates regarding topology changes in direct neighborhood are propagated throughout the network using form of distance vector routing or link state flooding. The routes to the known destinations are calculated from these updates and maintained in routing table and hence it's called table-driven approach [2] [3].

Examples of such protocols include Destination-Sequenced Distance-Vector (DSDV), Wireless Routing Protocol (WRP), and Optimized Link State Routing (OLSR) etc. [1].

1.2 Reactive protocols
These protocols discover routes only when needed for data transfer, so called on-demand protocols [1] [2] [3]. When any node wants to send data to other node for which there is no active route available, then it discovers a route first and then initiates data transfer. The discovered route is maintained as long as the communication continues.

Examples of on-demand protocols include Dynamic Source Routing (DSR), and Ad hoc On-demand Distance Vector (AODV) [1][2].

A secure and high capacity image hiding scheme using DWT and arithmetic coding

Janki Jasani ; Sarita Visavalia All Authors

Abstract: Steganography is the art of hiding the existence of the secret message being communicated in the multimedia carrier such as image, audio file, video file etc. Due to wide... **View more**

Metadata

Abstract:
Steganography is the art of hiding the existence of the secret message being communicated in the multimedia carrier such as image, audio file, video file etc. Due to widespread usage of images over internet and presence of high redundancy in images image steganography is very popular. In this paper, we propose a novel scheme for hiding the secret image behind the grey scale cover image. We use the properties of Haar wavelet coefficients for hiding the secret bits. Arithmetic coding is performed on secret image before embedding in the cover image to reduce the size of secret message. It also provides security to the secret data as the result of arithmetic coding will be in encoded form. PSNR and SSIM are used to measure the quality of the stego image. Proper cover selection is very necessary for effective use of this technique.

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Contents

In today's communication world, the transfer of information through digital media has been increased very much. Information is very important and major factor for any organization by all aspects. With rapid growth of technologies in the internet, it has become so easy to use and access it for everyone. So security of such information has become potential requirement at the time of communication as well as storage and other purposes too. Steganography is one of such technique that provides privacy to communication. The word Steganography is derived from the Greek words "stegos" meaning "cover" and "grafia" meaning "writing" [2]. It is the kind of technique that hides the existence of the secret information behind digital object such as image, audio or video etc. Image Steganography has become the most popular technology because images are widely used medium over internet and images contain high redundancy. Many of the fields like medical, defence, intelligence, banking, commercial business etc have many applications that need research in this area. All these applications seeking security of information need different degrees of privacy.

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Reliable and Efficient Distribution of Multicast Session Key for Deduplicated Data in Cloud Computing

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Abstract: Data deduplication is one of the fascinating features of any cloud computing storage service which is generally realized as Cross User Data Deduplication (CUDD). Although it provides optimization which is challenging to achieve due to security concerns. A User always concerns about privacy and confidentiality of the data from honest but curious insiders. Encryption introduces new challenge like key distribution among the group of clients who share the same file and also raises constraints of forward and backward secrecy of the data when any user upload or delete the data. Efficient and secure key distribution along with data integrity verification are the biggest challenges in CUDD. In this work, we have proposed the solution of efficient key management in CUDD along with the data integrity verification. We have provided the solution multicast key distribution using error correcting codes that maintain users' access rights, which is more efficient and reliable.

Keywords: Data deduplication, Rekeying, MDS code, Data integrity, (K, Θ) uncheatability, Server unforgeability.

1. Introduction

Data deduplication becomes a most important requirement of cloud computing storage applications. It optimizes storages as well as network bandwidth. Deduplication can be categorized as the target-based deduplication handled by the target storage server, while the client remains uninformed of any deduplication that occurs at the server side. This strategy optimizes storage consumption but does not save communication bandwidth. Apart of it, in source-based deduplication, before transmitting data to the server duplication will be checked at the client. Once the duplicates have been found then actual data is not sent. The method improves utilization of storage as well as communication bandwidth.

Providing solution of data deduplication is not that much trivial as it seems. To prevent from unauthorized access clients may encrypt the data using symmetric key encryption algorithms. The algorithm should be efficient in term of execution and should not be dependent on the size of the file. As mentioned earlier, If the data is encrypted then, to provide data deduplication solution is challenging because it complexes the key sharing and the content matching. So key must be shared among the clients having the identical file to provide the confidentiality and data deduplication. Considering this, efficient key distribution algorithm must be used which should take care of key distribution management. Content matching can be solved using some of the Provable Data Possession techniques as given in [1] or some hashing technique.

In cloud computing storage application, deduplication can be implemented as group of users such that clients having identical data will form the multicast group. To provide the confidentiality, group will share session key among all the clients within the group. The key will be initially generated by Key Management Centre (KMC) and first client who have put the data initially. The group memberships change because client may upload new file or delete older file, the KMC releases an independent session key from all the old session keys and retract older key. The rekeying procedure assure the newly joined individuals can't recover the

planes including the x–y plane (the azimuthal plane), the x–z plane (the elevation plane orthogonal to the main circuit board), and the y–z plane (the elevation plane parallel to the main circuit board) are shown. The measured and simulated results for the E_θ and E_ϕ radiation are presented, and agreement between the measurement and simulation is also obtained.

At 830 MHz, strong radiation in the $-y$ direction or the left-hand-side direction is seen (see the patterns in the x–y and y–z plane), although port 1 for the low-band excitation is close to the right-hand side of the main circuit board. This is mainly owing to the excited surface currents on the device ground plane of the main circuit board, which also contributes to the antenna radiation. At 1800 MHz, similar behavior is observed. Strong radiation in the $+y$ direction or the right-hand side direction is seen (see the patterns in the x–y and y–z plane at 1800 MHz). Again, this is owing to the surface currents on the device ground plane excited by port 2. In general, the obtained radiation characteristics show no special distinction to those of the reported LTE antennas and are acceptable for practical smartphone applications.

4. CONCLUSION

A very-low-profile hybrid antenna with the IFA mode, OSA mode, and CSA mode excited for the LTE operation in the modern smartphone has been proposed. The antenna has also been fabricated and tested. The measured data fairly agree with the simulated results. Acceptable radiation characteristics have been obtained. With a very-low-profile of 3 mm only, the antenna can cover the 824–960 and 1710–2690 MHz bands for the LTE operation (low band covering the LTE band 5 and 8 and high band covering the LTE band 10, 15, and 16). The techniques of generating the hybrid resonant modes with good impedance matching have also been addressed. The proposed antenna is especially suitable for the modern smartphone application to accommodate a large display panel.

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SQUARE LOOP SLOTS LOADED SUBSTRATE INTEGRATED WAVEGUIDE BASED HORN ANTENNA

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ABSTRACT: *This article represented the effective approach to improve the bandwidth and gain response of substrate integrated waveguide antenna (SIW) using novel defected microstrip structure (DMS) technique for Ku band applications. First of all, Horn antenna was designed using SIW technique and it provided gain around 6 dB. Single square loop slots and multiple square loop slots were introduced in SIW based horn antenna and performance analysis have been carried out. Their responses proved that they were not only responding the fundamental mode but also at different high order modes. Creation of multiple square loop slots not only increased bandwidth but also it increased gains more than 8.5 dB. Moreover, the proposed antennas also responding dual frequencies with more than 500 MHz bandwidth, −2 dB side-lobe levels and VSWR was around 1.35. All the structures were simulated using Ansoft high frequency structure simulator. Comparison between results verified the effectiveness of the proposed idea.* © 2016 Wiley Periodicals, Inc. Microwave Opt Technol Lett 58:1577–1582, 2016; View this article online at wileyonlinelibrary.com. DOI 10.1002/mop.29857

Key words: *substrate integrated waveguide; horn antenna; square loop slots; bandwidth; return loss*

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Dual-band wearable antenna using split ring resonator

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ABSTRACT

This paper presents dual-band wearable antenna using split-ring resonator (SRR). The SRR is placed near patch and feed line. SRR makes a major contribution to the first operating band (2.32 GHz), but it has a minor effect on the second operating band (3.5 GHz). The wearable antenna at 3.5 GHz (without using SRR) is also presented for comparison sake. The simulation results are analyzed and compared with the measured results, which shows that there is a good agreement between them.

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1. Introduction

Since last few years, several researchers have shown possible design and fabrication of microstrip antenna with substrates such as felt,[1,2] polyamide,[3] jeans,[4] and leather.[5] These antennas are known as wearable antenna or textile antenna. Fast development of flexible and wearable systems in applications of body area networks, RFID tags, flexible displays has created a great demand of antennas with multiband operation with flexible and wearable substrates.

In [6], "h"-type dual-band microstrip antenna is presented which has two paths for current, which is responsible for dual-band performance. In [5], the dual-band operation is achieved by loading the bow-tie slot antenna with bend slot stubs on the edges. In [7], the antenna comprises the shape of L-I-inverted L shape for dual-band performance. The helical and loop antenna are used for MICS and ISM bands in [8]. The monopole line and the trapezoidal ground plane were used to obtain dual-band performance in [9]. In [10], the dipole consists of two fork-type structures placed back to back for dual-band operation.

The split-ring resonator (SRR) proposed by Pendry [11] is having small dimension in terms of wavelength. Due to its small size,[12] it attracts researchers for size miniaturization of microwave components. Dual-band antenna,[13] triple-band antenna [13] are presented using complementary SRR. In this paper, the author investigates the dual-band wearable antenna using SRR. The SRR is kept near the patch and feed line. Single-band and dual-band wearable are simulated and fabricated. Compared with the above-mentioned papers, proposed antenna is simple in structure and easy to fabricate.

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ORIGINAL ARTICLE

Synthetic Plasma Liquid Based Electronic Circuits Realization-A Novel Concept

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ABSTRACT

Biomedical research is contributing significant role in the field of biomedical engineering and applied science. It brings research and innovations to a different level. This study investigated artificial human blood –synthetic plasma liquid as conductive medium. Keeping in mind the conductivity of synthetic plasma, astable multivibrator as well as differential amplifier circuit were demonstrated. The circuits were given normal input voltages at regular temperature and ideal conditions. The result shows desired response which supports the novel concept. For both the circuits, phase shift of 180^0 achieved by analysing biological electronic circuits. (*Int J Biomed Sci*** 2016; 12 (3): 79-82)**

Keywords: Synthetic plasma; biomedical science; human body

INTRODUCTION

Majority of human body consists of water and blood particles like white cell, red cell, platelets. Liquid blood is responsible for supply of nutrients such as glucose, amino acids, and fatty acids (dissolved in the blood or bound to plasma proteins (e.g., blood lipids)). An artificial human blood named synthetic plasma was made in the laboratories of applied science to investigate and analyse its behaviour in order to realise liquid based electronic circuits.

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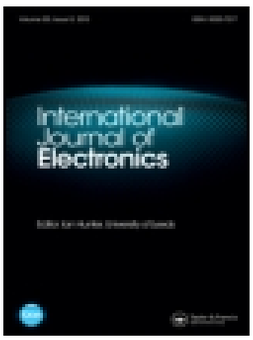
Human blood based liquid memristor is made possible and feasible for research and analysis (1). Electronic diode, electronic field effect transistor and gate circuitry is possible to design with the help of human tissue (3). Two human palm fingers were used for the investigation and three rings were designed to acts as gate, sourse and drain terminals. Keeping ring diameter, size and ideal pressure, field effect transistor characteristics were successfully achieved (4).

Physical model of human tissue skin based memoristor and their Network is possible for biomedical analysis (2). This literature supports novel idea to design electronic circuit from synthetic plasma liquid. There is a relation between total body capacitance (TBC) and basal metabolic rate (BMR) because of the electrical properties of human body parts (6). So it is very clear that human body parts can be treated as different electronic components.

The human body can be analyzed as a transmission medium for electrical current by means of numerical simulations and measurements. Properties of predefined tissue layer and variations related to human body geometry were



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Implementation and comparative analysis of the optimisations produced by evolutionary algorithms for the parameter extraction of PSP MOSFET model

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Implementation and comparative analysis of optimization evolutionary algorithms for parameter extraction of PSP MOSFET model

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The paper proposes an application of evolutionary algorithms specifically artificial bee colony (ABC), variant ABC and particle swarm optimization (PSO) to extract parameters of metal oxide semiconductor field effect transistor (MOSFET) model. These algorithms applied for MOSFET parameter extraction problem using Pennsylvania surface potential (PSP) model. MOSFET parameter extraction procedures involve reducing error between measured and modelled data. The paper shows that ABC algorithm optimizes the parameter values on basis of intelligent activities of honey bee crowd. Some modifications have been implemented of basic ABC algorithm and projected as a modification of ABC algorithm. Particle swarm optimization is population based stochastic optimization method motivate by bird flocking activities. The performance comparison of these algorithms evaluated with respect to quality of solutions. Simulation results show that PSO algorithm is better than variant ABC and basic ABC algorithm for the parameter extraction of MOSFET model and implementation of ABC algorithm is simple than PSO algorithm.

Keywords: evolutionary algorithm, PSP model; parameter extraction; extraction strategy; ABC algorithm ABC variant algorithm; particle swarm optimization

1. Introduction

MOS integrated circuits are made with fundamental construction blocks of metal oxide semiconductor transistors. VLSI circuits utilizing metal oxide semiconductor technology have appeared as a leading technology in the semiconductor industry. Circuit simulation tools help to predict the performance of the circuits before circuits are fabricated. The correctness of simulation of advanced model is dependent in which capacity they confine the circuit components behaviour. To extract parameters of MOS device is especially significant fraction of device modelling. Parameter standards have to be selected in view of that the model approximates the performance as near to measured value. Determining these values is not a simple task because some of these parameters may not be identified perfectly and supposes these values are recognized correctly, this value may not be finest to utilize in mathematical equation of the model since critical device models are depend on number of guesses and estimations (Yannis Tsividis, 2010).

The main purpose is to use model expressions with the truthful values for their parameters to decrease the error between experimental data and model generated

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Comparative Study of Different Methods for Brain Tumor Extraction from MRI Images using Image Processing

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Abstract

Background/Objectives: The objective of this paper is to study various segmentation methods implemented using MATLAB and to compare accuracy of each. **Statistical Analysis/Findings:** Preprocessing is required for better segmentation, as it removes noise and makes images having equal attribute so that accuracy to segment can be increased. Segmentation using Thresholding, region based segmentation and watershed segmentation, all the methods are performed and Comparison of accuracy of all the methods has been calculated on basis of actual tumor part and segmented tumor part. Morphological operations are used in all the methods in order to avoid noise part of segmented image and to have higher accuracy. Accuracy of the three methods which are region based, thresholding and watershed are 87.48, 91.34 and 92.76 respectively. Here we have used all T2-weighted Magnetic Resonance Imaging (MRI) images as it is noninvasive technique and having high contrast between tumor and normal part. **Application/Improvement:** Segmented tumor with higher efficiency leads to help doctor in anatomy and pathology to classify tumor type so that treatment could be started accordingly as soon as possible.

Keywords: Brain Tumor, Image Processing, MRI, Morphological Operations, Thresholding, Tumor Extraction

1. Introduction

Conventionally brain tumor was being decided according to biopsy, Human inspection, Expert opinion, etc. An expert also needs other experts to make decision, because he alone cannot detect type of tumor correctly. All these procedures take too much time to classify tumor correctly which delay the treatment. In addition to that the human prediction is not always correct[1]. Automated classification and detection of tumors in different medical images is simulated by the inevitability of high accuracy. At present with the rapid growth of the Artificial Intelligence (AI) development in Biomedicine, computer-aided diagnosis attracts more and more attention. It has been put to a test that double reading of medical images could lead to better tumor exposure. But the cost intended in double reading is very high, that's why good software to comfort humans in medical institutions is of great concern at present.

Discussed performance analysis of three methods to segment tumor viz., region growing, K Mean and Fuzzy C Mean methods, have used median filter for image denoising in order to reduce noise due to imaging devices. The performance was evaluated on the basis of 'error percentage as compared to ground truth'[2]. In[3] compared three different semi-automated methods, viz., Modified Gradient magnitude Region Growing Technique (MGRRGT), level set and a Marker Controlled Watershed Method (MCWM), and have evaluating their relative performance in the segmentation of tumor. Where images were preprocessed using image smoothing and contrast enhancement. In[4] developed numerous methods to detect and segment tumor from brain MRI and its features such as centroid, perimeter and area are calculated from the segmented tumor.

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Lunar Surface Crater Topology Generation using Adaptive Edge Detection Algorithm

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Abstract: The probability of precise soft landing on the lunar surface could be significantly increased by using craters as a navigational landmark. This article aims at the edge information of crater for lander navigation. First, histogram of an image is calculated and adaptive Gaussian filter is applied. Then adaptive canny algorithm is applied to detect edges of craters at different illumination. The craters are extracted by the mechanism of paring the selected valid edges followed by pattern fitting. These detected craters are used as navigational landmarks and for velocity estimation of the lander. Experimental results show the adaptive ability of algorithms for crater detection at different illuminations and different terrains. Craters at high illuminations are also efficiently detected. These detected craters are matched with the reference crater database by use of pattern matching algorithm for horizontal velocity calculations.

1. INTRODUCTION

The interplanetary mission has a requirement of landing precision within few hundreds of meters of a predetermined site [1]. It is extremely difficult to have such precision by old navigational methods like deep space network and inertial navigation system [2-4]. Craters are uneven elliptical surfaces with shadows. Craters are good navigational landmarks which exist almost on every lunar surface. Navigation method as proposed in [5, 6] based on crater matching is implemented by processing real time data of lunar surface and then by comparing that data with stored crater database before starting of landing mission. Few of the experiments show that such kind of navigation is capable to give precise landing of lander [7, 8]. To extract such craters, from the planetary images, is difficult due to noise in the image, image blurring and uneven illumination due to different Sun angles on the plant. To deal with uneven illumination issues, utilization of adaptive threshold algorithms is required. This will allow real time processing of the images at different illuminations and different elevation angles of the Sun with respect to lunar surface.

There are two broad categories of crater detection techniques, area information based detection and edge information based detection [9,10]. Generally area information based techniques has more computational resources requirement as it is highly influence by alterations in illumination. Some of the morphological techniques are illustrated in [11-13]. The edge information based technique depends on shape of the crater hence it has low influence of change in illumination which in turn demands smaller amount of data processing. This makes edge detection techniques computation and cost effective. The crater detection algorithm is divided into five steps: Image blurring, adaptive detection of edge, selection of valid edges, edges pairing and pattern fit. Algorithm presented in section II describes the procedure of crater detection.

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Control Board of Commercial Stove

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***Abstract*: The Control board provides control for fuel feeding and burning the pallets used in company. The single control board can control clean energy stoves of Model-1. It has interactive user interface to control and monitor various fuel feeding and burning requirements. The Model-1 product has automatic control mechanism based on temperature input from the cooking vessel. Thus a model-1 is proposed which utilized multi layer approach along with principle components analysis. The qualitative and quantitative results show that the proposed model gain advantages of lower complexity along with approximately 90% accuracy.**

Keywords—Controller(8-bit), Thermocouple, GSM Module, Serial Protocol (UART and SPI)

I. INTRODUCTION

The main aim of this Commercial Stove to provide a biomass pellet based large scale cooking solution. In user point of view, this Commercial Stove provide saving against Gas and Diesel up to around 30%. This Commercial Stove has two models (1) Model-0.

This Model is uniquely designed for large scale continuous cooking application, using a clean, cost effective and eco-friendly fuel. It is an energy efficient appliance that is an ideal alternative to fossil fuels such as a LPG, PNG, and Diesel.

As shown in figure1 the Control board is an electrical hardware device containing equipment for regulating electrical devices that makes decisions regarding whether or not proposed changes to a software project should be implemented.

Fig. 1 Control Board

II. WORKING OF COMMERCIAL STOVE

As Shown in figure2, the pellets are put inside the chamber1. And heater is put inside the chamber2.

When power is turn on and user press the Ignition key than motor and heater are turn on and pellets are move to chamber2 via belt and due to heater on the pellets are burn. After completion of the ignition process the user press normal button. In that motor will be on and off and two fans are on continuously as per defined speed. Due to this flame will be created and cooking will be start at this mode. Thermocouple sense the temperature of cooking plats and using that value the stove will change mode automatically.

This stove has two modes.

1) High Mode
2) Low Mode (By Default run this mode)

The value of motor on/off time, heater on time, fans speed is different in these two modes. The value of motor on/off time and some other feature will decided by user and it is re-configurable by user.

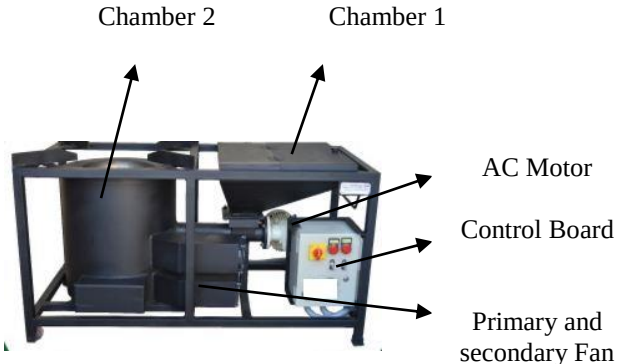

Fig. 2 Commercial Stove

Figure3 shown block diagram of control board. This control board consists two main Microcontrollers with programmable input/output peripherals.

Temperature and field dependent low frequency noise characterization of Ge n-FETs

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We report temperature (RT-150 K) and field dependent low frequency noise measurements on Ge n-FETs. Specifically, we delineate the temperature, field, and interfacial layer (GeON vs. GeO_2) dependence of the gate overdrive index (β) on corresponding changes in volume interface trap density (N_{it}) and mobility (μ). For $N_{it} < 1 \times 10^{20}$ cm^{-3} eV^{-1}, the dominant noise mechanism, number or mobility fluctuation, depends on the change in μ, but for $N_{it} > 1 \times 10^{20}$ cm^{-3}eV^{-1} near the conduction band edge, changes in μ as well as N_{it} determine the noise mechanism. Finally, we show that the β values of Ge n-FETs are significantly different from conventional Si transistors as well as Ge p-FETs at RT and 150 K due to much higher N_{it} and/or μ values of the Ge n-FETs. *Published by AIP Publishing.*
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I. INTRODUCTION

N and p-channel germanium (Ge) transistor research has gained a significant momentum in recent years due to the promise of increased drive currents resulting from higher carrier mobilities as compared to silicon (Si). As shown in Fig. 1(a, top),[1–5] a key challenge for Ge n-channel transistors with germanium oxide (GeO_2) and germanium oxynitride (GeON) interfacial layers (ILs) is the poor IL/Ge substrate interface with a high interface trap density (D_{it}) near the conduction band edge. Across the bandgap, conduction band edge D_{it} is significantly higher than the valence band edge $D_{it.}$ It can be also seen from Fig. 1(a) that Ge FETs have an overall higher D_{it} (top) than Si FETs (bottom). This behavior is also observed in other channel materials such as SiC[6,7] and InGaAs.[8] Higher D_{it} implies a larger number/concentration of defects that can act as trapping-detrapping centers for inversion charge carriers. When inversion carriers occupy these traps, it not only leads to a decrease in the inversion charge density but also makes the traps act as positively or negatively charged scattering centers. The inversion charge carriers experience an electrostatic force (either attraction towards or repulsion from IL/semiconductor interface) due to the charged centers resulting in increased Coulombic scattering and a decrease in mobility. However, at high inversion charge density, electrostatic screening of the charge centers by inversion charge carriers helps in reducing the effect of Coulombic scattering. On the other hand, the screening effect decreases with increasing number of charge centers.[2] Hence, if there are more defects, like in case of Ge n-FETs than in case of Si n/p-FETs and Ge p-FETs, there is more pronounced Coulombic scattering which degrades inversion mobility (μ) and surface inversion charge density (N_S). Surface/bulk Coulomb scattering dominated mobility decreases with a decrease in temperature (T), whereas phonon scattering dominated mobility increases with a decrease in temperature.[9] Fig. 1(b) shows that (i) μ increases with a decrease in temperature for Si n-FET[5] and Ge p-FET[2] in accordance with the phonon scattering model and (ii) μ decreases with a decrease in temperature for Ge n-FET[2] in accordance with the Coulombic scattering model.[9] Further, traps close to the band edge assist in channel to gate carrier tunneling, contributing to gate leakage and device reliability degradation.[10,11] Hence, it is essential to study and reduce the traps close to band edges, especially the conduction band edge for Ge n-FETs. Temperature and gate field dependent methods can be used to probe traps within the bandgap as shown by four different regions of operation in Fig. 1(c). However, unlike field based methods, low temperature techniques enable extraction of more accurate trap information by avoiding trap generation during the measurement. Depending upon the temperature and N_S values, these regions can overlap. There are reports of low temperature conductance[12] and low temperature charge pumping[13] characterization on Ge FETs to extract the interface trap density. Also, a recent report[14] on the room temperature (RT) low frequency noise (LFN) characterization of Ge FETs compares Ge p-FETs and n-FETs in terms of oxide trap density (N_{bt}) and Coulomb scattering coefficients (α_{sc}). However, there are no Ge gate stack studies that present temperature and field dependent noise mechanisms and their dependence on μ and volume interface trap density (N_{it}) values. In this work, we report extensive temperature and field dependent LFN data for Ge n-FETs from RT to low temperature (150 K) for low N_S and high N_S. Specifically, this work (a) compares GeON and GeO_2 ILs in terms of N_{it} values extracted from LFN power spectral density data, (b) delineates dependency of the noise mechanism (β) in terms of two of its basic originating components μ and N_{it}, and (c) compares field and temperature-dependent β of Ge n-FETs with those of Ge p-FETs and Si FETs. Since this study was carried out on large area devices, we can only access the average response of traps close to the quasi-Fermi level at a particular temperature and N_S values. Even though LFN measurements for large area devices and random telegraph noise (RTN) data for small area sub-micron devices cannot

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4. MEASUREMENT RESULTS

A photograph of the fabricated antenna is shown in Figure 6. The antenna prototype was experimentally tested using right-handed and left-handed circularly polarized transmitter antennas, for investigating the polarization purity and the gain. The tests were done over all three GPS bands of L_1, L_2, and L_5, covering frequencies from 1.15 to 1.60 GHz. The antennas were tested in the University of Manitoba's Antenna Laboratory.

We have fabricated and tested two other antennas. We accumulated large amount of information to enable us assessing the performance of the antennas at different frequencies. For brevity, here the radiation patterns of the antenna at the middle GPS frequency band of 1.2 GHz are presented. It is noted that for the antenna under study having a right-hand spiral winding direction, the LHCP component represents the cross polarization. Better cross-polarization levels, that is, LHCP components, are obtained in the first mode.

The measured RHCP and LHCP patterns of the antenna with $n = 2.5$, operating at their first mode, are plotted in Figure 7 at the middle GPS frequency band of 1.2 GHz. The corresponding measured results for the second mode operation are given in Figure 8, at the same frequency of 1.2 GHz. The antenna height is only 29 mm, which is about 0.1λ, where λ is the free-space wavelength at $f = 1.2$ GHz. Comparing the measured results with the numerical ones in Figures 4 and 5, it is noted that the copolar components are in good agreement. However, there is a slight asymmetry in the measured results of the first mode. The measured cross polarizations were also somewhat higher. These are attributed to several factors; such as the scattering associated with the connecting cables in the measurement setup, different absorber compactness used in practice, as well as the axial ratio of the CP transmit antenna source itself. The transmit antenna was a microstrip patch with an axial ratio of about 1.0 dB. Nevertheless, the cross-polarization levels are well below -15 dB, or axial ratios better than 3 dB, which exhibit satisfactory CP performance.

5. CONCLUSION

A low-profile four-arm Archimedean spiral antenna was presented for GPS frequency bands for both dominant and higher order spiral modes. The antenna axial size reduction was achieved by a combination of absorbing material and a novel wideband balun. The proposed balun was a small disk printed on the bottom of a thin dielectric slab, on top of which the spiral itself was etched. The novelty of the design was in its simplicity. Prototype antennas were fabricated and tested in the University of Manitoba Antenna Laboratory. The results for both first and second modes were provided, which successfully verified the idea in practice. In the simulation, Cumming's absorber C-RAM LF-79 layers were used. The simulation results matched with the measurement ones. The overall height of the structure was about 0.1λ; where λ is the free-space wavelength at the middle GPS frequency band, that is, 1.2 GHz.

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K BAND CLASS-C MESFET BASED FREQUENCY QUADRUPLER WITH HIGHLY SELECTIVE SIW BANDPASS FILTER FOR INTER SATELLITE COMMUNICATION

Romil Patel and Amit Patel

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ABSTRACT: *This article presents the single stage active frequency quadrupler design for generating a tone in the K band (23.5 GHz) frequency range using GaAs MESFET device. Harmonics current generation characteristics of GaAs MESFET (NE900000) is modeled and analyzed in reference with gate voltage. Based on this, its optimum operating class-C is decided for its application as a frequency quadrupler. Using this model and introducing resonator (Idler) based harmonic rejection techniques, a narrowband −0.310 dBm output power ×4 frequency multiplier from C-band to K-band implemented using 0.5 μm GaAs MESFET. As the device operated in class-C operating condition, it produces harmonics content due to clipping of output signal. At the output of the proposed multiplier design, a highly selective surface integrated waveguide (SIW) based bandpass filter (with Q is better than 120) is attached, which provides excellent rejection of fundamental component (>90 dBc) and other harmonics assuring minimum rejection of 30 dBc. The proposed design consumes 60 mW power and provides ∼−7 dB conversion gain with input power having 7 dBm. Feasibility and layout geometry of the proposed design has been evaluated and simulated on the substrate RT-Duroid5880 using Agilent ADS software.*
 Microwave Opt Technol Lett 58:767–776, 2016; View this article online at wileyonlinelibrary.com. DOI 10.1002/mop.29661

Key words: *GaAs MESFET; class-C operation; frequency quadrupler; high Q SIWfilter; millimeter wave band; quarter wave resonator*

1. INTRODUCTION

In most microwave communication systems, intended tone from the reference signal is generated either by using chain of multipliers or the combination of PLL with multiplier approach, a general background of the idea can be found in [1,2]. For instance, JPL's ISARA Cubesat, the intended tone of 26 GHz is generated from an on board 25 MHz temperature controlled crystal oscillator (TCXO) by using a phase lock loop (PLL) frequency multiplier [3]. In order to generate modulated radar signal at mm-wave frequencies, the nonlinear behavior of frequency multiplier has been used to generate frequency signal

Design of High Data Rate and Multipath Efficient Underwater Acoustic Communication System Using OFDM–DQPSK

Kosha Mistry and Hardik Modi

Abstract Presently, underwater acoustic communication is an attractive option for underwater communication because of its low attenuation in underwater compared with electromagnetic waves and optical waves. Underwater communication channel is extremely complex in nature. By using multi-carrier communication, in this complex underwater acoustic communication channel, we perceived high data rate. An attractive multiplexing technique denoted as OFDM is one of the most promising multi-carrier communication methods for underwater environment. In this paper, basic knowledge about underwater acoustic communication and OFDM is given. MATLAB is used as functional software for implementing and defining differential quadrature phase shift keying along with orthogonal frequency division multiplexing.

Keywords Underwater acoustic communication · OFDM · QPSK · Multi-carrier communication · MATLAB

1 Introduction

In present, some of the applications of underwater acoustic communication are oceanography, for scanning weather, climate conditions and pollution, and shipping. In underwater environment natural resources are investigated by unmanned underwater vehicles (UUVs) and autonomous underwater vehicles (AUVs). Because of very slow in speed, acoustic wave underwater, and large number of multipath, there is long impulse response and large time delays. Frequency-dependent absorption of acoustic in the water band limits the underwater channel. This bandwidth limitation also limits the maximum achievable data rate

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Design of Rectangular and Hemispherical Dielectric Resonator Antenna

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Trushit K. Upadhyaya, Killol Pandya

***Abstract*—Dielectric Resonator Antenna covers up the most essential characteristics like high efficiency, large bandwidth, compactness, high gain which are the essential criteria for antenna in today's world. The objective of proposed work is to compare two shapes of DRA, called Rectangular DRA and Hemispherical DRA. The change in result in both the shape of DRA are observed, which justifies the hemispherical DRA gives large BW compare to the rectangular DRA.Both antennas are designed for 2.4GHz and 5.4GHz frequency application.**

***Index Terms*—Bandwidth, Dielectric Resonator Antenna, Rectangular Dielectric Resonator Antenna**

I. INTRODUCTION

Today's world relies on wireless communication. Due to which a lot of research on communication fulfilling the criteria of high speed has been increased[1-5]. To fulfill such requirement large BW, high radiation, high gain, compactness, flexibility characteristics are required. This gives rise to research an optimized antenna fulfilling the characteristics [6]. One of which is, Dielectric Resonator Antenna (DRA).DRA can be of any shapes like rectangular, hemispherical, circular, cylindrical, etc[7-9]. in three dimension model. DRA has its own assigned material having different relative permittivity values, which affects the characteristics of antenna[10]. Usually they are having high relative permittivity value. DRA is becoming most researched antenna due to its characteristic benefits[11-13].

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When comparison of microstrip patch with DRA is done then it is observed that DRA is more radiating than Microstrip patch because microstrip patch radiates only through two slots while that of DRA radiates through whole DRA's surface[14-15]. This gives wider bandwidth benefit. Moreover surface waves are negligible in DRA[16]. Design flexibility is much observed in DRA, due its different shapes. Also by changing the dimensions of DRA, one can design optimized antenna which gives benefits to researchers to think beyond the box[17-20]. Other than design benefits different feeding techniques give advancement towards optimized DRA[21]. From different optimum design in this paper two shapes, rectangular and hemispherical DRA are considered which are resonating at frequency of 2.4GHz and 5.4GHz respectively. Section II describes about designing methodology. Finally conclude this paper in section III.

II. DESIGNING METHODOLOGY

A. Rectangular DRA design

Basic RDRA design has been implemented in HFSS with dimensions represented in TABLE I.

TABLE I
DIMENSIONS OF RDRA

Parameter	Dimension of DRA	Dimension of substrate
Length (mm)	**30**	**90**
Width(mm)	**40**	**100**
Height (mm)	**1.56**	**2.2**
Relative Permittivity	**4**	**3.2**

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Enhanced bandwidth and gain of compact microstrip antennas loaded with multiple corrugated split ring resonators

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ABSTRACT

We present microstrip-based radiating structures loaded with multiple corrugated and non-corrugated split-ring resonator (SRR) metamaterials. We analyze how the change in gap spacing between multiple corrugated and non-corrugated SRRs can improve the bandwidth and gain performance compared to conventional SRR antenna designs. Regarding the corrugated designs, square teeth have been added to the outer edges of SRR rings. The microstrip antenna performance loaded with eight different SRR loads is analyzed. By changing the gap between the multiple SRR rings, the radiating response of the proposed antenna designs can be improved. Corrugated SRRs are also found to strongly improve the performance of conventional non-corrugated SRR-loaded antenna designs. The reflection coefficient, bandwidth, and radiation pattern results are presented and compared to previous relevant metamaterial microstrip antenna works. The highest obtained bandwidth is 420 MHz, which is achieved by three square teeth SRRs. The highest calculated gain is 7 dB and is achieved by loading two square teeth SRRs. The proposed antenna design can be tuned to different frequency bands by embedding microelectromechanical system switches in SRRs' gaps. The proposed antennas have compact size combined with high bandwidth and gain performance.

ARTICLE HISTORY
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KEYWORDS
Corrugation; split-ring resonator; metamaterial; antenna; square teeth

1. Introduction

In recent years, the need for antennas with features such as high bandwidth, small size, high gain, and multiband operation is increasing.[1] Antennas working on more than one frequency band and having small size can be used in cell phones.[2–5] In addition, high-gain antennas are very useful for satellite communication applications.[6,7] Broadband antennas are also gaining interest in recent years.[8] However, the microstrip patch antenna has the advantages of low cost and small size, but it has the disadvantages of low gain and narrow bandwidth. One of the potential solutions to improve its performance is by loading metamaterial elements.[9] Metamaterials are artificial materials with several unusual properties.

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Design and Simulation of Power Efficient Linear MOS Transconductor

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Abstract

Objectives: This paper proposes design of a linear and power efficient transconductance amplifier for Asynchronous Sigma-Delta Modulator (ASDM). **Methods/Statistical Analysis**: The proposed tranconductor circuit uses two linearization techniques which have been combined for design improvement. A triode transistors configuration with cross coupled transistor pair is used to increase the linearity. **Findings**: The proposed transconductor is specially designed to act as a filter for ASDM. The topology attains a DC gain (A_o) of 25 dB, a Gain-Bandwidth Product (GBW) of 70 MHz, cut-off frequency of 4 MHz and a power consumption of 72.44 µW when used as an integrator. **Application/Improvements:** Transconductor is simulated in TSMC 0.18µm technology with an operating voltage 1.8 V. Simulation results shows that the power consumption of circuit is very less, which makes it suitable for low power signal processing applications.

Keywords: Asynchronous Sigma-Delta Modulator (ASDM), Integrator, Linearity, Power Efficient, Transconductor

1. Introduction

Integrated analog filters are the basic building block to perform different signal processing operations. One of the most common signal processing application is integrator which is considered to be very important block in Asynchronous Sigma Delta Modulator (ASDM)[1]. There are two different approaches through which analog filters can be realized: Discrete-time and continuous time implementation. Due to the sampling process, discrete-time filters are mostly used only for low frequency applications. While continuous time filters do not use sampling process so they can be used in high speed applications.

Integrated continuous time filters can be implemented using different techniques like: OPAMP-RC, MOSFET-C and G_m-C[2,3]. When fabrication area is not constraint, OPAMP-RC is suitable choice as it is having good linearity. In MOSFET-C, filters resistors are replaced by MOSFET which has poor linearity compared to OPAMP-RC filters. Improvement in linearity is possible using different linearization techniques. Continuous-time filters can also be realised using G_m-C technique which has better frequency response, wider tuning range and low power consumption. G_m-C configuration uses transconductors and capacitors only and therefore such structures are simple compared to other approaches. For portable applications, power consumption is very critical parameter because battery life improves with low power circuit design[4].

Important consideration in G_m-C design remains in ideal characteristics of transconductance. Nonlinearity and sensitivity to parasitic capacitors are main problems related with this configuration[5].The linearity of transconductors can be improved through different design techniques as described in literatures. These methods include: CMOS triode transistors[6–9] crossed-coupled differential pairs[10,11], source degeneration resistor[12,13], class-AB configuration[14], adaptive biasing[15,16] etc.

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Controlling of FPGA-Based Optical Polarimeter Using LabVIEW

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Conference paper
First Online: 26 February 2016

Part of the Advances in Intelligent Systems and Computing book series (AISC, volume 409)

Abstract

LabVIEW is an interactive program development and execution system in which one creates programs using a graphical notation. This paper gives an idea about development of a graphical user interface for digital collection, and how one can control an instrument with the use of LabVIEW. It proposed the use of LabVIEW for controlling an optical polarimeter, which is based on Spartan 3E FPGA system. Optical Polarimeter works on the principle of rapid modulation of light, and measures the angle of rotation caused by passing polarized light through an optically active substance. A GUI is developed in LabVIEW to communicate with optical polarimeter in accordance with user's requirement. Serial connection takes place between FPGA board and host PC through LabVIEW. At a time, one data bit is send during serial communication and a complete byte is being sent with a start bit, stop bit, and parity bit. Entire system consists of two parts: Spartan 3E FPGA programming device and NI LabVIEW software.

Keywords

Data Acquisition with FPGA Using Xilinx and LabVIEW

Sanket Mehta, Nirmal Parmar, Jayanee Soni and Arpita Patel

Abstract This paper describes the concept of serial communication using LabVIEW software. Serial communication itself means to establish a communication between a host computer and a programmable device. Serial communication is democratic as most of the computers have one or more serial ports which dilute the usage of extra hardware other than a cable to connect the instrument and the computer. At a time one data bit is send during serial communication. Entire system constitutes of three parts: Xilinx software, programmable device, and LabVIEW software. Xilinx software is mainly used for creating UART communication code in VHDL. Programmable device is used to dump UART code. Logics and programmable blocks have been applied in LabVIEW for communication between host computer and programmable device. A programmable device utilized in the proposed system is FPGA of Spartan family, specifically used Spartan 3.

Keywords UART—Universal asynchronous receiver/transmitter · LabVIEW software · Xilinx software · FPGA—Field programmable gate array · Serial communication · SPARTAN 3 · Papilio loader · Hyperterminal

1 Introduction

Data acquisition is the process to receive data from hardware and display it in appropriate software. The application of data acquisition is controlled by many programs of software which are build up using diverse general-purpose program-

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Design and Implementation of Non Touch Enabled Password System

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Part of the Advances in Intelligent Systems and Computing book series (AISC, volume 409)

Abstract

In the field of virtual environment applications we are using mouse, keyboards, and so forth are the common controlling and directing devices. In the current age of technology, touch and non touch enabled technologies has prevailed over it. This paper presents a system where red color detection technology has been used which provides more a natural way of feeling of interacting with the devices. This work is an attempt to replace earliest devices to enter the input with the natural finger wrapped with red color tape by non-touching the screen. It displays the keypad on detection of red color. Keypad contains fundamental keys such as 0–9 digits, Delete, and All Clear key to enter the password. The system can be used in real-time applications for password security systems in the areas such as ATM, Jewelers Shop, Home Security, etc. This proposed system gain advantages of cost-effectiveness, replacement of keyboard, and more preferable where space is scarce. It provides accuracy of 92 %.

Keywords

Human machine interaction Non touch enable technology Red color detection Centroid ATM Jewelers shop Home security

Notes

Acknowledgments

FPGA based Temperature Control and Monitoring System for X-ray Measurement Instrument

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***Abstract*: This paper describes a Pulse width modulation technique implemented in a Field Programmable Gate Array (FPGA) to control the temperature of the Silicon Drift Detector (SDD) used in Spectrometer. Moreover, LabVIEW based Graphical User Interface (GUI) is developed for monitoring the temperature of DC-DC convertors and SDD. Here, Pulse width modulation (PWM) is used for the controlling the temperature of the SDD by controlling the voltage across the Thermo-Electric Cooler (TEC) or Peltier plate while temperature is measured by the temperature sensor available inside the SDD module. The paper also describes the usage of digital clock manager (DCM) for increasing the timer clock frequency of the PWM signal. LabVIEW based simulator is developed for monitoring and post processing the temperature and health parameter.**

***Index Terms*: Peltier Plate, Field Programmable Gate Array (FPGA), Digital Clock Manager (DCM), LabVIEW**

I. Introduction

Spectrometer is general used to determine the composite elements of rocks, minerals etc. Like other solid state X-ray detectors, silicon drift detectors measure the energy of an incoming photon by the amount of ionization it produces in the detector material.

Silicon drift detector (SDD) has outstanding property of extremely small value of the anode capacitance, which is practically independent of the active area. This feature allows to gain higher energy resolution at shorter shaping times compared to conventional photodiodes and Si(Li) detectors, recommending the SDD for high count rate applications [1]. Low detector capacitance, Low leakage current and Noise reduction by integrating FET with SDD in the first stage of signal processing are the salient features of the SDD. Also, the detector can handle much higher input count rates, allowing throughput count rates of up to 100 Kcps. SDD from KETEK has temperature sensor to readout the chip temperature and Thermo-Electric Cooler (TEC) or Peltier to maintain the chip temperature mounted on the same chip or on a ceramic[2]. We have used TI ADC128S102 Analog to Digital Converter (ADC) for monitoring the temperature of SDD and Temperature of DC-DC Converters.

In this paper, we have used FPGA for monitoring and maintain the temperature of the SDD because it has a capability of executing the concurrent operations and allowing parallel architectural design. Here, we have used PWM technique to control the voltage across the Thermo-Electric Cooler (TEC) or Peltier. Same FPGA is also utilized for the acquisition of the X-ray data from SDD and to monitor the temperature of the SDD and DC-DC converters. LabVIEW based simulator is also developed for the monitoring the temperature of SDD and health parameters of the instrument, in which data is acquired using UART protocol.

II. Thermoelectric Basic Principle

TECs are based on the Peltier Effect, when the current flows through the TECs conductor depending on the polarity of the current flow, the junction of two conductors will either release or absorb heat. The Peltier Effect is one of the three thermoelectric effects, the other two are known as the Seebeck Effect and Thomson Effect. TEC modules are used in applications where temperature stabilization, temperature cycling, or cooling below ambient is required. There are many products using TECs, including CCD cameras (charge coupled device), laser diodes, microprocessors and silicon drift detectors [3].

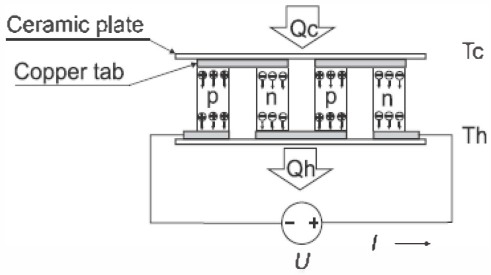

Fig. 1. Thermoelectric device [4]

The typical thermoelectric module is manufactured using two thin ceramic wafers with a series of P and N doped bismuth-telluride semiconductor materials sandwiched between them. The ceramic material on both sides of the thermoelectric adds rigidity and the necessary electrical insulation. The thermoelectric couples are electrically in series and thermally in parallel. A thermoelectric module can contain one to several hundred couples. As the electrons move from the P type material to the N type material, the electrons jump to a higher energy state absorbing thermal energy (cold side). Continuing through the lattice of material, the electrons flow from the N type material to the P type material dropping to a lower energy state and releasing energy as heat to the heat sink (hot side), as shown in figure 1.

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Global LBP Features for Iris Recognition using Blood Vessel Segmentation

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***Abstract*—Iris Recognition is found to be one of the most reliable and efficient technique for biometrics identification. In this paper iris recognition using blood vessel segmentation is proposed. After blood vessel segmentation, the segmented iris image is recognized using global texture features. The GLCM, Gabor and Local Binary Patterns are used for feature extraction. The for training of the extracted features using well known SVM classifier. The performance of the system is evaluated on DRIVE and High Resolution Image Databases. The system performs better for the combined features of GLCM and Gabor as compared to individually. The results of LBP are found to be more promising. This proposed approach of iris recognition using blood vessel segmentation is robust and secure and has the ability to recognize retinal images from the photographs of the known iris images. The system is more efficient in terms of accuracy as well as time complexity.**

Keywords: GLCM, Gabor, Local Binary Pattern, Blood Vessel Segmentation, SVM

I. Introduction

For assurance of public security, various biometrics security techniques have been proposed such as face, iris, hand geometry etc. Among the all available biometrics recognition techniques, iris recognition is proved to be the most reliable and efficient technique. In iris recognition, retinal iris image is analyzed using color as well as texture features. Most of the earlier work ignores the application of microvascular network for iris recognition. The retinal blood vessels of iris has unique structure and these patterns are randomly distributed, which can be used for identification of human being.

In this paper, an iris recognition system is proposed based on blood vessel segmentation. Various texture features such as GLCM, Gabor and Local Binary Patterns are extracted from the segmented blood vessel image of the iris. This paper essentially has two prime goals: One of the important objective of this paper is to study the features of iris to investigate their variability of microvascular network depending upon different persons through proper texture features. Another important objective of this paper is to study the different texture based features for classification of the features.

Basic theme of the proposed work is iris recognition by using blood vessel segmentation of retinal image. The proposed system consists of five stages. The main objective is recognition of iris samples. The first step is data collection procedure where iris image samples are taken for further processing and data measurements. Second phase of this experimental study is to pre-process the iris image samples for a standard benchmark and most importantly removal of noises to obtain the enhanced noise free images. Third and one of the most important phases is blood vessel segmentation. Then fourth one is feature extraction. Here in this phase Gabor wavelet, Local Binary Patterns and GLCM texture based features from the enhanced images are extracted by computing. The well-known SVM classifier is trained using these features which are then further used for iris recognition.

II. Related Work

Daugman [1] introduced the iris biometrics methodology first time. The integro differential operator is used here. The circular iris and pupil regions are located along with the arcs of the upper and lower eyelids. The circular path is located by the operator for most of the change in pixel values. This is done by varying the radius and centre x and y position of the circular contour. The integro-differential is much more similar to the Hough transform, because it also use first derivatives of the image and performs a search to find geometric parameters.

Advantages: The Hough transform suffers from thresholding problems. The proposed method works with raw derivative information. Hence the problems of Hough transform are overcome.

Limitations: The algorithm works on the local scale. Hence when there is a noise, it cannot perform well.

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Analysis of Geomagnetically Induced current in Transformer

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***Abstract*— Geomagnetically induced current (GIC) is harmful to the power system mainly on the transformer. Also, it causes serious problems to the transformers. It is DC bias current produced due to the effect of solar storm on earth. As GIC enter in the transformer through neutral wire it will lead to saturation of the transformer core. It produces harmonics in the power system. Due to saturation and harmonics, heating of transformer cores, burning of windings and miss operation of protective devices may occur. This paper presents the analysis of GIC effects in transformer's performance.**

Keywords—Geomagnetically induced current, Power System, Transformer, Harmonics.

I. INTRODUCTION

Due to the interaction between the space weather and Earth's magnetic field the current is produced at the ground level this current is called Geomagnetically induced current (GIC). This interaction is created due to the coronal mass ejections (CME) from the solar storm. The electro jet is produced by coronal mass injection, which passes through the magnetosphere. This process of production of electro jet is called geomagnetic disturbance (GMD). At the ground level a geoelectic field is induced due to electro jet which is DC current. The current flowing in the direction of this field is called as geomagnetically induced current (GIC). This current is created by the change in geoelectric field with respect to time [1].

The geomagnetic variations are slow in low frequency range about mHz as compared to 50 Hz frequency used in electrical power system. So when GIC flow through a transformer affects as the DC current [2].

The magnetizing current pulse is only range of $1/10^{th}$ to $1/12^{th}$ of the operating cycle because of the short duration of the high peaks of GIC (1 – 2minutes). Hence, the increase in temperature rises in the transformer windings due to GIC would be expected to be at least an order of magnitude lower than that estimated based on continuous duration DC currents. The same is true for temperature rises in the core and structural parts [3] .

When this DC current flow through a transformer it will cause the saturation of the transformer core. This saturated core produces harmonics in the transformer. This harmonics damage the transformer. GIC produces excessive heating of transformer due to which transformer windings may get burned. It increases the exciting current of transformer rapidly such as above maximum flux density value the transformer core gets saturated. GIC is dangerous for the power system as it causes increase in reactive power consumption, miss operation of relay etc. [4].

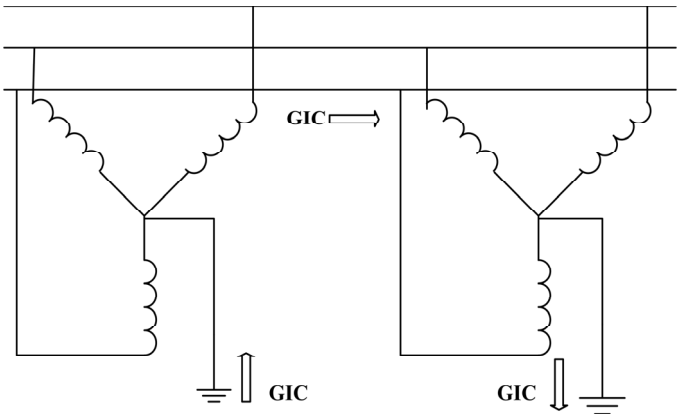

Fig. 1 GIC flowing along the transmission line between two transformers

These geomagnetically induced currents (GIC) flow from high resistance path to low resistance path. GIC enter from neutral wire of transformer and exit from power transmission systems through the neutral wire of transformer. These include reactive power consumption and system voltage instability creating load-flow problems, in particular at system interties. Also, erratic operation of voltage regulators and tap changers has happened, as well as transformer tripping due to differential relay operation. Other problems that may result from GIC are overloading of filters in HVDC transmission system and switching problems [5].

GIC can cause partial power system damage or whole system black-out. The largest electrical system blackout was occurred on March 13, 1989 due to high magnitude of GIC current in the entire zone of Quebec. This Hydro-Quebec blackout damaged a large step-up transformer on the generating side in power system at a nuclear plant on the east coast of the United States [6].

The largest first GIC event was observed in south of England where due to earth currents all telegraph lines in the

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An Analytic Review of Geomagnetically Induced Current Effects in Power System

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***Abstract*—The Geomagnetically induced current (GIC) produces unwanted adverse consequences in the power system. It causes problems in the power system like transformer core saturation, really miss operation, blackout of system, voltage instability and heating of transformers, disturbance in communication systems, corrosion of pipelines, railway tracks etc. This paper provides information about GIC and its different effects in various technological systems. Also present the possible solution to reduce GIC.**

Keywords—Geomagnetically induced current, Power System, Transformer, Harmonics.

I. INTRODUCTION

Geomagnetically induced current (GIC) is produced during geomagnetic storms at the earth's surface. This GIC current reaches the earth-surface when a geoelectric field is produced between earth's magnetosphere & ionosphere due to geomagnetic disturbance**.** Due to solar magnetic disturbances (SMD) may also known as geomagnetic disturbances (GMD) GIC flow on the ground surface. Its frequencies range between 0.001Hz to 0.1Hz [1].

This GIC flows in the path of high resistance to low resistance as per the characteristics of current. Therefore GIC flows in the earth soil to the neutral lead of transformer and various protective devices. This will leads to partial saturation of transformer core, consumption of reactive power, miss operation of relay and harmonics [2].Induced geoelectric field provide driving force to GIC [3].

In 1840s the first effect was noted on the early telegraph systems. In this period of time, magnetic storms have caused the blackout in electrical transmission system as well as damage in telecommunication systems [4]. The most considerable effect was power system failure in Quebec in Canada, for over nine hours. This is the largest effect due to the GIC [5]. Also there were many GIC effects in Sweden. On 6 April, 2000 in southern Sweden GIC of magnitude 300A has been calibrated in transformer rating of 400 kV [6]. The large geomagnetic storm was occurred on 7–10 November, 2004 in the south-east region of Brazil. The GIC amplitude of 15A was calculated in 500 kV power transmission lines [7].

The GIC enters in the power system equipments through the neutral wire.GIC effects are mainly in the transformer which causes saturation of core, generation of harmonics and mal-operation of protective relays. The GIC effects can be reduced by reducing the current entry in the neutral wire using GIC reducer.

In this paper, two methods are explained to reduce the GIC effects. (1) The standard distribution capacitor can be installed in power transformer neutral ground connections to stop the GIC. This standard distribution capacitors which provide the GIC blocking function is called Neutral blocking bypass device(NBBD) [8]. (2) The another method to reduce the GIC effect is to use the GIC reducer. The GIC reducer is consist of resistor in parallel with the varistor which form a passive circuit. This passive circuit is connected to the one end of transformer neutral wire and other end is joined to the ground [9].

The GIC effects in different systems are described in section II. The mathematical model of GIC effects in transformer is represented in section III. Section IV shows the available techniques to reduce the GIC effects. Finally conclusion is given in the section V.

II. GIC EFFECTS IN DIFFERENT SYSTEMS

GIC affects all systems which include electrical conductors used for signals or power transmission and it also affects the systems in which conducting properties are included such as railway tracks, pipelines and telecommunication. Pipeline is also affected by GIC may responsible for corrosion [10].

A.GIC effects on transformer

When GIC enters into the power system through transformer neutral wire, it causes partial saturation of transformer which increases heating of transformer and distortion in AC waveform responsible for relays miss operation [10]. From Hydro-Quebec incident it is found that GIC effect is different in different types of transformer. Three phase transformers are less sensitive than single phase transformers [11]**.**

B. GIC effects on HVDC system

The DC transmission line is very long in HVDC system and the three phase converter transformers consist of three single phase transformers. The magnetization curves of core material of converter transformer are very easily saturated. The reason for that is its too large magnetic circuit's permeability. Therefore the converter transformers are highly affected by GIC [12].

C. GIC effects on Relay operation.

Error in current transformer (CT) measurement increases as GIC superimposed on AC current. If the CT ratio is high

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TITLE: DEVELOPMENT AND VALIDATION OF HPTLC METHOD FOR SIMULTANEOUS ESTIMATION OF TERBINAFINE HYDROCHLORIDE AND MOMETASONE FUROATE IN COMBINED DOSAGE FORM

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ABSTRACT

A new simple, precise, accurate, specific and selective high performance thin layer chromatographic (HPTLC) method has been developed for the simultaneous estimation of Terbinafine hydrochloride (TH) and Mometasone furoate (MF) in cream dosage form. The chromatographic separation was achieved on Merck precoated silica gel aluminium plate 60 F254 using Toluene: Ethyl acetate: Glacial acetic acid (8: 4: 0.1 v/v) as mobile phase. The densitometric scanning was carried out at 248 nm. Response was found to be linear in the concentration range of 1000–3000 ng/band with correlation coefficient ($r^2 = 0.999$) for Terbinafine hydrochloride and 100-300 ng/band with correlation coefficient ($r^2 = 0.998$) for Mometasone furoate. All parameters of method, repeatability, precision, LOD, LOQ, % recovery were validated as per ICH guidelines. The proposed procedure was successfully applied for the simultaneous determination of both drugs in commercial cream preparation. The advantage of the method is simplicity, reasonable sensitivity, rapidity, excellent resolving power, low cost and is a more effective option than other chromatographic techniques in routine quality control.

Key Words: Terbinafine hydrochloride (TH), Mometasone furoate (MF), High performance thin layer chromatography (HPTLC).

INTRODUCTION

Terbinafine hydrochloride (TH) is an antifungal and enzyme inhibitor drug. Chemically, it is (2E)-N, 6, 6-Trimethyl-N-(naphthalen-1-ylmethyl) hept-2-en-4-yn-1-amine hydrochloride, clinically it is use in the treatment of dermatophyte infections of the toenail or fingernail caused by susceptible fungi. Also for the treatment of *tinea capitis* scalp ringworm) and *tinea corporis* (body ringworm) or *tinea cruris* jock itch). Mometasone furoate (MF) is a glucocorticoid having anti-inflammatory activity and chemically it is 9,21-Dichloro-11β-hydroxy-16α-methyl-3,20-dioxopregna-1,4-dien-17-yl furan-2-carboxylate and it is also useful treatment of dermatological diseases. This combination of drugs is useful for relief of corticosteroid responsive dermatomes where fungal infections are present, suspected, or likely to occur. Both the drugs are marketed as combined dose cream formulation in the ratio of 10:1 w/w TH: MF. Literature survey reveals that Terbinafine hydrochloride (TH) can be estimated by spectrophotometrically, HPTLC and HPLC individually or with other drugs in bulk drugs and in human plasma[1-5] while Mometasone furoate (MF) can be estimated by spectrophotometrically, HPLC and HPTLC in combination with other drugs[6-10]. However, there is no analytical method has been reported for the estimation of TH and MF in a combined dosage formulation. Present work describes HPTLC method[4] for simultaneous estimation of TH and MF in cream formulation. Method validation was done according to ICH Q2 (R1) Guidelines.

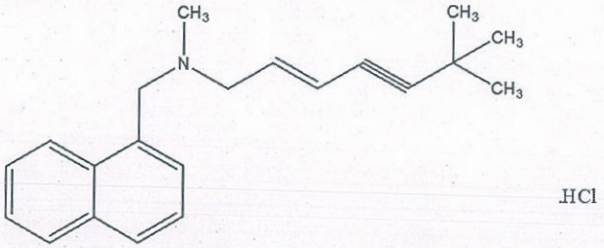

Figure 1: Structure of TH

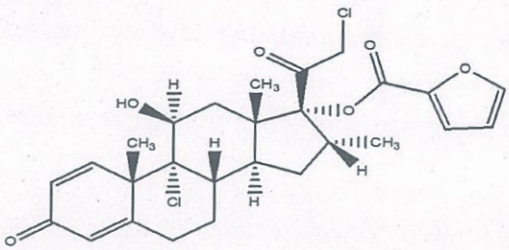

Figure 2: Structure of MF

MATERIALS AND METHODS:

Instrument

A CAMAG Linomat V sample applicator equipped with an applicator microsyringe (Hamilton, Bonaduz, Switzerland) and CAMAG UV cabinet with dual wavelength UV lamp (254 and 366 nm); densitometric scanning was performed at 248 nm with CAMAG TLC scanner IV operated in absorbance mode and controlled by Wincats 1.4.7 software.

Materials

Standard gift sample of Terbinafine hydrochloride was provided by Aarti Drugs sales, Mumbai and Mometasone furoate was povided by Glenmark Generics pharmaceutical, Nasik. Combined dose Terbinafine hydrochloride and Mometasone furoate cream sebifin™ plus was purchased from local market. Methanol (AR Grade), Toluene (AR Grade), Ethyl acetate (AR Grade) and Glacial acetic acid (AR Grade) were used as solvents, procured from Loba Chemie pvt ltd., Mumbai.

Optimized Parameters for Chromatographic Condition

As stationary Phase, Silica gel 60F254 TLC Precoated Plates was selected and after trials of various mobile phase, final mobile phase selected was Toluene: Ethyl aceate: Glacial acetic acid (8: 4: 0.1 v/v/v). Plate development technique was simple ascending at ambient room temperature and chamber saturation time was 20min. Run distance was 80mm and detection wavelength was 248 nm. Spotting Parameters were band width of 6 mm and syringe used was of 100µl capacity. Scanning Parameters were set of slit dimension of 6 × 0.45 mm, detection was done at wavelength 248 nm and scanning speed was 100 mm/sec. In integration Parameters, baseline correction was done, peak threshold, height was 10AU, peak threshold, area was 50 and peak threshold, slope was kept 5.

Stock solutions

Stock solution: Standard stock solutions of TH (1000 µg/ml) and MF (1000 µg/ml) were prepared in methanol.

Working solutions

Working solution: Standard working solutions of TH (500 µg/ml) and MF (50 µg/ml) were prepared in methanol and used for the analysis.

Method validation

The developed method was validated for linearity, range, specificity, precision, accuracy and robustness as per ICH guidelines.

Linearity and range

Each concentration mixture in the range of 1000-3000 ng /spot for TH and 100-300 ng/spot for MF was spotted five times on individual plates and response was measured after scanning. For evaluation of linearity, peak area and concentrations were subjected to least square regression analysis to calculate calibration equation and correlation coefficient.

Specificity

The specificity of the method was ascertained by analyzing TH and MF in presence of excipients of TH and MF in cream formulations. The bands of TH and MF in the sample were confirmed by comparing R_f values and respective spectra of the sample with those of the standards. The peak purity of TH and MF was assured by comparing the spectra at three different levels, that is, peak-

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REVERSE PHASE HPLC AND DERIVATIVE SPECTROPHOTOMETRIC METHODS FOR SIMULTANEOUS ESTIMATION OF FENBENDAZOLE AND NICLOSAMIDE IN PHARMACEUTICAL DOSAGE FORM

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ABSTRACT

The present study narrates the developed and validated simple, reliable, sensitive, precise and accurate Spectrophotometric and RP-HPLC methods for the simultaneous estimation of Fenbendazole and Niclosamide in pharmaceutical dosage form. In the first order derivative method 0.1 N methanolic HCl was used as diluent. The zero crossing point wavelengths selected for the analysis were 226 nm and 317 nm for Fenbendazole and Niclosamide, respectively and RP – HPLC method has been developed using 1% methanolic HCl as diluent. Separations of drugs were achieved on L1 C18 100 A^0 column (250 x 4.6 mm, 5 µ) using 2 gm potassium dihydrogen phosphate and acetonitrile (70:30, v/v) as mobile phase with flow rate 1.0 mL/min. The detection wavelength was 290 nm. Validation of developed methods was done according to ICH Q2 (R1) guideline. Calibration curve was linear over the concentration range of 3-9µg/mL (Fenbendazole) and 10-30 µg/mL (Niclosamide) for spectrophotometric method and 24 - 39 µg/mL (Fenbendazole) and 80 – 130 µg/mL (Niclosamide) for RP – HPLC method. The developed RP-HPLC and derivative spectrophotometric method were successfully applied for the quantitative determination of cited drugs in pharmaceutical dosage form. The correlation coefficients (r^2) value greater than 0.995. Accuracy of methods were determined by recovery studies and it was found to be 98 to 102 %. The % RSD values for all the validation parameters were less than 2.0 % for both the methods. The developed UV and RP-HPLC methods were compared by t - test and it was found that t_{stat} value was less than $t_{critical}$ value for all. Hence there was no significant difference between the developed methods.

Keywords: Fenbendazole, Niclosamide, UV- Spectrophotometry, RP-HPLC, Validation

1. INTRODUCTION

Fenbendazole(FEN) is chemically methyl 5-(phenyl thio)-2-benzimidazolecarbamate (Figure 1) is a veterinary anthelmintic product belonging to the chemical class of the benzimidazoles.[1] It is soluble in methanolic HCl. FEN has a broad-spectrum of activity against gastrointestinal roundworms and lungworms.[2] It is official in Indian Pharmacopoeia(IP)[3], British Pharmacopoeia(BP)[4] and United States Pharmacopoeia (USP)[5]. Niclosamide (NIC) is chemically 5-chloro-N-(2-chloro-4-nitrophenyl)- 2 hydroxy benzamide (Figure 2) is a veterinary anthelmintic product belonging to the chemical class of salicylamide.[2] It is soluble in methanolic HCl. NIC is used to treat tapeworm infections. It is not used for the other types of worm infections like pinworms or roundworms. It is official in Indian Pharmacopoeia (IP)[6]. The combination of FEN and NIC is widely used as an anthelmintic.

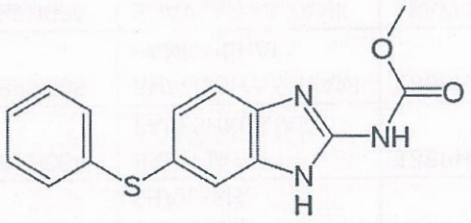

Figure 1: Structure of FEN

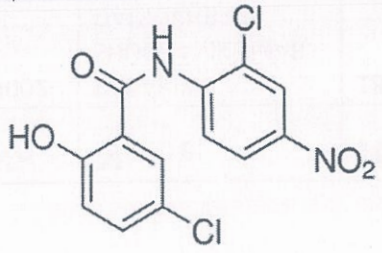

Figure 2: Structure of NIC

Literature review reveals that there are several analytical methods were reported, such as UV spectrophotometry[7-12], HPLC[13-17], HPTLC[18], LC-MS[19] for the estimation of FEN and NIC either individually and it's combination with other drug. However no method has been reported for simultaneous estimation FEN and NIC in pharmaceutical formulations. So, the aim of the present work was to develop accurate, precise and sensitive RP-HPLC and derivative spectrophotometric methods for the simultaneous estimation of Fenbendazole and Niclosamide in Pharmaceutical dosage form.

2. EXPERIMENTAL

2.1 Chemicals and Reagents:

FEN and NIC reference standard were procured from Pharmanza (India) Pvt. Ltd, Cambay, Gujarat. The marketed suspension (Fensamide) used contains 30 mg FEN and 100mg NIC and was manufactured by Pharmanza (India) Pvt. Ltd. Analytical grade hydrochloric acid(HCl) ,acetonitrile, methanol and potassium dihydrogen phosphate were procured from Loba chemicals. WFI water used for HPLC System.

2.2 Equipments, instrumentation and software:

UV-Visible double beam spectrophotometer with a matching pair of 1 cm quartz cuvettes (Shimadzu UV-1800, Shimadzu Corporation, Kyoto, Japan), connected to a computer loaded with Shimadzu UV - PC version 3.42 software was used to record the absorption spectra of solutions. The spectral band width was 0.5 nm. An integrated HPLC system, LC 20AT from Shimadzu Corporation, Japan was used for the chromatographic separation of FEN and NIC. The HPLC system was comprised of a binary gradient pump and manual sampler, column oven and UV detector. PC-installed LC solution software was used to record and integrate the chromatograms. Electronic weighing balance (Shimadzu AUX 200) was used for weighing the samples.

2.3 Spectrophotometric conditions for First Order Derivative Methods[20-21]:

2.3.1 Experimental condition:

According to the solubility characteristics, the common solvent for the both drugs was found to be 0.1 N methanolic HCl. The selected wavelengths for the analysis were 266 nm (ZCP of FEN) and 317 nm (ZCP of NIC), respectively.

2.3.2 Preparation of stock solutions:

Accurately weighed and transferred FEN (10 mg) and NIC (10 mg) into two different 100 mL and 10 mL volumetric flask, respectively. The volume was made up to the mark with 0.1 N methanolic HCl. The final concentration of FEN and NIC were 100 (µg/mL) and 1000 (µg/mL), respectively.

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Research Article

EFFECT OF UNSAPONIFIABLE FRACTION OF SEEDS OF *HYGROPHILA SPINOSA* T. ANDER ON TESTOSTERONE PRODUCTION OF RAT LEYDIG CELLS *IN VITRO*

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ABSTRACT

Objective: Seeds of *Hygrophila spinosa* (HS) T. Ander (Acanthaceae) are traditionally used as aphrodisiac and spermatogenic in Indian System of Medicine. Preliminary phytochemical screening of plant revealed the presence of triterpenoids and sterols in seeds. The study was planned to assess the effect of unsaponifiable fraction prepared from seeds of HS on isolated rat Leydig cells for testosterone (T) production using *in vitro* method.

Methods: Leydig cells were isolated from Wistar rats, aseptically, *in vitro* by collagenase cell dispersion method. Cells (2×10^6 cells/ml) were then incubated with a unsaponifiable fraction of HS (10, 100 and 1000 µg/ml dose levels in triplicate) in an incubator at 37°C under atmosphere of 95% CO_2 condition for 3 hrs in aseptic condition. Dehydroepiandrosterone was used as positive control in the study. The amount of testosterone secreted in culture media was estimated using high performance thin-layer chromatography (TLC). Benzene: Ethyl acetate (5:5% v/v) was employed as mobile phase and silica gel G F_{254} aluminum coated TLC plate as the stationary phase.

Results: The results indicated dose-dependent increase in testosterone concentration in test groups. Isolated rat Leydig cells treated with the test fraction showed increased amount of testosterone present in culture media as compared to that of control.

Conclusion: Unsaponifiable fraction prepared from seeds of HS showed ability to enhance biosynthesis of testosterone in isolated rat Leydig cells. *In vitro* studies showed that the fraction might act locally in testis on Leydig cells and stimulated testosterone synthesis.

Keywords: Aphrodisiac, Spermatogenic, *Hygrophila spinosa,* Testosterone.

 DOI: http://dx.doi.org/10.22159/ajpcr.2016.v9i6.14049

INTRODUCTION

The plant Kokilaksha is known as *H. spinosa* (HS) in Sanskrit literature belonging to Acanthaceae family and its seeds have been used in Ayurvedic preparations as *Vajikarana Aushadhi,* i.e., aphrodisiac and spermatogenic [1-3]. The plant has shown many pharmacological activities such as cooling, tonic, spermatorrhea, aphrodisiac, and spermatogenic [4]. Phytochemical study of this plant showed that seeds contain mucilage, sterols, unidentified alkaloids, fatty acids, minerals, and carbohydrates [5-12].

Literature survey revealed that this plant is not systematically screened for the claimed activity. Hence, unsaponifiable fraction prepared from seeds of HS was screened for testosterone production and release by *in vitro* method using isolated Leydig cells from male Wistar rats.

METHODS

Reagents and chemicals

All the solvents and chemicals used were of analytical grade and procured from Loba Chemicals, India. Materials and media used for *in vitro* studies were purchased from Sigma-Aldrich, USA, Acros Organics, India and Hi-media, India.

Plant materials

Whole plants of HS were collected in August from tribal area of Anand district, Gujarat, India. The plant samples were identified by taxonomist at J and J Science College, Nadiad, Gujarat, India. The specimen of the collected plant material was submitted to the department for future reference with specimen number 2011/NV/HS. Seeds were separated from the plants, dried under shade and milled using laboratory grinder to 70# powder. This powder was used for further extraction process.

Preparation of unsaponifiable fraction

Dried seed powder (4 kg) was extracted using 5000 ml of hexane (00160, Loba Chemie) in Soxhlet's extraction apparatus at 60°C for 48 hrs. Hexane extract was filtered and refluxed with sufficient quantity of 10% potassium hydroxide (05378, Loba Chemie) in methanol (00196, Loba Chemie) for saponification purpose. The content was removed and mixed with equal amount of water. The content was then partitioned with solvent ether (001040, Loba Chemie) to separate unsaponified matter. Ethereal extracts were pooled and passed through anhydrous sodium sulfate to remove moisture present. All ethereal portions were mixed together and evaporated to dryness using rotary vacuum evaporator (Heidolph, Germany) at 30°C. The yield of unsaponifiable fraction was determined and found to be 1.2% w/w. The fraction was then subjected to TLC studies for detection of sterols and triterpenoidal compounds present.

Detection of sterols and triterpenoidal compounds

The unsaponifiable fraction was evaluated for the presence of sterols and triterpenoidal compounds using TLC. Post chromatographic derivatization was performed using Liebermann-Burchard reagent [13]. Optimized mobile phase employed to separate these compounds on silica gel coated TLC plates (silica gel G 60 F_{254}, Merck) was hexane:ethyl acetate:methanol:glacial acetic acid (6:4.5:0.5:0.2 v/v/v/v) with saturation time of 10 minutes.

Animals

Protocols for *in vitro* studies were approved by the Institutional animal Ethics Committee (IAEC) constituted as per the norms of Committee for the Purpose of Control and Supervision of Experiments on Animals. The protocol numbers assigned were RPCP/IAEC/2013-14/R29, RPCP/IAEC/2011-12/R7 respectively. Healthy male Wistar rats of weight 250-350 g were used in the experiments. Rats were received

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Research Article

SIMULTANEOUS ESTIMATION OF CURCUMINOIDS, PIPERINE, AND GALLIC ACID IN AN AYURVEDIC FORMULATION BY VALIDATED HIGH-PERFORMANCE THIN LAYER CHROMATOGRAPHIC METHOD

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ABSTRACT

Objective: The present study was proposed to quantitatively estimate the amount of three marker compounds; curcuminoids, piperine, and gallic acid in a multicomponent ayurvedic formulation using high-performance thin layer chromatographic (HPTLC) method for routine analytical work.

Methods: TLC separation was performed on silica gel 60 F_{254} plates using toluene:ethyl acetate:formic acid:methanol (5.6:2.2:1.2:1.0 v/v/v/v) as mobile phase. Plate was developed by to a distance of 90 mm at ambient room temperature with 20 minutes saturation time. Densitometric analysis was performed at 327 nm. Method was validated as per International Conference on Harmonization Q2 (R1) guideline also.

Results: Piperine, curcuminoids, and gallic acid were separated on TLC at retention factor values of 0.71, 0.61, and 0.29, respectively. The described method was linear over the range of 300-700 ng/spot, 100-300 ng/spot, and 250-550 ng/spot, respectively, for curcuminoids, piperine, and gallic acid. The accuracy of the method was assessed by recovery studies and was found to be 101.71%, 99.67%, and 99.59% for curcuminoids, piperine, and gallic acid, respectively. The amount of curcuminoids, piperine, and gallic acid in the ayurvedic formulation was found to be 3.99% w/w, 1.9% w/w, and 0.8% w/w, respectively, when analyzed quantitatively by developed validated HPTLC method.

Conclusion: The method can be used as a tool for quality control of herbal formulation.

Keywords: Curcuminoids, Piperine, Gallic acid, High-performance thin layer chromatographic.

 DOI: http://dx.doi.org/10.22159/ajpcr.2016.v9s2.13131

INTRODUCTION

Curcuminoids present in turmeric is used as antiseptic in cut, wounds, inflammations, sore throat, urticaria, and skin allergies, whereas piperine, a constituent of black and long pepper, is used as bioavailability enhancer. Piperine is also reported to have antiallergic, antiasthmatic, hepatoprotective, antimalarial, and antiamoebic action. Gallic acid is used in dyspepsia, constipation, piles, enlarged liver, and spleen and also as an antioxidant [1].

Ayurvedic formulation "Haridrakhand" is used to treat urticaria and may skin diseases, and it contains these three herbs together. Thus, it is essential to ascertain the amount of each active phytoconstituent of plant present in the formulation. A literature survey revealed that high-performance thin layer chromatographic (HPTLC) [2-8], high-performance liquid chromatography [9-11], ultraviolet-visible spectroscopic [12], and spectrofluorimetric [13] methods had been developed for the determination of curcuminoids, piperine, and gallic acid individually. So, the present study is aimed to develop a validated HPTLC method for estimation of curcuminoids, piperine, and gallic acid simultaneously.

METHODS

Plant materials and formulation

Raw powdered plant materials mentioned in the formula for the preparation of ayurvedic formulation were procured from local market. Plant powders were identified and authenticated by taxonomist, Dr. A. M. Patel, J. and J. Science College, Nadiad, Gujarat, India. Sample specimens of plant powders were retained and submitted to the Department of Pharmacognosy, Ramanbhai Patel College of Pharmacy with voucher specimen No. 2010/PG/QA/SP. Ayurvedic formulation "Haridrakhand" was prepared as per the method described in Ayurvedic Formulary of India [14].

Chemicals and materials

All solvents and reagents used were of analytical grade and purchased from LOBA, India. Precoated silica gel 60 F_{254} TLC plates were obtained from Merck, Mumbai, India. Curcuminoids (95%), piperine (98%), and gallic acid (99%) were obtained from Loba Chemie - Ahmedabad, Sigma-Aldrich - USA, and Himedia - Mumbai, respectively.

Instrumentation

Chromatographic separation was performed with CAMAG Linomat V sample applicator equipped with Hamilton Syringe and CAMAG TLC Scanner IV. Software win CATS version 1.4.7 was used for data acquisition.

Preparation of ayurvedic lab formulation (Haridrakhand)

All ingredients listed below in Table 1 were accurately weighed as per required quantity, powdered, mixed well, and passed through sieve. Starch paste and water were added to prepare sticky mass. Then sticky mass was passed through sieve 80#, and granules were collected, air dried, and packed in air tight container.

Preparation of standards and sample solutions

About 10 mg of each curcuminoid, piperine, and gallic acid were accurately weighed and transferred separately to a 10 ml volumetric flask and dissolved in 10 ml of methanol. The flask was sonicated in ultra sonicator bath for 15 minutes, and volume was made up to 10 ml with methanol to give a stock solution containing 1000 µg/ml

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Current Drug Delivery, 2016, *13*, 000-000

Implementation of "Quality by Design (QbD)" Approach for the Development of 5-Fluorouracil loaded Thermosensitive Hydrogel

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C. Dalwadi

Abstract: The purpose of this study was to investigate Quality by Design (QbD) principle for the preparation of hydrogel products to prove both practicability and utility of executing QbD concept to hydrogel based controlled release systems. Product and process understanding will help in decreasing the variability of critical material and process parameters, which give quality product output and reduce the risk. This study includes the identification of the Quality Target Product Profiles (QTPPs) and Critical Quality Attributes (CQAs) from literature or preliminary studies. To identify and control the variability in process and material attributes, two tools of QbD were utilized, Quality Risk Management (QRM) and Experimental Design. Further, it helps to identify the effect of these attributes on CQAs. Potential risk factors were identified from fishbone diagram and screened by risk assessment and optimized by 3-level 2-factor experimental design with center points in triplicate, to analyze the precision of the target process. This optimized formulation was further characterized by gelling time, gelling temperature, rheological parameters, *in-vitro* biodegradation and *in-vitro* drug release. Design space was created using experimental design tool which gives the control space and working within this control space reduces all the failure modes below risk level. In conclusion, QbD approach with QRM tool provides potent and effectual pyramid to enhance the quality into hydrogel.

Keywords: Control strategy, critical quality attributes, critical process parameters, critical material attributes, experimental design, design space, quality risk management, risk criticality assessment.

1. INTRODUCTION

The traditional quality by testing (QbT) approach evaluates the quality of product by testing it at the end with the cost of time and manpower for the regulatory criteria. Although there is a major uncertainty in scale up of a product from pilot to production scale [1]. When products fail to comply with their specifications, it will causing rejection of the product from the regulatory market. This misunderstanding of product and manufacturing process produces a broad gap between regulatory bodies and the manufacturing companies which require the strict regulatory monitoring [2].

In 2002, the U.S. Food and Drug Administration (FDA) provides a model paper for current Good Manufacturing Practice (cGMP) for the 21st century. This paper explained an aspiration that companies have to manufacture a safe, efficacious and quality product as soon as possible. This approach is known as Quality by Design (QbD). As per International Conference on Harmonization (ICH) Q8 guidelines QbD is defined as a "*systematic, scientific, risk-based, holistic and proactive approach to pharmaceutical development that starts with predefined objectives and emphasizes product and process understanding as well as process control*" [3] QbD can identify the attributes that affect the quality from the patient's point of view which must be required for the product, and explains how these attributes can be changed to produce a desired quality drug product [4] Application of these guidelines in the development of formulation is described in (Fig. **1**).

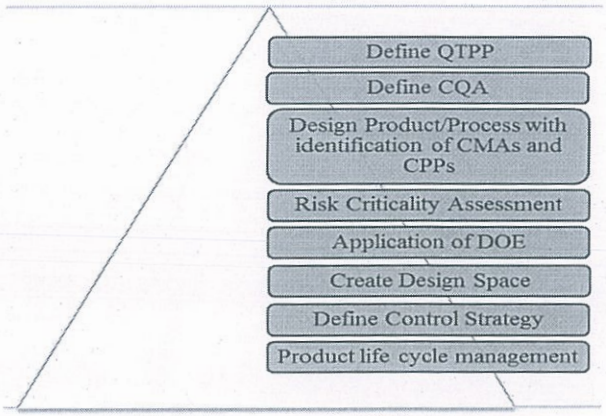

Fig. (1). Steps in the development of QbD Protocol for formulation development.

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Recent Patents on Drug Delivery & Formulation 2016, *10*, 000-000

RESEARCH ARTICLE

Development and Optimization of Controlled Porosity Osmotic Tablets of Lamotrigine Solid Dispersion

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ARTICLE HISTORY

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Abstract: ***Background:*** The purpose of this study was to investigate the application of a controlled porosity osmotic tablet (CPOT) utilizing solid dispersion (SD) of poorly soluble drug. The patents on Cyclobenzaprine HCl (US4968507 A) and Venlafaxine salts (EP 2085078 A1) helped in the selection of drug and polymers.

Method: The SDs having different ratio of drug to carrier (PVP K 30) were prepared by kneading method and optimized. Effect of three independent variables, total amount of osmogen (mannitol& potassium chloride), total amount of polymer (polyethylene oxide WSR 301, hydroxy propyl methyl cellulose K100 M) and polymer1: polymer 2 ratio were investigated using Box Behnken design. Core and coated tablets were evaluated for various parameters. *In-vitro* drug release profiles of CPOT tablets were compared with reference product Diffcore tablet, Lamictal XR (GlaxoSmith Kline Inc., USA).

Results: All formulations showed acceptable parameters. Drug release from CPOT was determined as complete, zero order and pH-independent within the physiological pH range of the GI tract. Drug release was directly proportional to initial level of polymers and osmogens.

Conclusion: The present results confirmed that prepared LTG SD serves as solubility modulator. Further, CPOT of LTG based on SD proved to be successful in delivering the drug in a controlled manner ensuring the once daily dosing for the treatment of convulsive disorders.

Keywords: Controlled release, pH-independent release, similarity factor, solid dispersion, osmogen.

INTRODUCTION

Lamotrigine (LTG)is an antiepileptic drug (AED) of the phenyltriazine class with its chemical name 6-(2,3-dichlorophenyl)-1,2,4-triazine-3,5-diamine(or 3,5-diamino-6-(2,3- dichlorophenyl)-1,2,4-triazine). It is used as a monotherapy and as an adjunct with other antiepileptic agents for the treatment of partial seizures and primary and secondary generalized tonic – clonic seizures. It is also used for seizures associated with the Lennox – Gastut syndrome [1, 2].

Formulations of LTG are commercially available in oral immediate release tablets (Lamictal®), chewable dispersible tablets (Lamictal® CD) and extended release tablets (Lamictal® XR) from GlaxoSmith Kline Inc., USA. LTG is rapidly and completely absorbed after oral administration with negligible first-pass metabolism, its absolute bioavailability is 98% [3, 4]. In the treatment of epilepsy with LTG IR formulations, it is speculated that the troughs may lead to breakthrough seizures or reduced seizure threshold and the peak plasma concentration may result in some adverse events (AE) or alternatively the neurological side effects are normally seen at higher plasma concentrations. To ameliorate the drawbacks associated with conventional LTG-IR formulations, LTG is formulated into a controlled release once-daily dosage form. Lamictal®XR tablets contain a modified release eroding matrix formulation (DiffCORE) designed to control the dissolution rate of LTG over a period of approximately 12–15 h [5-7]. Victor Biton *et al.* reported that the LTG XR may be preferable over LTG IR for many patients because of its ease of use (once-daily dosing),more stable serum drug concentration with similar safety and efficacy profiles of LTG IR [8-10].

LTG is classified as a BCS class IIb drug. It shows pH-dependent aqueous solubility and dissolution in which solubility decreases as the pH of gastro intestinal tract increases [1]. Osmotic drug delivery system (ODDS) is a type of extended drug delivery system having advantages over other extended drug delivery systems, like the zero order rate delivery, minimal side effects and minimal effect of food on the delivery, unaffected delivery regardless of pH conditions of the GIT. In the present study, CPOT of LTG was prepared to improve seizure management through maintenance of steady state concentration. CPOT consists of drug and os-

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Stability-indicating high-performance thin-layer chromatographic method for simultaneous estimation of the active pharmaceutical ingredients metolazone and spironolactone

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This work represents the validation of a stability-indicating thin-layer chromatographic technique for the simultaneous estimation of metolazone (METO) and spironolactone (SPIRO) from marketed formulation (tablets). Thin-layer chromatography was performed using precoated silica gel plate 60 F_{254} using ethyl acetate—chloroform—GAA (5:5:0.1 *v*/*v*) as the mobile phase for the separation of METO and SPIRO. The stability study forms an integral part of the formulation development process, and its use is also encouraged by various guidelines. Stress study was performed on active pharmaceutical ingredients (APIs) as well as on formulation for establishing a stability-indicating thin-layer chromatographic method for both drugs. The APIs were subjected to change under various environmental conditions such as pH, temperature, oxidation, etc. to determine their effect on the stability of drugs. The developed method was able to resolve drugs and their degradation products formed under the aforementioned conditions. The wavelength selected for quantitation was 238 nm. The method was validated as per the International Conference on Harmonization (ICH) guidelines and found to be linear in the range of 50–300 ng spot^{-1} for METO and 200–1200 ng spot^{-1} for SPIRO. The relative standard deviation (% RSD) values of the precision study were <2% which indicated that the developed method was precise; recovery was found to be 99.02–100.58% and 99.26–100.17% for METO and SPIRO, respectively. It could be concluded from the stability study that METO was prone to acidic hydrolysis and photolysis while SPIRO was prone to alkaline degradation.

Accepted Manuscript

Recent expansion of pharmaceutical nanotechnologies and targeting strategies in the field of phytopharmaceuticals for the delivery of herbal extracts and bioactives

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Current Drug Delivery, 2016, *13*, 000-000

Nanoemulsions for Intranasal Delivery of Riluzole to Improve Brain Bioavailability: Formulation Development and Pharmacokinetic Studies

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R. H. Parikh

Abstract: *Background*: Amyotrophic Lateral Sclerosis (ALS), a motor neuron disease (MND), is a progressive neurodegenerative disorder characterized by the deterioration of both upper and lower motor neurons. Only one drug (riluzole) has been approved for the treatment of ALS. Riluzole is a BCS class II drug having 60% absolute bioavailability. It is a substrate of P-glycoprotein and BBB restricts its entry in brain. *Objective*: This investigation was aimed to develop O/W nanoemulsion system of riluzole to improve its brain bioavailability. *Methods*: Riluzole loaded nanoemulsion was prepared by phase titration method. It was consisting of 3% w/w Sefsol 218, 28.3% w/w Tween 80:Carbitol (1:1) and 68.7% w/w water. It was characterized for drop size, drop size distribution, transmittance, viscosity, pH, zeta potential, conductivity and nasal ciliotoxicity study. Thermodynamic stability and room temperature stability of prepared nanoemulsion formulation were evaluated. Pharmacokinetic and brain uptake study was carried out using albino rats (wistar) post intranasal and oral administration. *Results*: Riluzole loaded nanoemulsion was having a drop size of 23.92±0.52 nm. It was free from nasal ciliotoxicity and stable for three months. Brain uptake of riluzole post intranasal administration of riluzole loaded nanoemulsion was significantly ($P < 4.10 \times 10^{-6}$) higher when it was compared with oral administration of riluzole loaded nanoemulsion. *Conclusion*: This study indicates that nanoemulsion of riluzole for intranasal administration could be a promising approach for the treatment of ALS to minimize the dose of riluzole in order to avoid dose related adverse events.

Keywords: ALS, Amyotrophic lateral sclerosis, Brain uptake, Intranasal drug delivery, Nanoemulsion, Mixture design.

1. INTRODUCTION

Motor neuron disease (MND) refers to a group of progressive neurodegenerative disorders that are distinguished by the deterioration of upper motor neurons and/or lower motor neurons. Amyotrophic Lateral Sclerosis (ALS) is a MND that is characterized by the deterioration of both upper and lower motor neurons [1]. The frequency of ALS ranges between 1.5 and 2.5 in 100,000 [2] with an average age of onset being between ages 55 and 75 years [3]. The expected survival from initiation of the symptoms is 3 years. Only one drug (riluzole) has been approved for the treatment of ALS. The approval of only one drug over the years bears testimony to the fact that very minimal progress has been achieved in the treatment of ALS.

Blood brain barrier (BBB) remains one of the reasons for the lack of success in the development of treatments for ALS as it obstructs the penetration of therapeutic agents. This rigid control over the passage of molecules is provided by the brain capillaries which are made up of endothelial cells having extremely tight junctions [4] and high electrical resistance. Several approaches are available to bypass BBB. Some of these approaches include receptor-mediated transport, carrier mediated transport, osmotic disruption of BBB using hyperosmolar agents, transcranial delivery and nasal drug delivery.

Intranasal route may facilitate entry of drugs into brain through olfactory route and trigeminal route [5, 6]. Products such as Zomig® nasal spray (AstraZeneca, New Zealand) are available in the market for improved brain bioavailability as claimed in their data sheet [7, 8].

Nanotechnology based delivery systems may provide alteration in biodistribution of drugs. They can be also engineered to provide targeted delivery of drugs. Thus nanotechnology has great significance in development of drug delivery systems to treat diseases/disorders for which effective treatments are not yet developed.

Nanoemulsion (NE) is a clear, isotropic mixture of oil, water and surfactant, frequently in combination with a cosurfactant [9]. Droplet diameter of nanoemulsion is usually < 100 nm [10, 11]. It is a promising drug carrier system for delivery of poorly water soluble drugs as well as for delivery of drugs having poor permeability [12, 13].

Riluzole is a BCS class II drug [14]. Oral bioavailability of riluzole is 60% [14]. Riluzole is a substrate of P-glycoprotein [15] and BBB restricts the entry of riluzole in

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Article

Article

HPTLC Method for Estimation of Topiramate in Solubility Studies, Diffusion Studies, Plasma, Brain Homogenate and Pharmaceutical Formulation

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Abstract

Topiramate, 2,3:4,5-bis-*O*-(1-methylethylidene)-β-D-fructopyranose, is an anticonvulsant drug indicated in the treatment and control of partial seizures and severe tonic–clonic (grand mal) seizures in adults and children. An economic and rapid high-performance thin-layer chromatographic (HPTLC) method was developed and was validated for the quantitative determination of topiramate in plasma, brain homogenate and pharmaceutical formulation. The simple extraction method was used for the isolation of topiramate from formulation, plasma and brain homogenate samples. HPTLC separation was achieved on an aluminum-backed layer of silica gel $60F_{254}$ plates using toluene : acetone (5.0 : 2.0, v/v) as mobile phase. Spots of developed plates were visualized by spraying of reagent [3.0% phenol in the mixture of ethanol : sulfuric acid (95 : 5, v/v)]. Quantitation was achieved by densitometric analysis at 340 nm over the concentration range of 1,000–5,000 ng/spot. The method was found to give compact spot for the drug (Rf: 0.61 ± 0.018). The regression analysis data for the calibration plots showed good relationship with a correlation coefficient of 0.9983. The minimum detectable amount was found to be 165 ng/spot, whereas the limit of quantitation was found to be 500 ng/spot. Statistical analysis of the data showed that the method is precise, accurate, reproducible and selective for the analysis of topiramate. The developed method was successfully employed for the estimation of topiramate in samples of equilibrium solubility study, diffusion study, microemulsion formulation and suspension formulation (developed in-house), rat plasma and rat brain homogenate samples.

Introduction

Topiramate (TPM) is chemically 2,3:4,5-bis-*O*-(1-methylethylidene)-β-D-fructopyranose (1) (Figure 1). TPM is an anticonvulsant drug indicated in the treatment and control of partial seizures and severe tonic–clonic (grand mal) seizures in adults (2). It is indicated for the treatment of Lennox–Gastaut syndrome, a disorder with multiple types of seizures and mental retardation, in children (3, 4). It is also used for the prophylaxis of migraine headache in children and adults (5, 6), treatment of bipolar disorders (7) and as a mood stabilizer (8). It is also investigated as a promising agent for obesity treatment (9), neuropathic pain (10), sleep-related eating disorder (11), alcohol use disorder (12, 13) and smoking cessation (14–16).

TPM is marketed by Ortho-McNeil-Janssen Pharmaceuticals under the brand name Topamax® in 15, 25, 50, 100 and 200 mg doses (1).One of the major disadvantages of TPM is weight loss (17). In the present study, we developed microemulsion (ME) of TPM for oral as well as intranasal administration to improve its brain bioavailability. The improvement in brain bioavailability may help in dose reduction as well as in minimizing the undesirable effect of weight loss.

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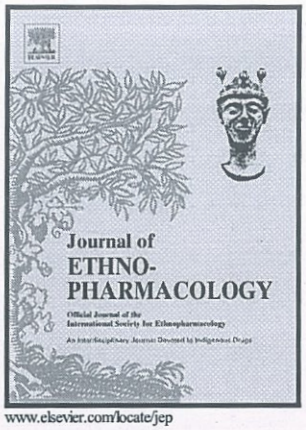

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Aphrodisiac and spermatogenic potential of Alkaloidal fraction of Hygrophila spinosa T. Ander in rats

Niraj Y. Vyas, Manan A. Raval

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Current Analytical Chemistry

Title: Supercritical Fluid Chromatographic Method for Montelukast: Application in Content Uniformity and Degradation Study

VOLUME: 12 **ISSUE:** 6

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Keywords: Supercritical fluid chromatography (https://www.eurekaselect.com/search/aws_search.php?searchvalue=Supercritical fluid chromatography), montelukast (https://www.eurekaselect.com/search/aws_search.php?searchvalue= montelukast), degradation study (https://www.eurekaselect.com/search/aws_search.php?searchvalue= degradation study), content uniformity (https://www.eurekaselect.com/search/aws_search.php?searchvalue= content uniformity), resolution (https://www.eurekaselect.com/search/aws_search.php?searchvalue= resolution), degradation products. (https://www.eurekaselect.com/search/aws_search.php?searchvalue= degradation products.)

Abstract: Background: Supercritical Fluid Chromatography (SFC) is an eco-friendly and sensitive method for the determination of various polar and non-polar analytes. SFC is offering advantage of low solvent consumption. The aim of this paper is to describe a novel SFC method for determination of montelukast in formulation and exploring the possibility of the method for the degradation study of montelukast.

Methods: Methanol was used as solvent for analyte. Supercritical carbon dioxide (SC-CO2) was used as a mobile phase at a flow rate of 1.9 mL/min with 5% v/v methanol as co-solvent. Chromatographic separation was achieved on Zorbax SB Phenyl column (150 mm X 4.6 mm, 5 µm) with monitoring of the eluent at 238 nm using UV detector. The column temperature and back pressure of the system were 400C and 200 bar respectively. The physical properties like densities and polarities of the mobile phase were optimized from the effect of pressure, temperature and co-solvent concentration on chromatographic parameters. Validation of the developed method was carried out as per ICH guidelines in terms of selectivity, linearity, precision, recovery, robustness and solution stability.

Results: The retention time for montelukast was 8.71 ± 0.14 min. Beer-Lambert's law was found to obey in the concentration range 10-250 µg/mL with correlation coefficient 0.999. The method was found to be precise, accurate and robust with % RSD of less than 2%. Assay of montelukast was found to be 100.43 and 96.17% in formulations containing 10 mg and 5 mg of montelukast respectively. Montelukast was found to get degraded in acid, photo and peroxide stress conditions, while no degradation was observed in base and thermal stress conditions.

Conclusion: The method was successfully applied for the assay and content uniformity of different marketed formulations having a dose of 10 or less than 10 mg of montelukast. The developed method proved its potential for the separation of degradation products of montelukast in various degradation conditions.

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Document details - Evaluation of brain targeting efficiency of intranasal microemulsion containing olanzapine: Pharmacodynamic and pharmacokinetic consideration

Drug Delivery

Volume 23, Issue 1, 2 January 2016, Pages 307-315

Evaluation of brain targeting efficiency of intranasal microemulsion containing olanzapine: Pharmacodynamic and pharmacokinetic consideration(Article)

Patel, R.B., Patel, M.R., Bhatt, K.K., Patel, B.G., Gaikwad, R.V.

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Abstract

Document details - Microemulsion-based drug delivery system for transnasal delivery of Carbamazepine: Preliminary brain-targeting study

Drug Delivery

Volume 23, Issue 1, 2 January 2016, Pages 207-213

Microemulsion-based drug delivery system for transnasal delivery of Carbamazepine: Preliminary brain-targeting study(Article)(Open Access)

Patel, R.B., Patel, M.R., Bhatt, K.K., Patel, B.G., Gaikwad, R.V.

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Abstract

Document details - E- Governance: A smarter approach for imparting health awareness, health education and patient counseling in community pharmacy setting

International Journal of Pharmaceutical Research

Volume 8, Issue 2, 2016, Pages 6-12

E- Governance: A smarter approach for imparting health awareness, health education and patient counseling in community pharmacy setting(Review)

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Abstract

Document details - A systematic review on effect of canagliflozin in special population

Current Diabetes Reviews

Volume 12, Issue 3, 1 September 2016, Pages 211-222

A systematic review on effect of canagliflozin in special population(Review)

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Abstract

Canagliflozin is a competitive, reversible, highly selective SGLT2 inhibitor and available in 100mg and 300mg as oral tablet form. Owing to this, it induced glucosuria and cause changes in glucose homeostasis without affecting insulin. This review addressed the efficacy and safety of canagliflozin in a specialized patients such as chronic kidney disease (stage III CKD), high risk cardiovascular patient and elderly population. Canagliflozin has reduced HbA1c in all the specialized population, albeit reduction is less as compared to the normal cohort. Additionally, canagliflozin causes

Document details - Comparison of induction therapy using anti-thymocyte globulin and using basiliximab for live donor kidney transplant recipients: A single-center, prospective, cohort study

Asian Journal of Pharmaceutical and Clinical Research

Volume 9, Issue 6, November 2016, Pages 187-191

Comparison of induction therapy using anti-thymocyte globulin and using basiliximab for live donor kidney transplant recipients: A single-center, prospective, cohort study(Article)(Open Access)

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Abstract

Document details - An overview of different analytical techniques for leukotriene antagonists in different matrices

Current Pharmaceutical Analysis

Volume 12, Issue 4, 2016, Pages 275-295

An overview of different analytical techniques for leukotriene antagonists in different matrices(Review)

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Abstract

Qualitative and quantitative analysis plays a vital role in ensuring the safety and efficacy of drugs in different dosage forms. A detailed literature survey is one of the most essential requirements for all focussed research activities. Leukotriene antagonists are widely used for the treatment and management of asthma in different dosage forms. Leukotriene antagonists, being potent drugs present special challenges in the development and validation of analytical

Document details - Acute toxicity evaluation of protodioscin rich extract of Trigonella foenum-graecum L in rats

Asian Journal of Pharmaceutical and Clinical Research

Volume 9, December 2016, Pages 152-155

Acute toxicity evaluation of protodioscin rich extract of Trigonella foenum-graecum L in rats(Article)(Open Access)

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Abstract

Objectives: The objective of this study was to investigate the acute toxicity of standardized protodioscin rich extract (PRE) of Trigonella foenum-graecum L (26.63% w/w; PRE). Methods: To evaluate the toxicity of PRE, the acute toxicity of the extract on adult rats were investigated. A fixed large dose of 2 g/kg body weight of PRE was administrated by a single oral gavage, and 1 g/kg body weight of PRE was administered by intravenous according to the Organisation for Economic Co-operation and Development guidelines. Results: In 2 weeks, PRE showed no obvious acute toxicity.

Document details - Paliperidone microemulsion for nose-to-brain targeted drug delivery system: Pharmacodynamic and pharmacokinetic evaluation

Drug Delivery

Volume 23, Issue 1, 2 January 2016, Pages 346-354

Paliperidone microemulsion for nose-to-brain targeted drug delivery system: Pharmacodynamic and pharmacokinetic evaluation(Article)

Patel, M.R., Patel, R.B., Bhatt, K.K., Patel, B.G., Gaikwad, R.V.

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Document details - Novel microemulsion-based gel formulation of tazarotene for therapy of acne

Pharmaceutical Development and Technology

Volume 21, Issue 8, 16 November 2016, Pages 921-932

Novel microemulsion-based gel formulation of tazarotene for therapy of acne(Article)

Patel, M.R., Patel, R.B., Parikh, J.R., Patel, B.G.

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Abstract

Document details - Formulation, optimization and characterization of cationic polymeric nanoparticles of mast cell stabilizing agent using the Box–Behnken experimental design

Drug Development and Industrial Pharmacy

Volume 42, Issue 5, 2016, Pages 747-757

Formulation, optimization and characterization of cationic polymeric nanoparticles of mast cell stabilizing agent using the Box–Behnken experimental design(Article)

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Abstract

Document details - Formulation development and evaluation of medicated chewing gum of anti-emetic drug

Saudi Pharmaceutical Journal

Volume 24, Issue 2, 1 March 2016, Pages 153-164

Formulation development and evaluation of medicated chewing gum of anti-emetic drug(Article)(Open Access)

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Abstract

Context: Medicated chewing gum (MCG) of Domperidone Maleate (DM) was developed by direct compression method with the goal to achieve quick onset of action and to improve patient compliance. Objective: Formulation development of MCG of DM and optimization of the formulation by screening of different excipients. Material and methods: MCG containing DM was prepared by screening different concentrations of sweeteners, flavouring agents,

Document details - Incidences of-and risk factor for new onset diabetes after transplantation in live donor kidney transplantation: A prospective single centre study

International Journal of Pharmacy and Pharmaceutical Sciences

Volume 8, Issue 2, 2016, Pages 230-233

Incidences of-and risk factor for new onset diabetes after transplantation in live donor kidney transplantation: A prospective single centre study(Article)

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Abstract

Objective: The objective of present study was to evaluate incidence and risk factors for the development of new-onset diabetes after transplantation (NODAT) after kidney transplantation at our center. Methods: A total 79 nondiabetic patients who underwent living donor kidney transplantation from January 2014 to August 2014 were prospectively

Document details - Microencapsulation of lutein extracted from marigold flowers (Tagetes erecta L.) using full factorial design

Journal of Drug Delivery Science and Technology

Volume 33, 1 June 2016, Pages 75-87

Microencapsulation of lutein extracted from marigold flowers (Tagetes erecta L.) using full factorial design(Article)

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Abstract

Lutein (LUT), is one of the most important carotenoids having prominent antioxidant activity. However, its use is limited due to poor solubility and instability under adverse conditions. LUT was microencapsulated with soluble polymers using spray drying to improve its solubility and bioavailability. Maltodextrin (polysaccharide base) and copovidone (polyvinyl pyrrolidone vinyl acetate based copolymer) were evaluated as hydrophilic carriers for encapsulation of LUT. Design of Experiments (DOE) was utilized and microencapsulation process was optimized using

Document details - Modified formulation of febuxostat: Improved efficacy and safety

International Journal of Pharmacy and Pharmaceutical Sciences

Volume 8, Issue 1, 2016, Pages 359-366

Modified formulation of febuxostat: Improved efficacy and safety(Article)

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Abstract

Objective: Febuxostat, a xanthine oxidoreductase inhibitor, is a drug of choice for hyperuricemia and Gout. But it also suffers from drawbacks in terms of pharmacokinetic profile and toxicity. It is available as immediate release formulation in the market. The objective is to develop a modified release formulation of febuxostat that can serve the dual purpose of increasing the efficacy and decreasing the toxicity, thereby improving safety. Methods: Pharmacokinetic and pharmacodynamic data, including drug concentration profile, efficacy data and toxicity data have

Document details - Synthesis and biological evaluation of cyclo [(N-Me, O-Me) Tyr-Leu- Ala-Gly-Pro] a pseudostellarin-a analog

International Journal of PharmTech Research

Volume 9, Issue 6, 2016, Pages 250-256

Synthesis and biological evaluation of cyclo [(N-Me, O-Me) Tyr-Leu- Ala-Gly-Pro] a pseudostellarin-a analog(Article)

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Abstract

N-methylated analog of pseudostellarin-A was synthesized by solution phase peptide synthesis using dicyclohexylcarbodiimide as a coupling reagent in the presence of a base. The structure of the compound was confirmed by IR, ^{1}H NMR, ^{13}C NMR, FABMASS and elemental analysis. The synthesized compound was screened for antifungal and anthelmintic activity. The N-methylated Cyclo [(N-Me, O-Me) Tyr-Leu-Ala-Gly-Pro] compound showed

Document details - Formulation development and evaluation of temozolomide loaded hydrogenated soya phosphatidylcholine liposomes for the treatment of brain cancer

Asian Journal of Pharmaceutical and Clinical Research

Volume 9, Issue 3, May-June 2016, 5p

Formulation development and evaluation of temozolomide loaded hydrogenated soya phosphatidylcholine liposomes for the treatment of brain cancer(Article)

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Abstract

Document details - Q-absorption ratio and simultaneous equation spectrophotometric methods for simultaneous estimation of fenbendazole and niclosamide in pure drug and pharmaceutical formulations

Indian Drugs

Volume 53, Issue 1, January 2016, Pages 47-53

Q-absorption ratio and simultaneous equation spectrophotometric methods for simultaneous estimation of fenbendazole and niclosamide in pure drug and pharmaceutical formulations(Article)

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Abstract

Faculty of Computer Science and Applications

Indian Journal of Science and Technology, Vol 9(22), DOI: 10.17485/ijst/2016/v9i22/92713, June 2016
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A Comparative Study on Various Data Mining Algorithms with Special Reference to Crop Yield Prediction

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Abstract:

Objectives: To compare different data mining algorithms with the same parameters on the 10fold cross validation test to predict the crop yield. **Methods/Analysis**: Different data mining classification algorithms like K-nearest Neighbor, K-means, Neural Network, Support Vector Machine, Case-based Reasoning, Decision Tree algorithm, etc. are applied for various application of agriculture domain. A comparative study is done by using J48, Naïve Bayes and Simple Cart algorithms to determine which classification algorithm is best fitted for crop prediction. **Findings**: In this study, this work reveals the superior performance of J48 classification algorithm with accuracy 89.33% for crop prediction than the other two classification algorithms Simple Cart and Naïve Bayes. **Novelty /Improvement**: This study first time demonstrates the application of different data mining classification techniques (as discussed above) in the domain of agriculture for yield prediction.

Keywords: Classification Algorithm, Crop Prediction, Data Mining, Decision Tree, J48

1. Introduction

Agriculture is being playing a significant role in the Indian Economy. Agriculture is the most important occupation for most of the Indian families and large percentage of population in India is reliant on agriculture for livelihood. Agriculture is the main source of income and employment for the majority of people in this world especially of rural areas. In above circumstance, the right selection of crop is absolutely necessary for better yield proportion so a system needs to be in place for doing correct prediction of yield.

Data Mining, termed as the process of discovering patterns from gigantic databases[1]. The Data Mining techniques are used to extract the precise and previously unknown patterns or information from huge volume of data[2,3]. In this study, various classification algorithms of data mining, particularly Simple Cart, J48, and Naïve Bayes algorithms of decision tree are explored for crop prediction. The utmost significant parameters in the selection of classification algorithm are accuracy, efficiency and error rate for proposed research work.

The main objective of using information unseen within the database provides the inspiration to the researcher in the area of agriculture for applying such techniques to do forecast for imminent trends of agricultural progressions. For the same, so many work is being done by employing various data mining techniques on agriculture database. Verheyen et al. had done the classification of the soil profile using fuzzy k-means of classification techniques with extra grades algorithm[4]. The author Bhargavi et al. has applied the Naïve Bayes algorithms of data mining for soil classification[5]. The k-means clustering algorithm is employed to classify plant, soil and residue using various color images[6]. The k-means algorithm is also explored for apple grading before marketing[7], to tracking out the

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Customized Prediction Model to Predict Post-Graduation Course for Graduating Students Using Decision Tree Classifier

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Abstract

Background/Objectives: Excellence of Universities is based on students' success in their academic and it is possible if the students are instructed or counseled before getting admitted in their post graduation. So, we have developed a model for the post graduating students to utilize their intelligence in right direction. **Methods/Statistical Analysis**: If students are given admission in right course then their academic success is guaranteed by the university. To formulate the prediction, decision tree classifiers are best suitable as it has potential to generate comprehensible output. It is generating the tree and rules which will be used to formulate the predictions. Hence, this approach is of two steps approach known as training phase and testing phase. **Findings:** The model trains on the basis of the defined instances and from the defined instances the classified builds the rules. These rules are used to formulate prediction for unknown valued instances. This article depicts the customized classification model to predict the Post-Graduation degree of the students. The model is based on J48 decision tree algorithm for classification. The model is trained by the data collected through survey of different institutions with the purpose of differentiating and predicting students' choice and to generate unbiased result. We obtained certain patterns of the students preferences to select their post graduation course. On the basis of such rules which are derived from historical data, are used to predict post graduation course for unknown instance. We have used J48 classification algorithm for decision tree to predict the post graduation course based on their academic history and other identified parameters. We have identified total 14 parameters to predict the class label of 15thattribute. **Applications/ Improvements:** We have customized a model using Weka which uses the J48 algorithm to predict students' post graduation degree. We have obtained 94.03% accuracy of prediction against 4 classes as final attribute.

Keywords: Classification, Customization in Weka, Post Graduation Course Selection, Prediction Model, Weka

1. Introduction

Enforcement of people in education in adequate direction is the ultimate goal of education[1]. One of the major challenges for knowledge discovery and data mining systems stands in developing their data analysis capability to discover out of the ordinary models in data[2].

Student's success in Post-Graduation course is most crucial as it defines the career of the students. Students take admission in Post Graduate courses not based on their inclination for a particular subject but they may take the admission based on many other aspects also. This problem has grown up and became concern in many countries. This problem is known as "The One Hundred Factor

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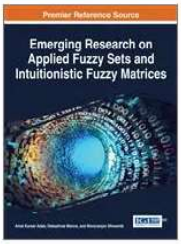

An Efficient Method for Forecasting Using Fuzzy Time Series

Pritpal Singh (CHARUSAT University, India)

Source Title: Emerging Research on Applied Fuzzy Sets and Intuitionistic Fuzzy Matrices
 | Pages: 18
DOI: 10.4018/978-1-5225-0914-1.ch013

Abstract

Forecasting using fuzzy time series has been applied in several areas including forecasting university enrollments, sales, road accidents, financial forecasting, weather forecasting, etc. Recently, many researchers have paid attention to apply fuzzy time series in time series forecasting problems. In this paper, we present a new model to forecast the enrollments in the University of Alabama and the daily average temperature in Taipei, based on one-factor fuzzy time series. In this model, a new frequency based clustering technique is employed for partitioning the time series data sets into different intervals. For defuzzification function, two new principles are also incorporated in this model. In case of enrollments as well daily temperature forecasting, proposed model exhibits very small error rate.

1. Introduction

Faculty of Sciences

Gastroenterology 2016;151:733–746

BASIC AND TRANSLATIONAL—LIVER

Loss of Junctional Adhesion Molecule A Promotes Severe Steatohepatitis in Mice on a Diet High in Saturated Fat, Fructose, and Cholesterol

Khalidur Rahman,[1,2] Chirayu Desai,[3] Smita S. Iyer,[4] Natalie E. Thorn,[1] Pradeep Kumar,[1] Yunshan Liu,[2] Tekla Smith,[1,2] Andrew S. Neish,[5] Hongliang Li,[6,7] Shiyun Tan,[8] Pengbo Wu,[8] Xiaoxiong Liu,[6,7] Yuanjie Yu,[8] Alton B. Farris,[5] Asma Nusrat,[9] Charles A. Parkos,[9] and Frank A. Anania[1,2]

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BACKGROUND & AIMS: There is evidence from clinical studies that compromised intestinal epithelial permeability contributes to the development of nonalcoholic steatohepatitis (NASH), but the exact mechanisms are not clear. Mice with disruption of the gene (*F11r*) encoding junctional adhesion molecule A (JAM-A) have defects in intestinal epithelial permeability. We used these mice to study how disruption of the intestinal epithelial barrier contributes to NASH. **METHODS:** Male C57BL/6 (control) or *F11r*$^{-/-}$ mice were fed a normal diet or a diet high in saturated fat, fructose, and cholesterol (HFCD) for 8 weeks. Liver and intestinal tissues were collected and analyzed by histology, quantitative reverse-transcription polymerase chain reaction, and flow cytometry. Intestinal epithelial permeability was assessed in mice by measuring permeability to fluorescently labeled dextran. The intestinal microbiota were analyzed using 16S ribosomal RNA sequencing. We also analyzed biopsy specimens from proximal colons of 30 patients with nonalcoholic fatty liver disease (NAFLD) and 19 subjects without NAFLD (controls) undergoing surveillance colonoscopy. **RESULTS:** *F11r*$^{-/-}$ mice fed a HFCD, but not a normal diet, developed histologic and pathologic features of severe NASH including steatosis, lobular inflammation, hepatocellular ballooning, and fibrosis, whereas control mice fed a HFCD developed only modest steatosis. Interestingly, there were no differences in body weight, ratio of liver weight:body weight, or glucose homeostasis between control and *F11r*$^{-/-}$ mice fed a HFCD. In these mice, liver injury was associated with significant increases in mucosal inflammation, tight junction disruption, and intestinal epithelial permeability to bacterial endotoxins, compared with control mice or *F11r*$^{-/-}$ mice fed a normal diet. The HFCD led to a significant increase in inflammatory microbial taxa in *F11r*$^{-/-}$ mice, compared with control mice. Administration of oral antibiotics or sequestration of bacterial endotoxins with sevelamer hydrochloride reduced mucosal inflammation and restored normal liver histology in *F11r*$^{-/-}$ mice fed a HFCD. Protein and transcript levels of JAM-A were significantly lower in the intestinal mucosa of patients with NAFLD than without NAFLD; decreased expression of JAM-A correlated with increased mucosal inflammation. **CONCLUSIONS:** Mice with defects in intestinal epithelial permeability develop more severe steatohepatitis after a HFCD than control mice, and colon tissues from patients with NAFLD have lower levels of JAM-A and higher levels of inflammation than subjects without NAFLD. These findings indicate that intestinal epithelial barrier function and microbial dysbiosis contribute to the development of NASH. Restoration of intestinal barrier integrity and manipulation of gut microbiota might be developed as therapeutic strategies for patients with NASH.

Keywords: Occludin; Claudin-4; Bacterial Translocation.

Nonalcoholic fatty liver disease (NAFLD) is a leading cause of chronic liver failure in the United States, and its incidence is expected to increase in the near future.[1] One third of the US population, and a majority of obese individuals, develop nonalcoholic fatty liver (NAFL) or bland steatosis; a benign condition characterized by triglyceride deposition in hepatocytes.[2] Although asymptomatic, nearly 20% of individuals with NAFL progress to nonalcoholic steatohepatitis (NASH), and 15% of NASH patients develop cirrhosis.[2] In addition, NASH patients are at a higher risk for developing hepatocellular carcinoma.[3] Despite the growing incidence of NAFLD-related chronic liver disease, the lack of clarity in the mechanisms of NASH pathogenesis has hindered our ability to develop effective biomarkers as well as therapies for more severe forms of NAFLD. One major barrier to achieving this goal is the lack of a suitable murine model that faithfully recapitulates human NASH.

Abbreviations used in this paper: **ALT, alanine aminotransferase; AST, aspartate aminotransferase; αSMA, α smooth muscle actin; CRN, Clinical Research Network; FITC, fluorescein isothiocyanate; HFCD, high-fat, high-fructose, and high-cholesterol diet; HSC, hepatic stellate cell; IL, interleukin; JAM-A, junctional adhesion molecule A; LPS, lipopolysaccharide; MetS, metabolic syndrome; NAFL, nonalcoholic fatty liver; NAFLD, nonalcoholic fatty liver disease; NASH, nonalcoholic steatohepatitis; PCR, polymerase chain reaction; rRNA, ribosomal RNA; TJ, tight junction; TLR, Toll-like receptor.**

Most current article

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nature microbiology

LETTERS

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The microenvironment of injured murine gut elicits a local pro-restitutive microbiota

Ashfaqul Alam[1], Giovanna Leoni[2], Miguel Quiros[3], Huixia Wu[1], Chirayu Desai[1], Hikaru Nishio[3], Rheinallt M. Jones[1], Asma Nusrat[3]* and Andrew S. Neish[1]*

The mammalian intestine houses a complex microbial community, which influences normal epithelial growth and development, and is integral to the repair of damaged intestinal mucosa[1–3]. Restitution of injured mucosa involves the recruitment of immune cells, epithelial migration and proliferation[4,5]. Although microenvironmental alterations have been described in wound healing[6], a role for extrinsic influences, such as members of the microbiota, has not been reported. Here, we show that a distinct subpopulation of the normal mucosal-associated gut microbiota expands and preferentially colonizes sites of damaged murine mucosa in response to local environmental cues. Our results demonstrate that formyl peptide receptor 1 (FPR1) and neutrophilic NADPH oxidase (NOX2) are required for the rapid depletion of microenvironmental oxygen and compensatory responses, resulting in a dramatic enrichment of an anaerobic bacterial consortium. Furthermore, the dominant member of this wound-mucosa-associated microbiota, *Akkermansia muciniphila* (an anaerobic, mucinophilic gut symbiont[7,8]), stimulated proliferation and migration of enterocytes adjacent to the colonic wounds in a process involving FPR1 and intestinal epithelial-cell-specific NOX1-dependent redox signalling. These findings thus demonstrate how wound microenvironments induce the rapid emergence of 'probiont' species that contribute to enhanced repair of mucosal wounds. Such microorganisms could be exploited as potential therapeutics.

Intestinal mucosal damage is observed in inflammatory bowel disease, enteric infections, as well as following surgical/mechanical trauma and toxic/environmental insults. To model intestinal injury and repair, we and others have utilized miniaturized endoscopy and biopsy forceps to generate defined mucosal wounds in the distal colon of wild-type (WT) mice in a coordinated and highly reproducible fashion[9–11] (Fig. 1a and Supplementary Fig. 1). In this study, we first visualized the endogenous bacteria present in the colonic wound bed by panbacterial fluorescent *in situ* hybridization (FISH) and scanning electron microscopy (Fig. 1b,c). During homeostasis, the microbiota in the colonic contents is largely separated from the underlying colonic mucosa (Fig. 1b and Supplementary Fig. 2) by an inner mucus layer[12]. However, at day 0 to 2 post wounding, the injured mucosa is in direct contact with a commensal microbiota due to the loss of three key features: fully differentiated enterocytes, goblet cells and the derived mucus layer (Fig. 1b and Supplementary Fig. 2), which reverses within 4–6 days. To characterize the wound-associated microbiota, colonic mucosal tissue was collected on days 0, 2, 4 and 6 post injury, and total DNA was purified from the wounds as well as from adjacent intact mucosa and local luminal contents. Bacterial 16S rRNA genes (V4 region) were polymerase chain reaction (PCR)-amplified and the amplicons were sequenced using the Illumina Miseq high-throughput sequencing (HTS) platform[13]. At the phyla level, microbiota analysis revealed that the mucosa-associated microbiota consisted of a higher abundance of *Firmicutes* and a lower abundance of *Bacteroidetes* compared to the microbiota of the luminal content (Fig. 1d). Interestingly, the composition of phyla present in the wound bed at day 0 most closely resembled that of the luminal content. However, the microbiota composition of the resealing wounds at day 2 post biopsy, and later, differed considerably from that of intact mucosa as well as the colonic luminal contents (Fig. 1d). Furthermore, a principal coordinates plot (PCoA) also demonstrated that the microbiota associated with wounds 2 days post biopsy clustered distinctly from that of intact mucosa (Fig. 1e, circled cluster). Microbiota associated with resealing wounds at days 4 and 6 clustered progressively closer to those of intact mucosa. Linear discriminate analysis (LDA) identified seven anaerobic and microaerophilic commensal bacterial genera (Fig. 1f) that increased in abundance specifically in the early regenerative mucosa (days 2 and 4). Most notably, the relative abundance of anaerobic mucinophilic *Akkermansia* (phyla: *Verrucomicrobia*) increased dramatically (Fig. 1d,f). Additional bacteria that are represented in the wound-associated consortium include the anaerobic taxa *Coprococcus*, *Mucispirillum*, *Odoribacter*, *Prevotella* and *Oscillospira* (Fig. 1f). Interestingly, aerotolerant lactobacilli had decreased in number in wounds 2 days post injury, but had increased within 4–6 days after injury (Supplementary Fig. 3a). These findings indicate that, during repair of gut mucosal injury, temporally dynamic local environmental conditions in the wound favour the growth of specific taxa, and define a wound-associated microbiota consortium that preferentially thrives for several days and resolves to the original state as the wound repairs.

Sites of intestinal mucosal inflammation and subsequent restitution are characterized by multiple alterations in the tissue microenvironment, including the appearance of pro-resolving mediators, cytokines, mucins and changes in oxygen tension[6]. For example, during trinitrobenzenesulphonic acid (TNBS)-induced colitis, oxygen in the inflamed epithelia is rapidly depleted by the NOX2-mediated oxidative burst within recruited neutrophils, in concert with an increased synthesis of a mucin protein, MUC3, from the intestinal epithelial cells (IECs)[14]. We hypothesized that such physiological changes within a mucosal wound microenvironment establish preferential conditions for the rapid growth of *Akkermansia*, an anaerobic and mucinophilic organism. To explore this hypothesis, we first investigated oxygen depletion in biopsy wounds using pimonidazole HCl. This compound is reduced in a hypoxic environment and forms immunodetectable protein adducts. This analysis

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IDIOSYNCRASY OF LOCAL FUNGAL ISOLATE *HYPOCREA RUFA* STRAIN P2: PLANT GROWTH PROMOTION AND MYCOPARASITISM

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ABSTRACT

Trichoderma viride an anamorph of *Hypocrea rufa*, is a known bio-control agent against various fungal phytopathogens. In the present study, *H. rufa* strain P2 was tested for plant growth promoting (PGP) traits and antifungal activity against *Fusarium oxysporum*, *Alternaria alternata*, *Aspergillus niger*, *Sclerotium rolfsii*. *In-vitro* assessment of *H. rufa* strain P2 showed maximum IAA production of 68 µg ml^{-1}, solubilised tri-calcium phosphate up to 72 µg ml^{-1} and showed production of chitinase enzyme 120 U ml^{-1}. In order to determine *in-vivo* plant growth promotion, talc based formulation of *H. rufa* strain P2 was prepared and tested on *Arachis hypogaea* L. using seed and soil application. After 15 days, treated plants showed six-fold increases in the fresh and dry root mass whereas, fresh and dry shoot mass was increased up to two folds. The result indicates the local isolate *H. rufa* strain P2 can be categorized as phyto-friendly fungi which can be used as both, bio-control agent as well as phyto-augmenting bio-fertilizer

Keywords: *Hypocrea rufa* strain P2; Plant Growth Promoting Fungi (PGPF); Chitinase; talc based bio-formulation; Peanut (*Arachis hypogaea* L.)

INTRODUCTION

Rhizospheric fungi have the ability to stimulate plant growth are designated as 'Plant Growth Promoting Fungi' (PGPF) (**Hyakumachi, 1994**). PGPF is non-pathogenic soil inhabiting saprophytes, which have been reported for growth promotion in several crop plants and providing protection against diseases (**Shivanna *et al.*, 1996**). Such PGPF belongs to various genera, including *Penicillium*, *Trichoderma*, *Fusarium*, and *Phoma*. Few species of PGPF have been reported to trigger systemic resistance against numerous phytopathogens (**Shoresh *et al.*, 2005**). *Hypocrea rufa* is a common inhabitant of the rhizosphere and decisively recognized as a bio-control agent of soil-borne plant pathogens (**Harman *et al.*, 2004**). A praiseworthy amount of research has been focused on the mycoparasitic nature of *H. rufa* and its contribution in plant growth promotion. Antibiosis, competition, and mycoparasitism are the different mechanisms by which *H. rufa* controls plant-pathogenic fungi (**John *et al.*, 2010**). The complex process of mycoparasitism requires the production of plenty of cell-wall-degrading enzymes, such as chitinases, cellulases, polysaccharide lyases, proteases, and lipases, which digest the fungal cell wall (**Witkowska and Maj, 2002; Gruber and Seidl-Seiboth, 2012; Phitsuwan *et al.*, 2013**).
The mechanism of PGPF mediated plant growth promotion involves the production of various phytohormones like indole acetic acid (IAA) (**Contreras-Cornejo *et al.*, 2009**), gibberellic acid and cytokinins (**Salas-Marina et al., 2011**). Moreover, plant growth promotion is also supported by the production of siderophore, mobilization of insoluble phosphate, induction of different plant pathogen defense-related enzymes (i.e. β-1, 3 glucanase, chitinases). Production of such enzymes contributed to their biocontrol characteristics (**Dey *et al.*, 2004; Chandler *et al.*, 2008**). Reduction in severity of plant diseases by application of *H. rufa* under field conditions was also reported by **Hermosa *et al.* (2012)**. Field trials using talc-based bio-formulation of *H. rufa* was reported in India for the management of several soil-borne diseases applied through seed treatment and soil application (**Jeyarajan, 2006; Mukherjee *et al.*, 2012**).

Groundnut (*Arachis hypogaea* L.) is an important oilseed crop in India. Gujarat is the principal producer state of groundnut in the country. The area and production of groundnut in the state found about 30.9 per cent and 37.1 per cent respectively in India (**Swain 2013**). The yield of groundnut is dropping by 25 per cent from 1,170 kg per hectare to 1,560 kg per hectare in Gujarat (**SEA crop survey 2014**). Various biotic and abiotic factors are responsible for this loss. There is 28 to 50 % of mortality observed due to plant fungal pathogen (**Ghewande et al., 2002**). Various remedies like crop rotations, use of recommended chemical fungicide etc. are available to effectively control fungal disease. However, these types of strategies affect human health, environmental pollution, development of pathogen resistance to fungicide and the production cost (**Patel *et al.*, 2015b**). Apart from all these strategies, an unconventional approach is by inoculating crop seeds and seedlings with plant growth promoting organisms (**Patel *et al.*, 2015a**)
In spite of the well-documented history of *H. rufa* as a biofertilizer and biocontrol agent, very few researchers have aimed to test multiple traits from a single isolate simultaneously. Therefore, in the present study, multiple traits of PGPF were accessed in a local isolate *H. rufa* strain P2 along with its antagonistic activity against several fungal pathogens. *In-vivo* plant growth promoting the activity of *H. rufa* strain P2 was determined using *Arachis hypogaea* L. as a test plant

MATERIALS AND METHODS

Sample collection and Isolation

Farm soil sample was collected randomly at 15 cm soil depth using a cylindrical tube, from Anand, Gujarat (22°53'N, 72°96'E). One gram of soil was suspended in 9 ml of sterile distilled water. The serial aliquot of 0.1 ml was plated on selective medium, Rose Bengal agar with pentachloronitrobenzene (PCNB), and incubated at 28±2°C for 5-7 days. Isolate has shown green conidia was used further for experiments and identified using 18S rRNA gene sequencing. Pure culture was maintained and stored at 4°C on PDA.

cogent food & agriculture

SOIL & CROP SCIENCES | REVIEW ARTICLE

Portraying mechanics of plant growth promoting rhizobacteria (PGPR): A review

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Abstract: Population growth and increase in food requirement is the global problem. It is inevitable to introduce new practices that help to increase agricultural productivity. Use of plant growth promoting rhizobacteria (PGPR) has shown potentials to be a promising technique in the practice of sustainable agriculture. A group of natural soil microbial flora acquire dwelling in the rhizosphere and on the surface of the plant roots which impose beneficial effect on the overall well-being of the plant are categorized as PGPR. Researchers are actively involved in understanding plant growth promoting mechanics employed by PGPR. Broadly, these are divided into direct and indirect mechanics. Any mechanism that directly enhances plant growth either by providing nutrients or by producing growth regulators are portrayed as direct mechanics. Whereas, any mechanisms that protects plant from acquiring infections (biotic stress) or helps plant to grow healthily under environmental stresses (abiotic stress) are considered indirect mechanics. This review is focused to describe cogent mechanics employed by PGPR that assists plant to sustain healthy growth. Also, we emphasized on the PGPR-based products which have been commercially developed exploiting these mechanics of PGPR.

Subjects: Agronomy; Environment & Agriculture; Food Science & Technology; Plant & Animal Ecology; Soil Sciences

Keywords: plant growth-promoting rhizobacteria (PGPR); indole acetic acid (IAA); phosphate solubilization; siderophore production; antibiotic production; induced systematic resistance (ISR); ACC deaminase

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PUBLIC INTEREST STATEMENT

New and improved eco friendly techniques has to be introduced in the agriculture practices owing to the constant increase in the food demand due to growing global population. Use of chemical fertilizers do give good agricultural productivity but it slowly deteriorates agriculture land. Use of biofertilizers is an eco friendly substitution to the use of chemical fertilizers. Biofertilizers are composed of bacterial species which are beneficial to the plant growth and such microbes are termed as plant growth-promoting rhizobacteria (PGPR). Researchers are studying these microbes for the past 30 years to understand the mechanics employed by PGPR to support plant growth. Over the period of time, some of the mechanics of PGPR are well understood which we like to portray in this review.

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Mechanism of acid corrosion inhibition using magnetic nanofluid

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Abstract

The inhibition effect of magnetic nanofluid on carbon steel in acid solutions was investigated using gravimetric, potentiodynamic and SEM measurement. The inhibition efficiency increases up to 95% and 75% for 51.7 mM concentration, respectively, in 1 M HCl and 1 M H_2SO_4 medium. The adsorption of nanoparticles to the steel surface forms a barrier between the metal and the aggressive environment, which is responsible for observed inhibition action. The adsorption of nanoparticles on steel surface is supported by the Langmuir and Freundlich adsorption isotherm and surface morphology scanned through SEM.

Keywords: acid solution, weight loss, potentiostatic, acid inhibition
Classification numbers: 2.03, 4.02

1. Introduction

Carbon steel finds wide application as a construction material for heat transport system in nuclear, petrochemical, and chemical process industries. However, this material is highly prone to corrosion in an acidic environment. In order to prevent corrosion, different techniques are used like: treatment of metal surface coating [1, 2], treating the environment in which metal is exposed by removal of oxygen, controlling pH or using inhibitors [3–5] and changing the potential by cathodic or anodic protection.

With the advancement in high-performance nanostructured materials development, effectiveness of corrosion-resistant under a wider range of hostile environments is also established. Due to the regulated restriction of using chromate because of its high toxicity and carcinogenic characteristic, there arose the interest to research of chromium free alternative with equivalent or superior corrosion inhibition performance. A magnetic nanofluid (MNF) comprising myriad tiny ferromagnetic nanoparticles in aqueous media has a wide range of applications in engineering (like seals, dampers, loudspeakers, vibration and shock absorbers) to biomedical fields [6–8]. These nanoparticles are in the size range from 3 to 15 nm, which forms a stable suspension after coating with a stabilizer.

In our earlier approach we have shown the use of properly designed MNF as a promising corrosion preventive material [9, 10]. Our experiments of corrosion resistance of carbon steel with 1.0 M HCl and 1.0 M H_2SO_4 medium show almost 95% and 75% inhibition efficiency, respectively.

This work describes the mechanism responsible for the inhibiting action of MNF in the strong acidic media. The performance of MNF inhibitor is evaluated using gravimetric, polarization measurement technique and the surface morphology study through SEM. The inhibitive action is explained based on the empirical relations of Langmuir and Fraundlich adsorption isotherms.

2. Experimental

The procedure of preparing magnetic fluid inhibitor comprises of three parts: (i) magnetite nanoparticles were

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Prevention of hot spot temperature in a distribution transformer using magnetic fluid as a coolant

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ABSTRACT

A Mn–Zn ferrite magnetic fluid (TCF-56) having 5.6 mT fluid magnetization and high pyromagnetic coefficient, ($\partial M/\partial T$ = 177 A/m K) has been investigated as a coolant in a 3 kW prototype transformer for overloading condition (167%). The winding temperature of a transformer submerged in magnetic fluid reaches at 396.8 K after 3 h of overloading, which is 20 K lower, when the same experiment was carried out with pure transformer oil. Similarly, core and top oil temperature also decrease by 14 and 21 K, respectively, when TCF-56 is used. This cooling performance of TCF-56 attributes to the thermo-magnetic convection, which sets up due to the significant change in magnetization of the fluid with increasing temperature. This can be explained using the Rayleigh number. The normal life of a transformer under 167% overloading condition is calculated for pure oil and TCF-56. The result shows nine times increase in normal life expectancy in TCF-56 fluid compared to use of pure oil. The study leads to the conclusion that Mn–Zn ferrite magnetic fluid (TCF-56) used in a transformer can deliver more power than its nameplate rating with an improved normal life.

1. Introduction

A transformer is a static electrical device that operates using the principle of mutual induction. During the power transfer some amount of the input power is dissipated as losses, such as core loss, hysteresis loss, eddy current loss and stray loss. These losses are of the order of 1% of its full rated load and can be minimized by (i) using superior magnetic material for the core, (ii) tuning the thickness of the steel lamination, (iii) by closing the leakage flux lines, etc. With the increasing power rating of the transformer, these losses also increase, results in the temperature rise inside the transformer. The upper limit of temperature rise in the individual parts of a transformer must meet the criteria as defined in the relevant standards [1,2]. To conform to these specifications, one needs cooling mechanisms to disperse the high temperature induced by the losses. The typical cooling mechanism used for this is a natural air flow or insulating oil flow.

In an oil cooled distribution transformer, the heat transfer mechanism is grounded on the Archimedes law. But this is relatively poor and less efficient, due to which a large temperature gradient across the oil reservoir is observed, which results into creation of a localized region of intense temperature between the core and windings and between the windings, known as the "hot spot". The hot spot causes degradation of the insulation of the winding as well as the conductive components of a transformer, which finally results in a continuous sparking. Because of this, the insulating oil decomposes, forms an oil-carbon and decreases flash point of the oil. All these eventually lead to the failure of a transformer.

The hot spot temperature (HST) determines the normal lifespan of a transformer on loading. The permitted value of HST at rated load is specified by ANSI (American Standards Institute). This is a function of resistive temperature rise in the winding [2]. To forestall and/or trim down the hot spot winding temperature, an auxiliary cooling mechanism with fins or pumping devices to spread the oil inside the transformer tank is often employed. However, addition of fins requires more space and increases the overall weight of the transformer. On the other hand, oil pumps are cumbersome, consume power and need regular maintenance. The alternate way to enhance the heat dissipation is to modify the transformer oil cooling properties.

Potential to replace the insulating oil by magnetic fluid to eliminate "hot spot" in the transformer core and its winding is

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Influence of crystallite size on the magnetic properties of Fe_3O_4 nanoparticles

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ABSTRACT

Structural and magnetic properties of chemically synthesized magnetite nanoparticles have been studied using X-ray diffraction, Transmission Electron Microscopy and Vibrating Sample Magnetometer. Magnetically the synthesized nanoparticles are ranging from superparamagnetic to multi domain state. Average crystallite size of the synthesized magnetite nanoparticles were determined using X-ray line broadening and are found to be in the range of 9–53 nm. On the other hand, the TEM images show that the size is ranging between 7.9 and 200 nm with the transition from spherical superparamagnetic particles to faceted cubic multi domain particles. Magnetic parameters of the samples show a strong dependence on average crystallite size. The ratio of coercive field at *20 K* to that at *300 K* (H_c (*20 K*)/H_c (*300 K*)) increased sharply with decrease in crystallite size. A critical crystallite diameter of order 36 nm may be inferred as boundary between single domain to multi domain transition. Zero-field-cooled (ZFC) and field-cooled (FC) measurements at 10 Oe field validate the same for smallest and largest size samples, confirming that the anisotropy energy is greater than thermal energy upto 300 K temperature. For 9 nm sample broad ZFC curve with overlapping of FC curve is observed just at 300 K, indicating the effect of strong dipolar field in superparamagnetic system.

1. Introduction

Magnetic particles in the nanometer range represent interesting class of material from both scientific and technological point of view. Magnetic nanoparticles (NP) are an ideal system to study finite-size and surface effects. Finite-size leads to quantum confinement, whereas typical surface effects are related to the symmetry breaking of the crystal structure at the boundary of each particle [1–3]. These effect enhance the properties with respect to their bulk counterpart. It is well known that the size and shape controls the structural, chemical, physical, magnetic and other properties of the NP [4]. As the size decreases, surface effects become more significant because of the increasing fraction of surface atoms and reduced crystal symmetry due to incomplete atomic coordination [5]. The magnetic structure at the surface layer is different from that in the core of the NP which has a strong effect on the magnetic properties. Consequently, understanding the influence of surface chemistry on the magnetic properties of NP certainly facilitates our fundamental view of their unique magnetic behavior, such as, for example, the actual origin of the magnetic hysteresis in single-domain magnetic NP [6–9]. Moreover, understanding and controlling the effect of surface chemistry on the magnetic properties has become increasingly important for the technological applications of magnetic NP. The enhanced magnetic properties lead to novel materials which are used as high-density magnetic storage media, magnetic resonance imaging and drug delivery agent [10]. Magnetic nanoparticles are leading candidates for medical applications because of their unique multifunctional properties [11,12]. The magnetic NPs are being used as imaging, diagnostic and therapeutic tools in biomedicine. Superparamagnetic (SPM) materials are potential candidates for targeted drug delivery applications because of their size compatibility and ability to become highly magnetized only in the presence of a magnetic field [13–16]. The potential application of magnetic NP for biomedical purposes relies on the synthesis of high-quality materials from both the crystalline and magnetic points of view. In this sense, it is essential for their use to minimize the poly dispersion, heterogeneity and to maximize their magnetic response [17].

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Temperature dependence quasi-static measurements on a magnetorheological fluid having plate-like iron particles as dispersed phase

Zarana Laherisheth and Ramesh V Upadhyay

Abstract

In this work, the field-dependent rheological properties of the magnetorheological fluid system, featuring plate-like iron particles, at different magnetic fields in quasi-static mode are investigated using MCR 301 magnetorheometer at ambient temperature. At an intermediate field strength, static yield stress exhibits $H^{1.5}$ dependency, eventually becoming field independent at higher field. Later on, the temperature-dependent properties are analysed at the different magnetic field intensities. Observational data are obtained from magnetic field ranging from 0.0 to 1.1 T and in the temperature range 30°C–120°C. It is noted that at low field strength, the static yield stress increases initially with temperature and decreases with further increase in temperature. A yield stress model is suggested based on the average normalized sensitivity and magnetic field to describe the measured variation in the magnetorheological fluid response at higher temperature. This information will be useful for predicting thermal sensitivity of device performance.

Keywords

magnetorheological fluids, temperature dependence, static yield stress, power-law scaling

Introduction

Magnetorheological (MR) fluids are smart materials which show the change over from liquid to a nearly solid-like state under the influence of external magnetic fields (MR effect) in a few milliseconds. This remarkable property makes MR fluid a very good material for many applications (Jolly et al., 1999; Wereley, 2014). In the absence of magnetic fields, the MR suspensions have a relatively low viscosity and behave as Newtonian fluids. Yet, when a magnetic field is applied, particles magnetize and form chain-like structure along the field direction. As an effect, MR fluid exhibits large yield stress and is of special interest in torque-transfer applications such as shock absorbers, brakes, and clutches (Goldasz and Sapiński, 2012; Ha et al., 2013; Liu et al., 2006; Olabi and Grunwald, 2007; Park et al., 2006).

The key parameter that characterizes the viscoplastic properties of MR fluid is the yield stress, a critical value of shear stress when a viscoplastic fluid began to flow. The yield stress is a measure of magnetic field–induced structural strength. The value of yield strength depends on the applied magnetic field intensity, volume fraction of magnetic particles, particle shape and so on. Previous studies report mainly on the above variable parameters.

A number of models have been proposed to describe the variation of yield stress with a magnetic field (refer review article by Ghaffari et al., 2014). These can be broadly divided into two groups: macroscopic and microscopic models. The macroscopic model assumes a homogeneous structure and utilizes the magnetic energy minimization principle, while the microscopic model takes into account interparticle interactions. In most of these cases, the shear stress is higher than magnetostatic interaction between particles and shear-induced deformations are assumed to be affine. However, for conventional MR fluid, microscopic model of Ginder et al. (1996) that includes the anisotropic polar magnetostatic interaction between particles provides reasonable

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Spectroscopy and flavor changing decays of B, B_s mesons in a Dirac formalism

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In the framework of the relativistic independent quark model, the mass spectra and decay properties of B and B_s mesons are obtained using a Martin-like potential for the quark confinement. The predicted excited states are in good agreement with the experimental results as well as with the lattice QCD and other theoretical predictions. For instance, the $B_2(5747)$ as 1^3P_2, $B_1(5721)$ as 1^3P_1, and $B_0(5732)$ as 1^3P_0 are identified. The spectroscopic parameters are used to calculate the electromagnetic transitions, pseudoscalar decay constants, hadronic decay widths, and leptonic decay widths. The present result for the decay constant, $f_B(1S) = 188.56$ MeV, is in good agreement with recent lattice results (UKQCD Collaboration, Fermilab) and comparable with the experimental value of (206.7 ± 8.9). The pseudoscalar decay constant for the B_s meson obtained here, $f_{B_s}(1S) = 240.21$ MeV, is in very good agreement with recent lattice QCD and QCD sum rule predictions. The predicted branching ratio for $B^+ \to \tau^+\nu_\tau$ (1.354×10^{-4}) is in accordance with the value, $(1.65 \pm 0.34) \times 10^{-4}$ reported by the Particle Data Group (PDG). The branching ratios of the rare decays $B_s^0 \to \mu^+\mu^-$ $((3.1 \pm 0.7) \times 10^{-9})$ and $B^0 \to \mu^+\mu^-$ $(< 6.3 \times 10^{-10})$ as observed by the CMS and LHCb Collaborations very recently are in accordance with our predictions of 3.602×10^{-9} and 1.018×10^{-10}, respectively. The Cabibbo-favored hadronic branching ratios of $B^0 \to D^-\pi^+$ (3.724×10^{-3}), $B^0 \to D^{*-}\pi^+$ (3.475×10^{-3}), and $B_s \to D_s^-\rho^+$ (3.800×10^{-3}) are in good agreement with the respective PDG values. The mixing parameters x_q, χ_q for $B^0 - \bar{B}^0$ $(x_d = 0.769, \chi_d = 0.1859)$ and $B_s - \bar{B}_s$ $(x_s = 26.41, \chi_s = 0.49929)$ are also found to be in excellent agreement with the PDG values of $(0.770 \pm 0.008, 0.1862 \pm 0.0023)$ and $(26.49 \pm 0.29, 0.499292 \pm 0.000016)$, respectively.

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I. INTRODUCTION

Recent observations of various hadronic states (particularly in the heavy-flavor sector) by different experimental groups have revitalized the field of hadron spectroscopy [1,2]. Though a large number of these newly observed states are in the charm sector, there are many newly observed states in the beauty (bottom) sector as well. It has generated a vast interest in the heavy-flavor sector. For instance, the masses of low-lying $1S$ and $1P_J$ states of B and B_s mesons were recorded experimentally [1] and many of their excited states were predicted theoretically [3–11]. Experiments at CDF and DØ found several narrow B and B_s states, such as $B_1(5720)$, $B_2^*(5745)$, and $B_{s2}^*(5839)$ [12]. Among the various experimentally observed B and B_s meson states $[B^*, B, B_2(5747), B_1(5721), B_0(5732), B_s^*, B_s, B_{s2}(5840), B_{s1}(5830), B_{s1}(5850)]$, many of the predicted states are missing. For example, there is no evidence for $2S$, $1D$ states of B and B_s mesons and the center of mass of the $1P$ state. These unconfirmed states of B and B_s mesons have further generated considerable interest towards the spectroscopy of doubly open flavor mesons. The CDF Collaboration has very recently announced evidence of a new resonance $B(5970)^{+/0}$ in the $B^0\pi^+/B^+\pi^-$ invariant mass spectrum [13]. This state $B(5970)$ was also predicted theoretically [14] through the effective Lagrangian approach. They have assigned it as the 2^3S_1 state in the B meson family, while heavy meson effective theory [15] predicted this bottom meson as either the $2S(1^-)$, $1D(1^-)$, or $1D(3^-)$ state. Thus, recent experimental data on excited B and B_s states are partially inconclusive and require more detailed analysis involving their decay properties. In this context, we focus on only the open beauty ($\bar{b}q$ or $b\bar{q}$; $q \in u, d, s$) mesons, their mass spectra, as well as their decay properties in this paper. The study of B and B_s mesons also carries special interest as these hadrons with open flavors ($\bar{b}, u/d$ and $\bar{b}, s$) undergo flavor-changing decays with less interference from strong interaction decays. These particles thus provide a clean laboratory to study electromagnetic and weak interactions. Moreover, the understanding of the weak transition form factors of heavy mesons is important for proper extraction of the quark mixing parameters through the analysis of nonleptonic decays and CP-violating effects. QCD sum rules [16–19] is one of the nonperturbative approaches to evaluate hadron properties by using the correlator of the

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Regular Article - Theoretical Physics

D meson spectroscopy and their decay properties using Martin potential in a relativistic Dirac formalism

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Abstract For the present study, we have used the Martin-like potential for the quark confinement. Our predicted states in the S-wave, $2\,^3S_1$ (2605.86 MeV) and $2\,^1S_0$ (2521.72 MeV), are in very good agreement with experimental results of $2608 \pm 2.4 \pm 2.5$ MeV and $2539.4 \pm 4.5 \pm 6.8$ MeV, respectively, reported by the BABAR Collaboration. The calculated P-wave D meson states, 1^3P_2 (2462.50 MeV), 1^3P_1 (2407.56 MeV), 1^3P_0 (2373.82 MeV) and 1^1P_1 (2423.28 MeV), are in close agreement with experimental average (Particle Data Group) values of 2462.6 ± 0.7 MeV, $2427 \pm 26 \pm 25$ MeV, 2318 ± 29 MeV and 2421.3 ± 0.6 MeV, respectively. The pseudoscalar decay constant (f_P= 202.57 MeV) of the D meson is in very good agreement with the experiment as well as with the lattice predictions. The Cabibbo favoured nonleptonic decay branching ratios, BR($D^0 \to K^-\pi^+$) of 4.071 % and BR ($D^0 \to K^+\pi^-$) of 1.135×10^{-4}, are also in very good agreement with the respective experimental values of 3.91 ± 0.08 % and $(1.48 \pm 0.07) \times 10^{-4}$ reported by CLEO Collaboration. The mixing parameters of the D^0–$\bar{D}^0$ oscillation, x_q (5.14×10^{-3}), y_q (6.02×10^{-3}) and R_M (3.13×10^{-5}), are in very good agreement with BaBar and Belle Collaboration results.

1 Introduction

Very recently, experiments at LHCb [1] have reported a large number of D_J resonances in the mass range of 2.0 GeV/c^2 to 4.0 GeV/c^2, of which many belong to natural excited states of the D meson, while quite a number of them belong to unnatural states [1]. It is important and necessary to exhaust the possible conventional descriptions of $q\bar{Q}$ excitations [2,3] before resorting to more exotic interpretations [4–6]. Further theoretical efforts are still required in order to explain satisfactorily the recent experimental data concerning these open-charm states.

Apart from the challenges posed by the exotics, there are also many states which are admixtures of their nearby natural states. For example, the discoveries of new resonances of D states such as $D(2550)$ [7], $D(2610)$ [7], $D(2640)$ [8], $D(2760)$ [7] etc. have further generated considerable interest towards the spectroscopy of these open-charm mesons. The study of the D meson is of special interest as it is a hadron with two open flavours (c, $\bar{u}$ or $\bar{d}$) which restricts its decay via strong interactions. The ground state (D, D^*) mesons provide us with a clean laboratory to study weak decay and are useful to study the electromagnetic transitions. The masses of low-lying $1S$ and $1P_J$ states of the D mesons are recorded both experimentally [2,3] and theoretically [9–14]. Though lattice QCD and QCD sum rules are quite successful, their predictions for the excited states of the open flavour mesons in the heavy sector are very few. However, recent experimental data on excited D-states are partially inconclusive and require a more detailed analysis involving their decay properties. The understanding of the weak transition form factors of heavy mesons is important for a proper extraction of the quark mixing parameters, for the analysis of nonleptonic decays and CP-violating effects. The QCD sum rule (QSR) [15–19] is a non-perturbative approach to evaluate the hadron properties by using the correlator of the quark currents over the physical vacuum and it is implemented with the operator product expansion (OPE). Lattice QCD (LQCD) [20–22] is also a non-perturbative approach to use a discrete set of spacetime points (lattice) to reduce the analytically intractable path integrals of the continuum theory to a very difficult numerical computation. QCD sum rules are suitable for describing the low q^2 region of the form factors; lattice QCD gives good predictions for high q^2. As a result these methods do not provide a full picture of the form factors and, more significant, for the relations between the

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Research Article

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Functions of bounded fractional differential variation – A new concept

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Abstract: The idea of functions of bounded differential variation was introduced by Bhatt, Dabhi and Kachhia in [2]. In the present paper, we introduce functions of bounded fractional differential variation using the Caputo-type fractional derivative instead of the commonly used first-order derivative. Various properties and relation with some known results of classical analysis are also studied. We prove that the space $BFDV[a, b]$ of all functions of bounded fractional differential variation on $[a, b]$ is a normed algebra under certain type of norms.

Keywords: Functions of bounded fractional differential variation, functions of bounded differential variation, functions of bounded variation, Caputo fractional derivative

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1 Introduction

The fractional calculus is the theory of integrals and derivatives of arbitrary order. This concept is the generalization of integer-order differentiation and n-fold integration. The existence of fractional derivatives with various properties is shown in [4, 7, 11].

Definition 1.1. If $y \in AC^n[a, b]$, then the right-sided Riemann–Liouville fractional derivatives ${}^{RL}D^{\alpha}_{a+}y(x)$ and left-sided Riemann–Liouville fractional derivatives ${}^{RL}D^{\alpha}_{b-}y(x)$ of order $\alpha \in C(R(\alpha) \geq 0)$ on $[a, b]$ are defined, by Kilbas, Srivastava and Trujillo in [7], as follows:

$$ {}^{RL}D^{\alpha}_{a+}y(x) := \frac{1}{\Gamma(n-\alpha)}\Big(\frac{d}{dx}\Big)^n \int_a^x \frac{y(t)}{(x-t)^{\alpha-n+1}}\,dt \quad (x > a) $$

and

$$ {}^{RL}D^{\alpha}_{b-}y(x) := \frac{1}{\Gamma(n-\alpha)}\Big(-\frac{d}{dx}\Big)^n \int_x^b \frac{y(t)}{(t-x)^{\alpha-n+1}}\,dt \quad (x < b), $$

respectively, where $[R(\alpha)]$ denotes the integer part of $R(\alpha)$ and $n = [R(\alpha)] + 1$ for $\alpha \in N_0$; $n = \alpha$ for $\alpha \in N_0$.

Definition 1.2. The right-sided Caputo fractional derivatives ${}^{C}D^{\alpha}_{a+}y(x)$ and left-sided Caputo fractional derivatives ${}^{C}D^{\alpha}_{b-}y(x)$ of order $\alpha \in C(R(\alpha) \geq 0)$ on $[a, b]$ are defined via the Riemann–Liouville fractional derivatives, by Kilbas Srivastava and Trujillo in [7], as follows:

$$ {}^{C}D^{\alpha}_{a+}y(x) := \left({}^{RL}D^{\alpha}_{a+}\left[y(t) - \sum_{k=0}^{n-1}\frac{y^{(k)}(a)}{k!}(t-a)^k\right]\right)(x) $$

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SOME INTEGRAL TRANSFORMS AND FRACTIONAL INTEGRAL FORMULAS FOR THE EXTENDED HYPERGEOMETRIC FUNCTIONS

Praveen Agarwal, Junesang Choi, Krunal B. Kachhia, Jyotindra C. Prajapati, and Hui Zhou

Abstract. Integral transforms and fractional integral formulas involving well-known special functions are interesting in themselves and play important roles in their diverse applications. A large number of integral transforms and fractional integral formulas have been established by many authors. In this paper, we aim at establishing some (presumably) new integral transforms and fractional integral formulas for the generalized hypergeometric type function which has recently been introduced by Luo *et al.* [9]. Some interesting special cases of our main results are also considered.

1. Introduction and preliminaries

The theory of special functions has been one of the most rapidly growing research subjects in mathematical analysis. A lot of special functions in mathematical physics and engineering, such as Jacobi and Laguerre polynomials, can be expressed in terms of the generalized Gauss hypergeometric functions or confluent hypergeometric functions (see, *e.g.*, [17]). Certain extensions of the hypergeometric functions and several other familiar special functions have been presented and investigated (see, *e.g.*, [4], [5], [8], [12] and for a very recent work, see also [2], [16]). Very recently, Luo *et al.* [9] introduced the following extended generalized hypergeometric type function and investigated its various properties. The extended generalized hypergeometric function is defined, for

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SOME INTEGRAL TRANSFORMS INVOLVING EXTENDED GENERALIZED GAUSS HYPERGEOMETRIC FUNCTIONS

Junesang Choi, Krunal B. Kachhia, Jyotindra C. Prajapati, and Sunil Dutt Purohit

Abstract. Using the extended generalized integral transform given by Luo *et al.* [6], we introduce some new generalized integral transforms to investigate such their (potentially) useful properties as inversion formulas and Parseval-Goldstein type relations. Classical integral transforms including (for example) Laplace, Stieltjes, and Widder-Potential transforms are seen to follow as special cases of the newly-introduced integral transforms.

1. Introduction, preliminaries, and definitions

Throughout this paper let $\mathbb{C}$, $\mathbb{N}$ and $\mathbb{Z}_0^-$ denote the sets of complex numbers, positive and non-positive integers, respectively. Integral transforms have been widely used in various problems of mathematical physics and applied mathematics (for some recent works, see, *e.g.*, [1, 4, 8, 9]). Integral transforms with such special functions as (for example) the hypergeometric functions have been played important roles in solving numerous applied problems. Due mainly to their demonstrated applications, several generalizations of integral transforms with hypergeometric functions have been actively investigated. Virchenko and Ovcharenko [16] presented some new integral transforms with the generalized confluent hypergeometric function due to Virchenko [15]. Here, in this paper, using the extended generalized integral transform given by Luo *et al.* [6], we introduce some new generalized integral transforms to investigate such their (potentially) useful properties as inversion formulas and Parseval-Goldstein type relations. Classical integral transforms including (for example) Laplace, Stieltjes, and Widder-Potential transforms are seen to follow as special cases of the newly-introduced integral transforms.

Recently, Luo *et al.* [6] introduced the following extended generalized hypergeometric function ${}_pF_q^{(\alpha,\beta;\kappa,\mu)}$ and investigated its various properties. The

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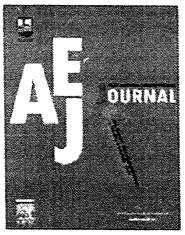

ORIGINAL ARTICLE

On generalized fractional kinetic equations involving generalized Lommel-Wright functions

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KEYWORDS

Fractional kinctic equation;
Laplace transforms;
Mittag-Leffler function;
Generalized Lommel-Wright function;
Fractional calculus

Abstract Fractional kinetic equations play an important role in certain astrophysical problems. In this paper, authors have established further generalization of fractional kinetic equations involving generalized Lommel-Wright functions. Solutions of these generalized fractional kinetic equations were obtained in terms of Mittag–Leffler function using Laplace transform. Some special cases also contain the generalized Bessel function and Struve function.

1. Introduction

Fractional kinetic equations gained remarkable interest due to their applications in astrophysics and mathematical physics. The extension and generalization of fractional kinetic equations involving many fractional operators were found [4,5,8,10,12–14,17,18].

If an arbitrary reaction is characterized by a time dependent $N = N(t)$ then it is possible to calculate the rate of change of $\frac{dN}{dt}$ by mathematical equation

$$\frac{dN}{dt} = -d + p, \tag{1}$$

where d is the destruction rate and p is the production rate of N.

Haubold and Mathai [5] established a functional differential equation between the rate of change of reaction, the destruction rate and the production rate as follows:

$$\frac{dN}{dt} = -d(N_t) + p(N_t), \tag{2}$$

where $N = N(t)$ is the rate of reaction, $d(N(t))$ is the rate of destruction, $p(N_t)$ is the rate of production and N_t denotes the function defined by $N_t(t^*) = N(t) - t^*, t^* > 0$.

A special case of (2), when spatial fluctuations or homogeneities in the quantity $N(t)$ are neglected, is given by the following differential equation [5,19]:

$$\frac{dN_i}{dt} = -c_i N_i(t), \tag{3}$$

where initial condition $N_t(t = 0) = N_0$ is the number of density of species i at time $t = 0, c_i > 0$. Solution of standard kinetic Eq. (3) is given by [19] as

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ORIGINAL ARTICLE

Fractional calculus approach to study temperature distribution within a spinning satellite

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KEYWORDS

Temperature distribution;
Fractional calculus;
Fractional differential equation;
Wright generalized hypergeometric function;
Laplace transform

Abstract This paper deals with the temperature distribution within spinning satellites and problem is formulated in terms of fractional differential equation. Applying fractional calculus approach, solution of this equation is obtained in terms of Wright generalized hypergeometric function, a generalization of exponential function.

1. Introduction

A spinning satellite is a satellite which has the motion of one axis held (relatively) fixed by spinning the satellite around that axis, using the gyroscopic effect. The attitude of a satellite or any rigid body is its orientation in space.

- The entire satellite including its antenna(s) spins.
- This means that the satellite's attitude is very stable because the satellite as a whole is acting as a gyroscope.
- Spinning can be achieved using rods with coils of wire around them.
- Current passing through the rods, creating magnetic fields around the wires.
- When this rod's magnetic field interacts with Earth's magnetic field, the rod begins to spin.
- An advantage of spin stabilized is it requires very little power.
- A disadvantage is that the solar panels cannot all collect power all the time because they will spin, so they don't face the sun once every rotation.
- Also, the instruments can only take measurements in one direction once every rotation.

Liu et al. [11] studied temperature distribution using improved thermal network model. The conventional thermal network model for satellite surface temperature distribution is directly solved by a new solution method on the basis of

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Electrospun Nanofibers of Poly(NPEMA-co.-CMPMA): Used as Heavy Metal Ion Remover and Water Sanitizer

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Abstract: Homo and copolymers of monomers 2-(N-phthalimido) ethylmethacrylate (NPEMA) and 4-Chloro-3-methyl phenyl methacrylate (CMPMA) were prepared in N,N-dimethyl formamide (DMF) solution at 70 °C using 2,2-azo-bisisobutyronitrile (AIBN) as initiator. The solution of poly(NPEMA-co.-CMPMA) in 20 % DMF was used to fabrication electrospun nanofiber by electrospinning technique. IR data were primarily employed to characterize polymers. The formation of nanofibers was identified by SEM study. The metal ion uptake capacity of copolymers and nanofibers were obtain by batch equilibrium method using different metal ion solution. The antimicrobial activity of the copolymers, Polymer nanocomposites and their nanofibers were tested against different microbial organisms by using quantitative method. The main objective of this investigation was to find whether nanofiber are better remover of metal ions compared to copolymers. It was also aimed to study the efficacy of nanofibers of copolymers and copolymer composite with nano Ag as water sanitizer.

Keywords: Copolymerization, Nanofibers, Electrospinning, Thermal properties, Adsorption, Antimicrobial activity

Introduction

Acrylate's and methacrylate's polymers have properties such as good transparency, weather-ability, chemical resistance, toughness, hardness, clarity and resistance to degradation by environment, because of these properties they have wide range of applications [1-13]. Reports on antimicrobial potential and heavy metal ion uptake by different acrylate/methacrylate copolymers are available [14-17]. The antibacterial polymers have attracted much attention because they minimize the environmental problems accompanying conventional disinfectants or antimicrobial agents with a low molecular weight. Due to their high surface area and pronounced micro and nano structural characteristics, the nanofibers of polymers find applications in many different areas like nano-catalysis, filtration and absorbent material, tissue scaffolds, drug delivery systems, wound healings, protective textiles, oil separation, storage cells, etc. [18-25]. A number of processing techniques such as drawing [26], template synthesis [27], phase separation [28], self-assembly [29], electrospinning [30], etc. have been used to prepare polymer nanofibers in recent years. Amongst the different ways of preparing nanofibre, electrospinning is commonly used since it is a simple, versatile and cost effective technique. In electrospinning, a solid fiber is generated as the electrified jet of viscous polymer solution is continuously stretched due to the electrostatic repulsion between the surface charges and evaporation of solvent.

Many researchers have successfully electrospun the polymers such as poly methylmethacrylate (PMMA) [31], Polyacrylonitrile (PAN) [32], polyvinyl alcohol (PVA) [33] and many more to nanofibers. Nanofibers with antibacterial activities are of global interest for their potential applications in various areas, particularly in medical devices, health care, hygienic applications, water-treatment, food packaging and storage. Because of more surface area, nanofibers offer greater interaction with microorganism leading to larger inhibition of the growth of microorganism [34-38]. Heavy metals pollutants in water can cause many serious ailments [39,40]. The conventional methods for the removal of toxic metal ions usually include chemical precipitation, reverse osmosis, electro deposition, ion exchange, evaporations, etc. However, most of these methods are either ineffective and/or very expensive, especially in removing heavy metals ions from very dilute solutions [41-45]. For the removal of heavy toxic metal ions adsorption is the most widely used method.

In this investigation we compare the antimicrobial activity and metal ion uptake by copolymers of NPEMA and CMPMA and their nanofibers. Antimicrobial activity was probed by quantitative method and uptake of different metal ions was studied by batch equilibrium method. The copolymers have been doped with nano Ag particles and their antimicrobial properties are judged against nanofibers.

The nanofibers are found to be good candidate for removal of metal ions and microorganism from water.

Experimental

Materials

Analytical grade N,N-Dimethyl formamide (DMF), Methanol, Phthalic anhydride, Ethanol amine, Benzoyl chloride, Methacrylic acid, Hydroquinone, Triethyl amine (TEA), 2,2-azobisisobutyronitrile (AIBN), Nickel nitrate, Cupric nitrate, Zinc nitrate, Lead nitrate and sodium salt of ethylene

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Bioproduction of D-Tagatose from D-Galactose Using Phosphoglucose Isomerase from *Pseudomonas aeruginosa* PAO1

Manisha J. Patel[1] · Arti T. Patel[1] · Rekha Akhani[1] · Samir Dedania[1] · Darshan H. Patel[1]

Received: 3 November 2015 / Accepted: 18 February 2016

Abstract *Pseudomonas aeruginosa* PAO1 phosphoglucose isomerase was purified as an active soluble form by a single-step purification using Ni-NTA chromatography that showed homogeneity on SDS-PAGE with molecular mass ~62 kDa. The optimum temperature and pH for the maximum isomerization activity with D-galactose were 60 °C and 7.0, respectively. Generally, sugar phosphate isomerases show metal-independent activity but PA-PGI exhibited metal-dependent isomerization activity with aldosugars and optimally catalyzed the D-galactose isomerization in the presence of 1.0 mM $MnCl_2$. The apparent *Km* and *Vmax* for D-galactose under standardized conditions were calculated to be 1029 mM (±31.30 with S.E.) and 5.95 U/mg (±0.9 with S.E.), respectively. Equilibrium reached after 180 min with production of 567.51 μM D-tagatose from 1000 mM of D-galactose. Though, the bioconversion ratio is low but it can be increased by immobilization and enzyme engineering. Although various L-arabinose isomerases have been characterized for bioproduction of D-tagatose, *P. aeruginosa* glucose phosphate isomerase is distinguished from the other L-arabinose isomerases by its optimal temperature (60 °C) for D-tagatose production being mesophilic bacteria, making it an alternate choice for bulk production.

Keywords *Pseudomonas aeruginosa* PAO1 · Phosphoglucose isomerase · D-Tagatose · D-Galactose

Introduction

D-Tagatose is a rare and safe ketohexose found in a gum exudate of the tropical tree *Sterculia setigera* [1]. Structurally, it is an isomer of D-galactose and C-4 epimer of D-fructose. The presence

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Research Article

Biochemical Leaning of Phosphoglucose Isomerase is More Towards Gluconeogenesis in *Pseudomonas aeruginosa* PAO1

Arti T. Patel, Rekha C. Akhani, Manisha J. Patel, Samir R. Dedania and Darshan H. Patel

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Abstract

Background: *Pseudomonas aeruginosa* is an opportunistic and highly versatile in metabolism. Whole genome sequence showed, the organism does not follow the normal glycolysis rather Entner-Doudoroff pathway for energy production. Whole genome sequence annotation shows the presence of glycolytic enzyme. It is important to study biochemical properties of glycolytic enzyme which may reveal the information for its role in other cellular processes. **Methodology:** Phosphoglucose isomerase, considered as a moonlighting protein by showing the role as an autocrine motility factor, cytokine, neuroleukin, differentiation and maturation factor. **Results:** The biochemical study revealed that the enzyme is most active under alkaline conditions with optimum pH of 8.0. The higher working temperature is 40°C and it does not require metal ions to initiate isomerization however, metal ion stabilizes the enzyme as compared to apoenzyme. The enzyme showed k_{cat}/K_m for glucose 6-phosphate and fructose 6-phosphate is ≈0.078 and ≈1.0 sec^{-1} mM^{-1}, respectively, which indicates that it has a role in gluconeogenesis rather than glycolysis. **Conclusion:** Amino acid sequence analysis establishes the evolutionary enzyme by showing conserved active site residues and share ≈48.13% identity with *Homo sapiens*.

Key words: *Pseudomonas aeruginosa*, phosphoglucose isomerase, moonlighting protein, glycolysis, gluconeogenesis

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Data Availability: All relevant data are within the paper and its supporting information files.

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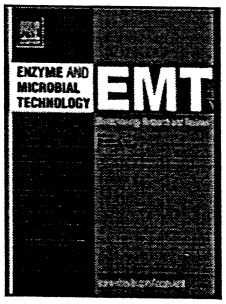

Title: Enhanced catalysis of L-asparaginase from *Bacillus licheniformis* by a rational redesign

Author: Ankit P. Sudhir Viplove V. Agarwaal Bhaumik R. Dave Darshan H. Patel R.B. Subramanian

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Enhanced catalysis of L-asparaginase from *Bacillus licheniformis* by a rational redesign

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Direct-Coated Photoconducting Nanocrystalline PbS Thin Films with Tunable Band Gap

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Dhaval Vankhade, Anjana Kothari & Tapas K. Chaudhuri

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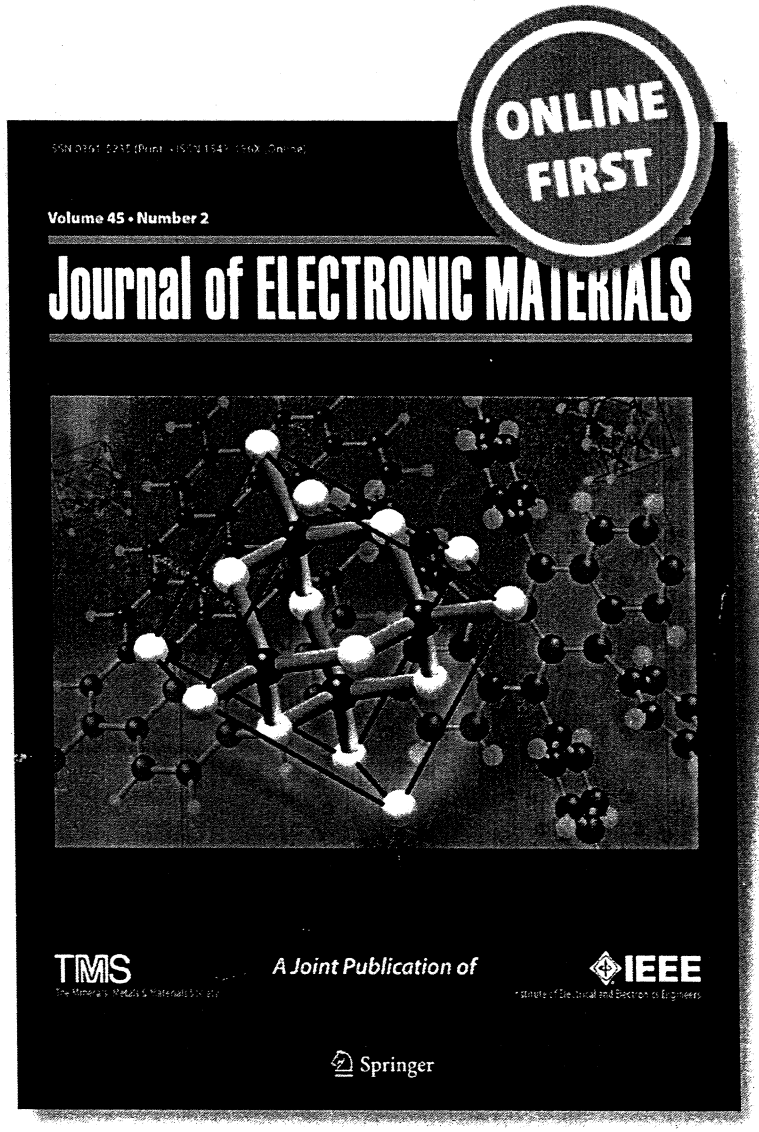

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Direct-Coated Photoconducting Nanocrystalline PbS Thin Films with Tunable Band Gap

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Nanocrystalline PbS thin films are deposited on glass by direct coating from a precursor solution of lead acetate and thiourea in methanol. A single coating has a thickness of 50 nm and greater thicknesses are obtained from layer by layer deposition. The films are smooth and shiny with roughness (rms) of about 1.5 nm. X-ray diffraction studies show that films are cubic PbS with crystallite size about 10 nm. The films are *p*-type with dark electrical conductivities in the range of 0.4–0.5 S/cm. These films are basically photoconducting. Photoconductivity monotonically increases with increase in thickness. The band gap of the films strongly depends on the thickness of the films. The band gap decreases from 2.4 eV to 1.6 eV as the thickness is increased from 50 nm to 450 nm. The tunability of the band gap is useful for technical applications, such as solar cells and photodetectors.

Key words: Lead sulfide, thin films, nanocrystalline, tunable band gap, photoconducting

INTRODUCTION

Films of nano-sized lead sulfide (PbS) has emerging as an extraordinary material for photovoltaics[1–16] and photodetectors[17–23] because of a significant size-dependent and tunable band gap.[24–26] Basically, normal bulk PbS is a IV–VI earth-abundant semiconductor with a narrow direct band gap of 0.41 eV at 300 K and absorption coefficient greater than 10^4 cm^{-1}. These photoconducting PbS films are used as near-infrared detectors with sensitivity in the wavelength range of 1–3 μm. PbS also has a large excitonic Bohr radius of 18 nm because of high dielectric constant 17.2 and low effective mass of electrons. Hence, it exhibits a strong quantum size effect for larger quantum dots (QDs) (< 18 nm) as compared to CdS or CdSe. Thus, the band gap of PbS QDs can be easily tuned from 0.41 (bulk) to 4 eV by selecting appropriate size.

PbS QDs synthesized by a hot-injection method using two distinct chemical routes.[27,28] The first method, described by Hines and Scholes,[27] is based on the reaction of lead oleate with bis(trimethylsilyl)-sulfide in octadecene which yields monodispersed QDs of sizes ranging from 2.6 nm to 7.2 nm. These QDs are bright but not fully air-stable. The second procedure suggested by Cademartiri et al.[28] utilizes the reaction between lead chloride and elemental sulfur in oleylamine as a solvent, producing QDs of sizes 4.2 nm and 6.4 nm. These QDs have a high PL quantum yield and thin films show good optical stability.

The fabrication of PbS QD devices as mentioned above is imperative to make thin films. PbS QD films are generally deposited by spin[15] or spray[29] from a suspension of QDs solvent. Before deposition of films, the QDs undergo several processing steps, such as controlled chemical synthesis with a capping agent, separation, removal of capping by ligand exchange and finally suspension in an appropriate solvent. These multi-steps not only render the QD film fabrication technique rather complex but also time consuming. Alternatively, a simple one-step deposition of nanoscale PbS thin films is desirable since it will simplify the fabrication of the devices.

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Optical and spectroscopic investigation of tunable size PbS nanocrystals embedded in insulating PVA matrix

Mitesh H. Patel[1,3] · Tapas K. Chaudhuri[1] · T. Shripathi[2] · U. Deshpande[2] · Vaibhav K. Patel[1,3]

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Abstract The thin film of Inorganic–Organic (Hybrid) nanocomposite (NCs) based on polyvinyl alcohol (PVA) and lead sulfide (PbS) have been synthesized using solution casting technique with different concentrations of PbS. The prepared films were characterized by X-ray diffraction (XRD) and Fourier transform infrared spectroscopy. The XRD confirms the presence of PbS nanoparticle (NPs) in PVA matrix. The morphology and thickness of NCs films were characterized by transmission electron microscopy and scanning electron microscopy, respectively. The optical transmittance (typically 220 nm) and photoluminescence spectra of NCs films were investigated in the wavelength range 300–2400 and 200–800 nm, respectively. The band gap of PbS NPs varies from 0.9 to 1.58 eV by altering the concentration of PbS.

1 Introduction

In the recent year fabrication of nano structured material and exploration of their properties have more magnetized to the researcher because of their physical and chemical properties that are characteristically different from their bulk. Inorganic compounds provide the potential for high carrier mobilities, band gap tunability, dielectric properties, thermal and mechanical stability. On the other hand, organic materials offer structural flexibility, convenient processing, tunable electronic properties and efficient luminescence.

Nanostructure materials particularly group IV–VI semiconductor have been more attracted to the researchers due to the unusual size dependent electrical and optical properties. The typical properties such as blue shift of the optical absorption, size dependent luminescence, exceptional third order non-linear effect [1] makes them captivating for the fabrication of photonic devices. The development of these type of semiconductor materials has led to the growth of a wide range of electroluminescent devices such as the infrared detector, sensors, solar cells [2–4], frequency stable lasers and light emitting diodes whose performance have been found to be modified significantly by the shape and size of the nanoparticles (NPs). Among the inorganic NPs, PbS NPs have received great attention because of their unique size dependent optical properties allow them extensive uses in numerous technological area such as, non-linear optical device [5–7], photo detectors [2, 3, 8], high refractive index material [9] and bulk heterojunction solar cells [4, 10–14] when it incorporates in the polymer matrix. The semiconductor nanocrystals (NC) are primarily studied for their enhanced optical properties. These optical properties are directly related to the size and size distribution of the NC which can be extracted from the optical absorption spectrum. If crystallite sizes are below the Bohr radius of both the holes and electrons in the semiconductor, strong quantum confinement occurs. Work with poly (vinyl alcohol) (PVA) as a stabilizer and matrix material for PbS has consistently shown shifted and featured absorption spectra. This was

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Novel gelatin-polyoxometalate based self-assembled pH responsive hydrogels: formulation and *in vitro* characterization

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ABSTRACT

The purpose of the study was to develop physically cross-linked novel pH-responsive gelatin – Wells–Dawson-type polyoxometalate (POM)-based self-assembled hydrogels using acrylic acid as a pH-responsive monomer. Cross-linking was achieved through electrostatic interactions between the cationic polymer and anionic Wells–Dawson POM $[P_2W_{15}O_{56}]^{12-}$. Ammonium persulfate and sodium hydrogen sulfite were used as initiators. The hydrogels were yellowish in color and exhibited low mechanical strength. Swelling, drug release, and pH sensitivity studies were conducted at pH 1.2 and 7.4. pH-dependent swelling and release of $[P_2W_{15}O_{56}]^{12-}$ from the prepared hydrogels were observed, with a maximum at pH 7.4. The hydrogels were characterized by thermogravimetric analysis, differential scanning calorimetry, scanning electron microscopy, and Fourier transform infrared spectroscopy for evaluation of the surface morphology, hydrogel confirmation, and thermal properties. The results obtained confirmed the development of a gelatin–POM-based self-assembled hydrogel. It can be concluded that as a result of successful physical cross linking, the prepared hydrogels possess desired characteristics of a drug delivery system and can hence be used for a controlled delivery of the encapsulated polyanions.

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KEYWORDS
Polyoxometalate; gelatin; hydrogel; self-assembling; pH responsive

1. Introduction

Hydrogels are three-dimensional hydrophilic cross-linked polymeric chain networks having high water content holding capacity [1,2] possessing aqueous solution as a solvent inside their structure.[3] Hydrogels retain their own structure and do not get dissolve because of formed chemical or physical linkages in between polymer chains.[4] Because of such exceptional soft and wet structure they are used as compatible materials for multiple applications like tissue engineering scaffolds, biosensors, and drug delivery. Hydrogels classification is dependent on constituting polymer source whether it is synthetic, hybrid, or purely natural. Cross-linking in hydrogels is either physical cross-linking mediated through non-covalent interactions, chemical cross-linking involving covalent interactions, or a combination of both. Water sorption inside the hydrophilic structure of hydrogels is through the osmosis, capillary action and hydration force balanced by the resisting expansion force offered by the cross-linked polymer chains.[5]

Controlled drug delivery systems offers an alternative way to regulate the therapeutic agents bioavailability in which an active therapeutic moiety is merged or placed in a polymeric structure in such a way that the material releases the drug in a predetermined desirable manner.[4] The drug released from a polymeric network structure depends on the formulation and the purpose of its application which may be anywhere either for few hours, to a month or for several years using various natural and synthetic polymers as drug delivery vehicles.[6]

Oftenly the uniform dispersal of the hydrophobic drug molecules in a high water content hydrogel is thermodynamically unstable. The chemical potential associated with concentration of drug promotes the drug redistribution and recrystallization outside or inside of the gel network. In order to cope with this stability issue one approach is the incorporation of the hydrophobic moieties into the hydrophilic nanoscale structures having reduced drug surface energy,[7] involving the use of certain functional groups which are chemically linked to the functional groups present in the polymer backbone leading to the formation of self-assembled structures attaining thermodynamic equilibrium state.[8] Forces involved in self-assembling gelation process are the physical interactions

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PAPER

Preparation and characterization of chemically deposited nickel sulphide film and its application as a potential counter electrode

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Abstract

Nickel sulphide (NiS) film has emerged as a counter electrode in many applications, such as thin film batteries, dye sensitized solar cells, and supercapacitors. In this regard, we report the direct liquid coating of pure hexagonal NiS films on glass using a precursor solution of nickel–thiourea complex. A uniform and void free film is observed using scanning electron microscopy. The room temperature electrical conductivity of ~5 × 10^3 S cm^{-1} and the positive thermoelectric power (+6 μV K^{-1}) specify p-type conduction. The temperature variation conductivity in the range 77–300 K depicts the transition of NiS films from conducting to semi-conducting behaviour at certain transition temperatures. Preliminary results from a cyclic voltammetry study shows the feasibility of NiS films as counter electrodes.

1. Introduction

Nickel sulphide (NiS) is a p-type semiconductor with a narrow band gap of 0.5 V, which exists in two polymorphs, hexagonal (α-NiS) and rhombohedral (β-NiS, millerite) [1]. Owing to its low toxicity and low cost as a binary semiconductor, NiS has been widely investigated as a cocatalyst with TiO_2 for the photocatalytic production of H_2 [2] (basically a hydrogen evolution reaction (HER)) for lithium-ion batteries [3, 4], supercapacitors [5, 6], and dye sensitized solar cells (DSSCs) [7, 8]. HER is basically a electrochemical reaction which requires an typical tree electrode geometry, including a counter electrode (CE). NiS as a CE has shown its capability to improve hydrogen (H_2) generation compared to the costly platinum (Pt) electrode [9]. Similarly, in lithium-ion batteries, NiS has received increasing attention as a cathode material because of its high lithium activity, high theoretical capacity (590 mAh g^{-1}), and high electrical conduction [3]. In both cases, NiS in the form of a CE was prepared mostly using the hydrothermal and solvothermal routes. In these routes thermal treatment was applied to the precursor solution for a long time, 48 h, followed by filtration and drying for several hours. Because of the aqueous reaction solution, the final electrode contains some impurities in addition to pure NiS, such as Ni hydroxide $Ni(OH)_2$, Ni, and Ni_2O_3. Supercapacitors have a different geometry, and NiS/conducting polymer composites were used as supercapacitor electrodes in [5] and [6]. They were prepared using the same solvothermal [5] and hydrothermal [6] routes, but with two steps each: one for the preparation of the Ni^{+2}/polymer complex and the second for the incorporation of sulphur into the Ni/polymer complex. This process is quite time consuming compare to the direct coating of the precursor layer.

In the case of DSSCs based applications, electrodeposited NiS as a CE has shown marked improvement in performance. Apart from electrodeposition, there are very few reports on the preparation of NiS in the form of films direct deposited by chemical routes. In the present work we perform and study the deposition of NiS films by a simple solution processed deposition procedure. Sun *et al* [7] reported the first deposition of NiS films using the electrodeposition process and their used as an electrode in DSSCs. They used the periodic potential reversal, in which the electrical current applied to the cell is reversed periodically. Ku *et al* [10] employed the same method for deposition of NiS films. Both observed the unwanted Ni and Ni_9S_8 phase on the optimized NiS CEs. Later, Chaung *et al* [11] demonstrated NiS films on a Ni base layer for DSSCs. Their Ni base layer and NiS films were

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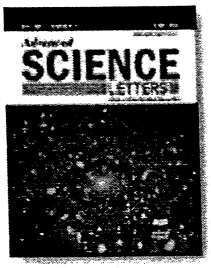

Facile One-Step Synthesis of PbS/Polyvinylpyrolidone Nanocomposite Films

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Films of PbS/polymer nanocomposites are generally prepared by two-step methods wherein PbS nanoparticles are first synthesized *in situ* polymer and then films are made by casting. In this paper, a simple one-step and rapid process for synthesis of films of PbS/polyvinylpyrolidone (PVP) nanocomposite by solid *in situ* thermolysis is reported. Precursor films are dip-coated on glass substrates from methanolic solution of lead acetate, thiourea and PVP. Shiny brown PbS/PVP films are produced by heating the precursor in air at about 100 °C for 10 min. X-ray diffraction and Transmission Electron Microscopy confirms the formation of PbS/PVP nanocomposite with nanoparticles of about 8 nm. The band gap of the PbS nanoparticles is 1.2 eV which blue-shifted from bulk value of 0.41 eV. Fourier Transformed Infrared Spectroscopy of nanocomposite reveals strong interaction between PbS nanoparticles and PVP.

Keywords: Nanocomposite; PbS Nanoparticles; PbS/PVP; in situ Thermolysis
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Direct-Coated Photoconducting Nanocrystalline PbS Thin Films with Tunable Band Gap

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Nanocrystalline PbS thin films are deposited on glass by direct coating from a precursor solution of lead acetate and thiourea in methanol. A single coating has a thickness of 50 nm and greater thicknesses are obtained from layer by layer deposition. The films are smooth and shiny with roughness (rms) of about 1.5 nm. X-ray diffraction studies show that films are cubic PbS with crystallite size about 10 nm. The films are *p*-type with dark electrical conductivities in the range of 0.4–0.5 S/cm. These films are basically photoconducting. Photoconductivity monotonically increases with increase in thickness. The band gap of the films strongly depends on the thickness of the films. The band gap decreases from 2.4 eV to 1.6 eV as the thickness is increased from 50 nm to 450 nm. The tunability of the band gap is useful for technical applications, such as solar cells and photodetectors.

Key words: Lead sulfide, thin films, nanocrystalline, tunable band gap, photoconducting

INTRODUCTION

Films of nano-sized lead sulfide (PbS) has emerging as an extraordinary material for photovoltaics[1–16] and photodetectors[17–23] because of a significant size-dependent and tunable band gap.[24–26] Basically, normal bulk PbS is a IV–VI earth-abundant semiconductor with a narrow direct band gap of 0.41 eV at 300 K and absorption coefficient greater than 10^4 cm^{-1}. These photoconducting PbS films are used as near-infrared detectors with sensitivity in the wavelength range of 1–3 μm. PbS also has a large excitonic Bohr radius of 18 nm because of high dielectric constant 17.2 and low effective mass of electrons. Hence, it exhibits a strong quantum size effect for larger quantum dots (QDs) (<18 nm) as compared to CdS or CdSe. Thus, the band gap of PbS QDs can be easily tuned from 0.41 (bulk) to 4 eV by selecting appropriate size.

PbS QDs synthesized by a hot-injection method using two distinct chemical routes.[27,28] The first method, described by Hines and Scholes,[27] is based on the reaction of lead oleate with bis(trimethylsilyl)-sulfide in octadecene which yields monodispersed QDs of sizes ranging from 2.6 nm to 7.2 nm. These QDs are bright but not fully air-stable. The second procedure suggested by Cademartiri et al.[28] utilizes the reaction between lead chloride and elemental sulfur in oleylamine as a solvent, producing QDs of sizes 4.2 nm and 6.4 nm. These QDs have a high PL quantum yield and thin films show good optical stability.

The fabrication of PbS QD devices as mentioned above is imperative to make thin films. PbS QD films are generally deposited by spin[15] or spray[29] from a suspension of QDs solvent. Before deposition of films, the QDs undergo several processing steps, such as controlled chemical synthesis with a capping agent, separation, removal of capping by ligand exchange and finally suspension in an appropriate solvent. These multi-steps not only render the QD film fabrication technique rather complex but also time consuming. Alternatively, a simple one-step deposition of nanoscale PbS thin films is desirable since it will simplify the fabrication of the devices.

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Electrical conduction of CZTS films in dark and under light from molecular solution ink

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Abstract

Cu_2ZnSnS_4 (CZTS) films were deposited by doctor blade printing from molecular solution ink. The molecular ink of metal-thiourea complex was synthesised without any capping in glutinous ethylene glycol. The resulting precursor films were subjected to heating in a furnace at 473 K in air and finally annealed at 623 K and 673 K, respectively for 1 hour in argon atmosphere. The films were pure kesterite CZTS as revealed from X-Ray diffraction and Raman spectroscopy. Electrical conductivity and hole mobility of the CZTS films increase with increasing annealing temperatures. The films were p-type and shows photoconductivity. To find out the dominant conduction mechanisms in these CZTS films, temperature variation of dark and photoconductivity has been investigated in the temperature range of 77 to 300 K. Both as-prepared and annealed films show nearest neighbour hopping below 200 K, while above 200 K the films dominated thermionic emission over grain boundary barriers.

Keywords: Molecular solution ink; CZTS; Electrical transport; Photoconductivity; Doctor-blade

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Electrochemical loading of TEM grids used for the study of potential dependent morphology of polyaniline nanofibres

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Key words. Nanofibre, polyaniline, sample loading, TEM.

Summary

An electrochemical method for loading electroactive materials over the TEM grid is reported. The protocol has been demonstrated using polyaniline as an example. The electroactive polymer was directly deposited over the Au TEM grid, used as working electrode in a 3 electrode electrochemical cell. The undisturbed as-deposited morphologies under the influence of various counter ions and *ex situ* electrochemical states have been studied and compared. Contrary to behaviour in bulk the individual polyaniline fibre was found thinner at anodic potentials. The movement of counter ions as a function of the electrochemical state of the polymer was studied using STEM-EDX elemental mapping.

The most crucial step in transmission electron microscopy (TEM) is the sample preparation. Albeit, several protocols have been exercised for loading the samples of various nature on the TEM grid (Williams & Carter, 1996), it is always arduous to transfer an electroactive material deposited on an electrode to the grid with its native morphologies. The only way is scratching or peeling the material from the electrode and loading over the grid (Zhang *et al.*, 2008; Lang *et al.*, 2009; Zhou *et al.*, 2015; Mu & Yang, 2008). Although this method has its own limitations and morphologies recorded thereon is always unreliable. Consequently reliable electron microscopy of the electroactive materials is limited to SEM only (Zhang & Wan, 2003; Muthukumar *et al.*, 2007; Zhang *et al.*, 2007, 2004; Karami *et al.*, 2012). Albeit few reports are known (Liu *et al.*, 2015) in the literature, where material grown on glassy carbon electrode were monitored *in situ* by TEM. Although high resolution cannot be achieved by this method as the beam current has to be kept low to prevent the sample from charring.

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Therefore, in current work we demonstrate an improved procedure of loading electroactive materials directly over the TEM grid using polyaniline (PANI) as an example. On account of material directly loaded over the TEM grid we were able to get high resolution images. The morphology of the polyaniline so deposited was investigated as a function of the size of counter ion as well as *ex situ* electrochemical potential and compared.

A unique property of conducting polymer that makes them a potential material for actuator applications is the dependence of its volume on the electrochemical state. It is known that during the redox cycling of conducting polymers the counter ions moves back and forth in the polymer matrix for charge neutrality (Kertész *et al.*, 1982; Duić & Mandić, 1992; Pei & Inganäs, 1992). This movement most commonly monitored through the electrochemical quartz crystal microbalance (EQCM) techniques (Xie *et al.*, 1997; Mahmoud *et al.*, 1998; Inzelt *et al.*, 1999; Cohen *et al.*, 2003; Xie *et al.*, 2007), radiotracer method (Inzelt & Horányi, 1987), optical beam deflection (Lopez *et al.*, 1994) and video microscopic observations (Lizarraga *et al.*, 2004, 2005). Although these techniques are not specific and manifest only weight and/or volume change. Consequently, the movement of specific counter ion in the polymer matrix as a function of potential has also been studied using STEM-EDX elemental mapping.

The electrodeposition was carried out in a custom made 3 electrode electrochemical cell. The schematic diagram and actual photograph of the cell are given in Figure S1a and S1b in ESI. The cell was fabricated using a teflon block. A well of 3.1 mm diameter and 6 mm depth was engraved at the top of the block to fit 3 mm TEM grid, as shown in Figure S1a. The length of the block was kept significantly long for fastening it during the experiment. A hole was made from the lateral side through which a platinum wire (0.5 mm diameter) was interleaved for the working electrode connection. The hole was then sealed with an epoxy to avoid any leakage of the electrolyte. A 3 mm HOPG (Highly Ordered Pyrolytic Graphite) disk was then placed in the bottom of the well but above the

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Fluorescence characteristics of carbon nanoemitters derived from sucrose by green hydrothermal and microwave methods

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ABSTRACT

In this work, fluorescent carbon nanoparticles (CNPs) were prepared through two green methods i.e. microwave and hydrothermal, using sucrose as carbon precursor. Both of these methods have offered fluorescent CNPs as characterized by TEM, FTIR, zeta potential, absorbance and emission techniques. Excitation dependent emission spectra were exhibited by aqueous dispersion of these CNPs when they were subjected to different excitation wavelengths. The luminous characteristics of CNPs obtained from both of these methods were studied and compared. Their fluorescence stability in water and buffer was monitored for about three months. Influence of pH and various metal ions on emission spectra were investigated.

1. Introduction

As compared to traditional organic fluorophores and semiconductor quantum dots, fluorescent carbon nanoparticles (CNPs) shows excellent properties such as tunable photoluminescence, biocompatibility, hydrophilicity and low/no toxicity [1–7]. Unique properties and potential applications of fluorescent CNPs in the fields such as sensing, bioimaging and drug delivery have attracted significant attention over the recent years [8,9]. Benign nature of fluorescent CNPs is one of their most interesting and enjoyable property [10,11]. There are two main types of approaches for preparation of fluorescent CNPs i.e. top-down approach and bottom-up approach. With top-down approaches, these are prepared by break down of bulk carbonaceous materials such as soot, graphite, and activated carbon [12]. With bottom-up approaches, these are prepared from carbonization of organic precursors such as dopamine and carbohydrate. Hydrothermal and microwave methods have been employed towards their green preparation of fluorescent CNPs. There are ample examples of green hydrothermal or microwave methods reports wherein natural precursor such as sweet potato, grass, pomelo peel, flour, strawberry juice, citrus lemon juice, and honey have been utilized for the preparation fluorescent CNPs [13–19]. On the other hand, using organic precursors such as formaldehyde, dopamine, saccharide, and ascorbic acid, limited green methods are reported for their preparation [20–23]. Organic precursors are mainly utilized with acid/alkali treatment, which makes the method environment unfriendly. For example, preparation methods using sucrose with sulphuric/phosphoric acid, lactose with sulphuric acid and glucose/sucrose/starch with NaOH/HCl are reported [24–27]. Therefore, it is highly desirous to develop green methods for the preparation of fluorescent CNPs using inexpensive and commonly available organic precursors.

To our knowledge, there is no report in the literature wherein two green methods have been employed using same carbon precursor (organic precursor) for preparation of fluorescent CNPs along with comparison of their fluorescent characteristics. In this work, we have employed green hydrothermal and microwave methods to obtain hydrophilic and fluorescent CNPs using sucrose as carbon precursor (organic precursor). Fluorescent CNPs obtained from both the methods were characterized by TEM, FTIR, zeta potential, absorbance and emission techniques. Fluorescent characteristics of CNPs obtained from hydrothermal and microwave pyrolytic methods were compared. Their fluorescence stability in water and buffer was monitored for about 3 months. Important investigations like effect of pH and metal ions on their fluorescence spectra were undertaken.

2. Experimental

2.1. Preparation of fluorescent CNPs

2.1.1. Microwave method

Fluorescent carbon nanoparticles (CNPs) were prepared by microwave methods using sucrose as carbon source. A 10 ml clear solution

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Temperature dependence quasi-static measurements on a magnetorheological fluid having plate-like iron particles as dispersed phase

Zarana Laherisheth and Ramesh V Upadhyay

Abstract

In this work, the field-dependent rheological properties of the magnetorheological fluid system, featuring plate-like iron particles, at different magnetic fields in quasi-static mode are investigated using MCR 301 magnetorheometer at ambient temperature. At an intermediate field strength, static yield stress exhibits $H^{1.5}$ dependency, eventually becoming field independent at higher field. Later on, the temperature-dependent properties are analysed at the different magnetic field intensities. Observational data are obtained from magnetic field ranging from 0.0 to 1.1 T and in the temperature range 30°C–120°C. It is noted that at low field strength, the static yield stress increases initially with temperature and decreases with further increase in temperature. A yield stress model is suggested based on the average normalized sensitivity and magnetic field to describe the measured variation in the magnetorheological fluid response at higher temperature. This information will be useful for predicting thermal sensitivity of device performance.

Keywords

magnetorheological fluids, temperature dependence, static yield stress, power-law scaling

Introduction

Magnetorheological (MR) fluids are smart materials which show the change over from liquid to a nearly solid-like state under the influence of external magnetic fields (MR effect) in a few milliseconds. This remarkable property makes MR fluid a very good material for many applications (Jolly et al., 1999; Wereley, 2014). In the absence of magnetic fields, the MR suspensions have a relatively low viscosity and behave as Newtonian fluids. Yet, when a magnetic field is applied, particles magnetize and form chain-like structure along the field direction. As an effect, MR fluid exhibits large yield stress and is of special interest in torque-transfer applications such as shock absorbers, brakes, and clutches (Goldasz and Sapinski, 2012; Ha et al., 2013; Liu et al., 2006; Olabi and Grunwald, 2007; Park et al., 2006).

The key parameter that characterizes the viscoplastic properties of MR fluid is the yield stress, a critical value of shear stress when a viscoplastic fluid began to flow. The yield stress is a measure of magnetic field–induced structural strength. The value of yield strength depends on the applied magnetic field intensity, volume fraction of magnetic particles, particle shape and so on. Previous studies report mainly on the above variable parameters.

A number of models have been proposed to describe the variation of yield stress with a magnetic field (refer review article by Ghaffari et al., 2014). These can be broadly divided into two groups: macroscopic and microscopic models. The macroscopic model assumes a homogeneous structure and utilizes the magnetic energy minimization principle, while the microscopic model takes into account interparticle interactions. In most of these cases, the shear stress is higher than magnetostatic interaction between particles and shear-induced deformations are assumed to be affine. However, for conventional MR fluid, microscopic model of Ginder et al. (1996) that includes the anisotropic polar magnetostatic interaction between particles provides reasonable

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Synthesis, characterization and *in silico* designing of diethyl-3-methyl-5-(6-methyl-2-thioxo-4-phenyl-1,2,3,4-tetrahydropyrimidine-5-carboxamido) thiophene-2,4-dicarboxylate derivative as anti-proliferative and anti-microbial agents

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ABSTRACT

A series of eight compounds diethyl-3-methyl-5-(6-methyl-2-thioxo-4-phenyl-1,2,3,4-tetrahydropyrimidine-5-carboxamido) thiophene-2,4-dicarboxilate (KM_{10-17}) analogues have been prepared by conventional methods and characterized by IR, Mass, NMR and elemental analysis. *In silico* docking studies on Human topoisomerase IIbeta (PDB Id: 3QX3) have been performed for all molecules (KM_{10-17}) synthesized. The compounds were tested for *in vitro* anti-proliferative activity on **VERO** and **786-O** cell lines. Out of all the synthesized compounds, KM_{11} & KM_{16} showed moderate activity on both cell lines. *In vitro* anti-microbial activity was also checked against *Bacillus subtilis* (**BS**), *Staphylococcus aurous* (**SA**), *Pseudomonas aeruginosa* (**PA**), *Escherichia coli* (**EC**) and *Candida albicans* (**CA**) by well diffusion method. The compound KM_{11} was found to have highest zone of inhibition against **BS**, **SA**, **PA** and **EC**. The molecules KM_{13} and KM_{16} exhibited good activity against **CA**. The compounds KM_{14} and KM_{16} indicated good zone of inhibition against **BS**.

1. Introduction

Renal cell carcinoma (RCC) is quite common and accounts for approximately 90% of all renal malignancies [1]. There was a 1.5:1 predominance ratio in men over women, mainly occurring between 60 and 70 years of age. A first-degree kidney cancer was also associated with an increased risk of RCC [2,3].

Pyrimidine derivatives are used to treat cancer as chemotherapy drugs [4]. In recent time, interest in dihydropyrimidine (DHPM) has increased because of its anti-carcinogenic [5], anti-microbial [6] activities. The multifunctional DHPM was prepared from Biginili type of multicomponent reactions [7]. Thiophene and its derivatives are the key structural moieties in heterocyclic chemistry and occupy a significant position in biological and medicinal chemistry. They exhibit a broad spectrum of pharmacological activities such as anti-hypertensive [8], anti-cancer [9,10] and anti-inflammatory [10] activities.

The present study aims at synthesizing derivatives of diethyl-3-methyl-5-(6-methyl-2-thioxo-4-phenyl-1,2,3,4-tetrahydropyrimidine-5-carboxamido) thiophene-2,4-dicarboxilate (KM_{10-17}). The molecules are characterized by IR, elemental, Mass and NMR techniques. *In silico* docking studies of these compounds KM_{10-17} was performed on human topoisomerase IIbeta enzymes (PDB ID: **-3QX3**). On the basis of these studies three analogues i.e. KM_{11}, KM_{14} and KM_{16} were tested on **VERO** and **786-O** cell lines. The anti-microbial properties of all the molecules were evaluated on gram positive bacteria, gram negative bacteria and fungus.

2. Material & methods

2.1. Chemistry

All the reagents were obtained commercially and used without further purification. Melting points (°C) were determined in open capillaries on digital melting point apparatus and were uncorrected. Precoated silica gel plates (silica gel 0.25 mm, 60 G F 254; Merck, Germany) were used for thin layer chromatography. Mass Spectra were recorded on LCQ Fleet and TSQ quantum access with

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Research paper

Synthesis and biological screening of novel 2-morpholinoquinoline nucleus clubbed with 1,2,4-oxadiazole motifs

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ABSTRACT

Novel series of 2-morpholinoquinoline scaffolds (**6a-n**), containing the 1,2,4-oxadiazole and moiety, was designed and synthesized in good yield (76–86%). The synthesized compounds were screened for their preliminary in *vitro* antimicrobial activity against a panel of pathogenic strains of bacteria and fungi. Molecular docking and pharmacokinetic study were carried out for the prepared compounds. The cytotoxicity of the synthesized compounds was tested at different concentrations using bioassay of *S. pombe* cells at the cellular level. The effect of synthesized compounds on the DNA integrity of *S. pombe* was observed on agarose gel. Compounds **6d**, **6e**, **6g**, **6h**, **6j** and **6n** exhibited excellent antimicrobial potency as compared to the standard drugs (i.e Ampicillin, Norfloxacin, Chloramphenicol, Ciprofloxacin) Compounds **6d**, **6e**, **6g**, **6k** and **6n** were found to have significant antifungal activity as compared to griseofulvin. Compounds **6f**, **6i**, **6k**, **6l** were found very less cytotoxic, while compounds **6d**, **6e**, **6g**, **6h** were found to exhibit maximum toxicity. The rest of the synthesized compounds were found to be moderately toxic.

1. Introduction

The occurrence of microbial and fungal infections has increased notoriously in current years [1,2]. Resistance to antimicrobial agents has increased health concerns cost and resulted in mortality and morbidity from treatment failures [3,4]. The development of novel structure leads remains a key challenge for medicinal chemists to design new, effective and broad spectrum antimicrobial and antifungal. The search for new antimicrobial drugs is an area characterized by active investigation with the goal of overcoming the phenomenon of multiple drug resistance strains of bacteria and fungi [5–7]. There is an imperative need to discover and develop novel antibacterial and antifungal agent with novel mechanism of action and enhanced activity profile, high potency without or with at least reduced systemic adverse effects. Aforementioned consequences motivated us to construct quinoline and morpholine core in one molecule which may play vital roles as significant building blocks in the targeted compounds bearing 1,2,4-oxadiazole moiety (**6a–n**).

Quinoline is the key building core for many naturally occurring (cinchona alkaloids) compounds and pharmacologically active substances. It demonstrates a broad range of biological activity such as antimalarial [8], antituberculosis [9], anti-HIV [10], antifungal, antibacterial, antiprotozoic and antibiotic activities [11]. *N*-Functionalized morpholine motifs have been recognized to possess diversified biological activities such as antiemetic [12,13], antidiabetic [14], inflammatory migraine and asthma [15,16], platelet aggregation inhibitors [17]. Moreover, 1,2,4-oxadiazole, known as an ester isostere, is present in a variety of biologically active compounds, such as benzodiazepine receptor ligands, muscarinic receptor agonists and 5-HT3 receptor antagonists [18]. 1,2,4-

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Effect of Growth Parameters on the Optical Properties of ZnO Nanostructures Grown by Simple Solution Methods

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Abstract. ZnO, a wide band gap semiconductor is of significant interest for a range of practical applications. One of the highly attractive features of ZnO is to grow variety of nanostructures by using low-cost techniques. In this paper, we report deposition of ZnO nanostructure rod-arrays (NRA) via low-temperature, solution-based deposition techniques such as chemical bath deposition (CBD) and microwave-assisted chemical bath deposition (MACBD). A detailed study of film deposition parameters such as variation in concentration of precursors and deposition temperature has been carried out. Compositional and structural study of the films has been done by X-ray Diffractometer to know the phase and purity of the final product. Morphological study of these structures has been carried out by Scanning Electron Microscopy. Optical study such as transmittance and diffuse reflectance of the films has been carried out as a function of growth parameters.

INTRODUCTION

Zinc oxide is a technically important semiconducting oxide possessing diverse and remarkable properties, such as, broad direct energy band gap (~3.3 eV) at R.T., piezoelectricity, optical absorption and emission, chemical stability and biocompatibility. Being a nontoxic, abundant and inexpensive semiconductor, it is now being used in a wide variety of applications ranging from solar cells to sensors. Deposition of these films from aqueous solutions by CBD and MACBD, simple and economic methods, are considered to be highly promising for large area applications [1]. This paper presents the structure dependent optical properties of CBD-/ MACBD ZnO nanostructure films.

EXPERIMENTAL

ZnO films were deposited from an aqueous chemical bath of $Zn(NH_3)_4^{2+}$. The typical deposition procedure has been given in our earlier reports [2,3]. In the present study, ZnO films were deposited at different temperatures, 55, 65, 75 and 85 °C on seed layer coated (SLC) glass substrates by CBD and MACBD techniques. The seed layer of thickness 20 nm was deposited by dip-coating method at 400 °C. The concentration of precursor solution (PS) varies as 0.025, 0.05, 0.075 and 0.1 M. The composition and texture of the films were determined from X-ray diffraction (XRD) plots (θ–2θ) recorded with a Bruker X-ray diffractometer (using Ni-filtered CuK_α radiation) from 20 to 80 degree. The morphology and structure of the films was studied by a Jeol (JSM-5610LV) scanning electron microscope. The transmittance (T) and diffuse reflectance (R) spectra of the films were measured from 300 to 1400 nm with a Shimadzu 2600 UV visible NIR spectrophotometer.

RESULTS AND DISCUSSION

Semitransparent, adherent and uniform ZnO films were formed on the lower side of SLC glass substrate. Figure 1(a) represents X-ray diffractogram (XRD) of ZnO films deposited at various deposition temperatures. It shows dominantly very sharp and strong (002) lines indicating the films are preferentially oriented along the c-axis. All the peaks match very well with the standard data (JCPDS: 36-1451). The corresponding scanning electron micrograph (SEM) is depicted in Fig. 1(b). The films consist of rods having dia. 250 – 880 nm and length ~ 1330 nm. The rods are distinct and possess narrow gaps in-between. The length on NRA increases with the deposition temperature. Such variation of NRA length (300 – 500 nm) has been observed for ZnO films deposited at 80 °C by Poornajar et al

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Optical Properties of PbS/PVP Nanocomposites Films

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Abstract. PbS/Polyvinylpyrrolidone (PVP) nanocomposites films with different volume fraction of PbS have been deposited from single molecular precursors. X-ray diffraction patterns conforms the formation of PbS nanocrystals in PVP matrix. The transmission spectra of the films in the wavelength range of 300 to 2400 nm show the absorption edges are blue shifted due to formation of PbS Nanoparticles. The band gap determined are 2.4, 1.5 and 1.25 eV for PbS volume fraction of 8.5, 16, 27%, respectively. The corresponding refractive indices, n determined from Fresnel relation are 1.8, 2, and 2.35 which are in between that of PbS (4.2) and PVP (1.48).

INTRODUCTION

Inorganic-polymer nanocomposites films are of interest since they have remarkable optical properties, such as, non-linear optical constants, high refractive index and longpass cutoff tunability due to the semiconducting inorganic nanoparticles embedded in polymer matrix [1]. Different inorganic nanoparticles, such as, PbS, ZnS, CdS, AgS, HgS, Cu_2S, ZnO, etc have been used for preparing nanocomposites. Among these, lead sulfide (PbS) has exceptionally large excitionic Bohr radius of 18 nm and high refractive index of 4.2, yielding size-dependent band gap from 0.5 to 3.5 eV. Thus, there are few reports [2-5] on PbS/polymer nanocomposites as optical material with high refractive index. Polymers investigated are gelatin [2], poly (ethylene oxide) (PEO) [3], polythiourethane (PTU) [4] and polyvinyl alcohol (PVA) [5].

Zimmermann et al. [2] in 1993 were the first to report the increment in refractive indices of PbS/gelatin films from 1.5 to 2.5 as the PbS volume fraction increased from 0 to 55 %. Year later, Kyprianidou-Leodidou et al. [3] investigated the refractive indices of PbS/PEO nanocomposites with different sizes of PbS nanoparticles ranging from 4 to 80 nm. Refractive indices were determined at 632.8 and 1295 nm by ellipsometry. The refractive index of PbS/PEO varied from 1.7 to 3.9. It was found that for PbS particle sizes below 25 nm, the refractive index decreased linearly with decrease in size. High refractive index PbS/PTU nanocomposites were also studied by Lu et al. [4].The refractive index of nanocomposites varied from 1.612 to 2.055 as the volume fraction of PbS varied from 1.3 to 10.2 %. Recently, Abdullah et al. [5] reported the structural and optical properties of PbS/PVA nanocomposites with varying concentrations of PbS. The band gaps of PbS/PVA were in the range of 3.14 to 2.35 eV for PbS volume fraction of 3.59 to 13.1 %. Literature survey reveals that the studies on optical properties PbS/polymer nanocomposites are very few. However, there has been no report on nanocomposites of PbS nanoparticles and polyvinylpyrrolidone (PVP). In this paper we report the optical properties of PbS/ PVP nanocomposite films.

EXPERIMENTAL

Nanocomposites films of PbS/PVP with different volume fraction of PbS were synthesized on glass substrates by our method reported [6] earlier from a precursor solution of lead acetate, thiourea, and PVP dissolved in

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Effect of Light on Hopping Conduction in Kesterite CZTS Thin Films

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Abstract. Mott variable range hopping conduction in dip-coated CZTS thin films has been studied in the temperature range of 77 to 150 K in dark and under different light intensities. The films were basically p-type and photoconducting. Various hopping parameters such as, Mott characteristic temperature, density of states at Fermi level, hopping distance and hopping energy of the CZTS films were investigated for different light intensities.

INTRODUCTION

Copper zinc tin sulphide (Cu_2ZnSnS_4/CZTS) is an earth-abundant and non-toxic semiconductor which if used as an absorber layer is expected to yield cost-competitive thin film solar cells [1]. A thorough understanding of the electrical transport properties of CZTS films is essential since these layers form a vital part of an electronic device (photovoltaic). Thus, electrical properties of polycrystalline CZTS films have been investigated from 16 to 400 K by various researchers [2-6]. Kosyak et al. [2] were first to investigated the transport properties of CZTS films as a function of temperature (30 to 300 K). The dominant mode of electronic transport was found to depend on the temperature range: thermionic emission (TE) over grain boundary (GB) barriers (150 to 300 K), nearest neighbour hopping (NNH) (70 to 150 K) and Mott variable range hopping (M-VRH) (30 to 70 K). Polycrystalline CZTS films generally have intrinsic defects [7], such as, Cu-on-Zn (Cu_{Zn}) antisites and Cu vacancy (V_{Cu}) along with [$2Cu_{Zn}$+Sn_{Cu}] clusters. Hence, at low temperatures conductivity of CZTS films is because of hopping, such as, NNH, Efros-Shklovskii variable range hopping (ES-VRS) and M-VRH. Gonzalez et al. [3] found that the conductivity of CZTS films is due to M-VRH from 100 to 180 K which turns into ES-VRH below 100 K. For spin-coated sol-gel CZTS films, Guo et al. [4] reported M-VRH in the temperature range of 40 to 175 K. Films prepared by ultrasonic spray pyrolysis by Ansari and Khare [5] showed NNH from 170 to 250 K and M-VRH from 70 to 170 K. Recently, Hamdi et al. [6] also scrutinized the temperature dependence of AC and DC electrical conductivity of polycrystalline CZTS and $Cu_2ZnSnSiS_4$ powder in the temperature range of 80 to 140 K depending on variable range hopping conduction. However, all the studies on hopping conduction are in dark and there are no reports on the effect of illumination on hopping conduction. In this paper we report the dark and photo-conductivity of dip-coated CZTS films in the temperature range of 80 to 150 K where M-VRH predominates. It is found that photo-conductivity in these films is also due to M-VRH. The hopping parameters have been evaluated for different level of illumination.

EXPERIMENTAL

The CZTS thin films were deposited on glass substrates by dip-coating from a methanolic solution of Cu^{+2}, Zn^{+2}, Sn^{+2} and thiourea as reported by Chaudhuri and Tiwari [8]. The thickness of CZTS film thus deposited is about 90 nm. To obtain higher thicknesses, the substrate was coated layer-by-layer. Typically, 5 times coated films (~ 450 nm) were used for this investigation. For electrical measurements gap cells (~ 2 mm) were fabricated with graphite paint (Ted Pella) as ohmic contacts. A two-probe method was used to measure the resistivity/conductivity of the

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Temperature dependence electrical conduction of solution-processed CZTS films in dark and under light

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Abstract. Electrical conduction of solution-processed Cu_2ZnSnS_4 (CZTS) films has been reported in dark and under light in the temperature range of 85 to 300 K. The films show nearest neighbor hopping mode of transport at below 200 K, while above 200 K the films were dominated by thermionic emission over grain boundary barriers, following, Seto's model for polycrystalline films. The hopping energy and grain boundary barrier height of CZTS films are found be decreases under illumination due to the photoconductivity. The films were pure kesterite CZTS as revealed from X-Ray diffraction and Raman spectroscopy.

1. Introduction

Cu_2ZnSnS_4 (CZTS) is emerging as the most promising absorber material for cost effective thin films solar cells (TFSCs) now a day's [1]. CZTS is p-type with a direct near-optimal band gap of 1.4 to 1.5 eV and high absorption co-efficient of above 10^4 cm^{-1} in the solar spectrum. Hence, it can be regarded as an alternative to conventional TFSC absorbers such as CdTe and $Cu(In,Ga)Se_2$ (CIGS). Recently, a conversion efficiency of 12.6 % has been achieved by depositing CZTSSe using a hydrazine ink based pure solution [2]. However, the performance of CZTS-based solar cells is still far away from the 20.8 % efficient CIGS devices. To enhance the photo conversation efficiency of solar cells, the basic electrical properties of the CZTS, especially temperature dependence of electrical conductivity is being vigorously studied all over the world [3-8]. Electrical properties of polycrystalline CZTS films in dark have been investigated from 10 to 300 K by various researchers [3-5]. However, under light, the report has been sparse [6-8]. Generally, the electrical conductivity can be governed by (a) Mott Variable Range Hopping (M-VRH), (b) Nearest Neighbour Hopping (NNH) and (c) Thermionic Emission (TE) over Grain Boundary (GB) barriers. The dominant mode of electronic transport was found to depend on the temperature range: TE over GB (150 to 300 K), NNH (70 to 150 K) and M-VRH (30 to 70 K). M-VRH is generally applicable to amorphous kind of materials and at below 50 K where electrons do not have enough energy to cross the potential barrier. Hence, in present case, M-VRH model is not expected in our

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Certain Properties of Modified Laguerre Polynomials Via Lie Algebra

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Abstract: The aim of present paper is to discuss some operators defined on a Lie algebra for the purpose of deriving some properties of modified Laguerre polynomials.

Keywords: Lie algebra, Modified Laguerre polynomials and Differential equation.

1 Introduction

Many important classical differential equations has connection with Lie theory. The interplay between differential equations, special functions and Lie theory is particularly play important role in mathematical physics. Radulescu [1] has discussed some properties of Hermite and Laguerre polynomials [2] using some operators defined on a Lie algebra. Further Mandel [3] obtained some properties of simple Bessel polynomials considered by Krall and Frink [4]. Pathan and Khan [5] discussed some properties of two variable Laguerre polynomials studied by Dattoli and Torre [6,7].

The Modified Laguerre polynomials (McBride [8]), defined as

$$f_n^{\beta}(x) = \frac{(\beta)_n}{n!}\,{}_1F_1\left[\begin{matrix}-n;\\ 1-\beta-n;\end{matrix} x\right] = (-1)^n L_n^{-\beta-n}(x) \quad (1)$$

Then $f_n^{\beta}(x)$ satisfies the two independent differential recurrence relations

$$\frac{d}{dx}(f_n^{\beta}(x)) = f_{n-1}^{\beta}(x) \quad (2)$$

and

$$x\frac{d}{dx}(f_n^{\beta}(x)) = (x+n+\beta)f_n^{\beta}(x) - (n+1)f_{n+1}^{\beta}(x) \quad (3)$$

Also (5) and (6) determine the ordinary differential equation

$$x\frac{d^2}{dx^2}(f_n^{\beta}(x)) + (1-\beta-n-x)\frac{d}{dx}f_n^{\beta}(x) + n f_n^{\beta}(x) = 0 \quad (4)$$

2 Main Result

Let $End\ V$ be the Lie algebra of endomorphisms of a vector space V, endowed with the Lie bracket $[\cdot,\cdot]$ defined by $[A,B] = AB - BA$, for every $A, B \in End\ V$. The main result of the paper is as follows.

Theorem 1. *Let $A, B \in End\ V$ be such that $[A,B]y_n = -y_n$, where the sequence $(y_n)_n \subset V$ is defined as follows: $Ay_0 = 0$ and $By_n = -(n+1)y_{n+1}$, for every $n \geq 1$. Then $Ay_n = y_{n-1}$ and y_n is an eigenvector of eigenvalue $-n$ for BA, for every $n \geq 1$.*

Proof: First, we shall prove

$$Ay_n = y_{n-1}, \text{ for every } n \geq 1.$$

For $n = 1$, this equality is evident, because

$$[A,B]y_0 = -y_0,$$

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Application of an industrial waste magnetic iron dust as a solid phase support for immobilizing enzyme of industrial applications

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Abstract

Magnetic iron dust, a byproduct by many chemical industries that performs the reduction of nitro compounds to amine, was used for laccase immobilization. The characterization of magnetic iron dust was done by X-ray diffraction, Fourier-transform infrared, and dynamic light scattering. Biodegradable polymer, chitosan, was coated on to the magnetic iron dust by reverse phase suspension method, which was confirmed by Fourier-transform infrared analysis. Immobilization of the laccase enzyme was done onto the chitosan-coated and non-coated magnetic iron dust. The immobilization was monitored by Fourier-transform infrared analysis. Binding efficiency, optimum pH, and optimum temperature for these immobilized laccases were investigated. X-ray diffraction pattern of magnetic iron dust confirmed presence of magnetite (Fe_3O_4) and maghemite (γ-Fe_2O_3) with a particle size of 529.6 nm measured by dynamic light scattering. Laccase was immobilized on chitosan-coated and non-coated magnetic iron dust,

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Assessment of Growth Factors Secreted by Human Breastmilk Mesenchymal Stem Cells

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Abstract

Introduction: Human breastmilk is a dynamic, multifaceted biological fluid containing nutrients, bioactive substances, and growth factors. It is effective in supporting growth and development of an infant. As breastmilk has been found to possess mesenchymal stem cells, the importance of the components of breastmilk and their physiological roles is increasing day by day. The present study was intended to identify the secretions of growth factors, mainly vascular endothelial growth factor (VEGF) and hepatocyte growth factor (HGF), from human breastmilk mesenchymal stem cells under basal conditions of in vitro cell culture using synthetic media and human cord serum.

Materials and Methods: The growth factors were analyzed with the enzyme-linked immunosorbent assay technique.

Results: The cultured mesenchymal stem cells of breastmilk without serum revealed significant differences in secretions of the VEGF and HGF growth factors (8.55 ± 2.26402 pg/mL and 230.8 ± 45.9861 pg/mL, respectively) compared with mesenchymal stem cells of breastmilk with serum (21.31 ± 4.69 pg/mL and 2,404.42 ± 481.593 pg/mL, respectively).

Conclusions: Results obtained from our study demonstrate that both VEGF and HGF are secreted in vitro by human breastmilk mesenchymal stem cells. The roles of VEGF and HGF in surfactant secretion, pulmonary maturation, and neonatal maturity have been well established. Thus, we emphasize that breastmilk-derived MSCs could be a potent therapeutic source in treating neonatal diseases. Besides, due to its immense potency, the study also emphasizes the importance of breastfeeding, which is promoted by organizations like the World Heatlh Organization and UNICEF.

Introduction

A MEDLINE SEARCH USING ONLY the phrase ''human milk composition'' reveals a steady increase in the number of scientific publications. This postulates the extraordinary new components of breastmilk are still being identified and studied for their potential in infant health. Recently, breastmilk has been introduced as a new source of stem cells.

The mammary gland is a metabolically active, dynamic organ that undergoes significant changes during pregnancy, lactation, and transformation.[1] Breastmilk is the secretory product of this mammary gland in the postpartum period. It is contemplated to be a dynamic, multifaceted biological fluid containing nutrients, bioactive substances, and growth factors. It provides growth, development, immunity, and protection to the newborn from various gastrointestinal and respiratory infections.[2]

The reappearance and remodeling of mammary gland tissue and its ability for expansion point out the existence of stem and progenitor cells in the mammary gland. Human breastmilk has been found to possess a putative mammary stem cell population with expression markers such as CK5, CK14, CK19, and nestin.[3,4] In addition, it is also identified as harboring heterogeneous unique cellular components like mesenchymal stem cells (MSCs), hematopoietic stem cells, side population cells, and endothelial cells.[3,5] As a result this breastmilk-derived stem cell population is believed to possess great potency for the treatment of a wide variety of neonatal diseases without any special intervention. Breastmilk has also been demonstrated to possess a subpopulation set of cells that showed positivity for markers of pluripotency such as Oct4, Sox2, and Nanog.[6]

Much attention has been devoted to the physiological roles of growth factors in the growth, maturation, and maintenance

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Fluorescent carbon nanoparticles as label-free recognizer of Hg^{2+} and Fe^{3+} through effective fluorescence quenching in aqueous media

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ABSTRACT: Preparation, characterization and ion sensing property of water-dispersible fluorescent carbon nanoparticles (CNPs) is reported. These CNPs are prepared from inexpensive source (candle soot) with a water-based preparation without using organic solvent. Excitation-independent fluorescence behavior is a notable feature of these CNPs, which is found in limited reports in the literature. These CNPs exhibit selective dual metal ion (Hg^{2+} and Fe^{3+}) recognition in aqueous media out of a large number of metal ions investigated. They also exhibit green fluorescence under UV light (365 nm) exposure, which disappears upon addition of Fe^{3+} and Hg^{2+}. The fluorescence quenching due to the aggregation of CNPs in presence of Hg^{2+} and Fe^{3+} is supported by TEM and AFM studies. Detail studies on stability of CNPs, selectivity, interference, reversible binding of metal ion and optimum experimental conditions for sensing of metal ions were carried out. The detection limits for Hg^{2+} and Fe^{3+} (80 and 40 nM) and the range of concentration through which quantitative measurement can be done (160 to 2000 nM) are also determined. These CNPs have been used for quantitative estimation of Hg^{2+} and Fe^{3+} in aqueous media.

Keywords: Fluorescent carbon nanoparticles; Mercury sensing; Iron sensing; Quenching

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Assessment of Growth Factors Secreted by Human Breastmilk Mesenchymal Stem Cells

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Abstract

Introduction: Human breastmilk is a dynamic, multifaceted biological fluid containing nutrients, bioactive substances, and growth factors. It is effective in supporting growth and development of an infant. As breastmilk has been found to possess mesenchymal stem cells, the importance of the components of breastmilk and their physiological roles is increasing day by day. The present study was intended to identify the secretions of growth factors, mainly vascular endothelial growth factor (VEGF) and hepatocyte growth factor (HGF), from human breastmilk mesenchymal stem cells under basal conditions of in vitro cell culture using synthetic media and human cord serum.

Materials and Methods: The growth factors were analyzed with the enzyme-linked immunosorbent assay technique.

Results: The cultured mesenchymal stem cells of breastmilk without serum revealed significant differences in secretions of the VEGF and HGF growth factors (8.55 ± 2.26402 pg/mL and 230.8 ± 45.9861 pg/mL, respectively) compared with mesenchymal stem cells of breastmilk with serum (21.31 ± 4.69 pg/mL and 2,404.42 ± 481.593 pg/mL, respectively).

Conclusions: Results obtained from our study demonstrate that both VEGF and HGF are secreted in vitro by human breastmilk mesenchymal stem cells. The roles of VEGF and HGF in surfactant secretion, pulmonary maturation, and neonatal maturity have been well established. Thus, we emphasize that breastmilk-derived MSCs could be a potent therapeutic source in treating neonatal diseases. Besides, due to its immense potency, the study also emphasizes the importance of breastfeeding, which is promoted by organizations like the World Heatlh Organization and UNICEF.

Introduction

A MEDLINE SEARCH USING ONLY the phrase ''human milk composition'' reveals a steady increase in the number of scientific publications. This postulates the extraordinary new components of breastmilk are still being identified and studied for their potential in infant health. Recently, breastmilk has been introduced as a new source of stem cells.

The mammary gland is a metabolically active, dynamic organ that undergoes significant changes during pregnancy, lactation, and transformation.[1] Breastmilk is the secretory product of this mammary gland in the postpartum period. It is contemplated to be a dynamic, multifaceted biological fluid containing nutrients, bioactive substances, and growth factors. It provides growth, development, immunity, and protection to the newborn from various gastrointestinal and respiratory infections.[2]

The reappearance and remodeling of mammary gland tissue and its ability for expansion point out the existence of stem and progenitor cells in the mammary gland. Human breastmilk has been found to possess a putative mammary stem cell population with expression markers such as CK5, CK14, CK19, and nestin.[3,4] In addition, it is also identified as harboring heterogeneous unique cellular components like mesenchymal stem cells (MSCs), hematopoietic stem cells, side population cells, and endothelial cells.[3,5] As a result this breastmilk-derived stem cell population is believed to possess great potency for the treatment of a wide variety of neonatal diseases without any special intervention. Breastmilk has also been demonstrated to possess a subpopulation set of cells that showed positivity for markers of pluripotency such as Oct4, Sox2, and Nanog.[6]

Much attention has been devoted to the physiological roles of growth factors in the growth, maturation, and maintenance

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Breastmilk-Derived Mesenchymal Stem Cells In Vitro Are Likely to Be Mediated Through Epithelial–Mesenchymal Transition

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Breastmilk had been identified to possess several non-immunological cell components including stem cells. However, as rightly mentioned in the correspondence, isolation of mesenchymal stem cells (MSCs) from breastmilk and its marker characterization are uncertain until today. One of the authors had already reported in her article[1] that breastmilk possesses various integral cellular components with scanty MSCs in fresh colostrums. However, there is no accumulating evidence or supporting studies (published articles) to prove that breastmilk possesses no MSCs under culture conditions.

The cultured breastmilk cells are heterogeneous initially and attain homogeneous MSC-like cells upon subsequent passages. This was also supported by Sani et al.[2] who specified that increasing number of MSCs would be obtained upon passages. Furthermore, there are evidences to suggest that growth factors such as vascular endothelial growth factor (VEGF) and hepatocyte growth factor (HGF) are secreted by MSCs.[3,4] Hence, we had cultured breastmilk extensively and had carried out the growth factor assay to prove that these mesenchymal stem-like cells that have been developed upon subsequent passages secrete these growth factors.[5] Since this article involves only the study of growth factor, we had not further discussed on MSCs here.

However, to further confirm our hypothesis, we had addressed this issue by in vitro culturing and characterizing the breastmilk-derived cells for hematopoietic, mesenchymal, and epithelial markers, and so on to confirm that breastmilk does not possess inherent MSCs but attains mesenchyml stem-like cells upon subsequent passages, which here might be due to epithelial-mesenchymal transition (EMT), as reported by Hassiotou et al.[6] This was further supported by Patki et al.[7] with the positive expression of breastmilk-cultured cells for E-cadherin. Hence, we say that these mesenchymal stem-like cells may grow through EMT, in which they express both epithelial and mesenchymal markers. This was also accepted by Foteini et al. in their recent correspondence addressed to you.

Thus, we strongly believe that breastmilk develops fibroblastic plastic-adherent mesenchymal stem-like cells upon subsequent passages and these cells have secreted the growth factors. Further in-depth characterization of cultured breastmilk-derived mesenchymal cells and its mediated mechanisms would give new insight into several unexplored applications.

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Biodeinking of old newspaper pulp using a cellulase-free xylanase preparation of Aspergillus niger DX-23

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ABSTRACT:

Old newspapers (ONP) are a significant source of raw materials for recycled paper industry. To obtain bright pulp for recycling, the ink from the ONP pulp is removed by chemical deinking process which is highly polluting and expensive. Due to high xylan content in ONP, the ink particles adhering on ONP pulp surface can be removed through detachment of ink/fibre bond by action of xylanases. In the present study, cellulase-free xylanases from fungi were specifically screened for deinking of ONP pulp. Among 16 cellulase-free xylanase producing isolates, strain DX-23 (identified as Aspergillus niger) produced maximum xylanase (48.9±0.02 Uml^{-1}). The xylanase of A.niger DX-23 (50 Ug^{-1} pulp), efficiently deinked the ONP pulp which exhibited 34.5% ISO brightness (22% higher than the untreated pulp). Improvement up to 78.8 % ISO brightness in ONP pulp compared to untreated pulp was achieved after optimization of conditions for deinking by response surface methodology and subsequent mild H_2O_2 treatment of deinked pulp. ATR-FTIR spectra, X-ray diffraction analysis and scanning electron micrographs of pulps confirmed the removal of surface ink particles from ONP pulp. The xylanase of A.niger DX-23 possessed molecular weight of 15.0 KDa, showed maximum activity at 50 °C and pH 5.0. Additives such as Mn^{+2}, Fe^{+2}, and sodium dodecyl sulphate enhanced the activity of xylanase, whereas, Zn^{+2}, Mg^{+2}, Ca^{+2} and Hg^{+2} and EDTA completely inhibited the activity. The K_m and V_{max} for the xylanase of A.niger DX-23 for hydrolysis of Birchwood xylan was found to be 2.38 mg/ml and be 230.8 µM/min/mg, respectively.

Key words: Xylanase; deinking; Aspergillus niger, Box Bhenken design, Old Newspaper.

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Half-sandwich iridium^{III} complexes with pyrazole substituted heterocyclic frameworks and its biological applications

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The low-spin Ir^{III} organometallic half-sandwich complexes of type $[(\eta^5\text{-}C_5Me_5)Ir(XY)Cl]^+$, (XY= bipyrazoles (4a-4b)/pyrimidin-2-amines (5a-5b)/triazolo[1,5-a]pyrimidines (6a-6b)) motifs have been synthesized and characterized. All the newly synthesized compounds have been evaluated for DNA binding properties with calf thymus (CT DNA) revealed enhancement in the binding constant (K_b) of complexes. The compounds bearing imidazole substituent are proving a good binder than that of compounds containing phenoxy linkage. Molecular docking attests π-π stacking interactions have been observed between receptor and compounds. Furthermore, the observed DNA cleavage potency has been ascribed to a multitarget mechanism of action of these compounds. Intriguingly, the chelation of ligands with Ir^{III} led to a remarkable enhancement of antibacterial activity against arbitrarily selected two Gram +ve and three Gram –ve bacterial stains. The complexes of triazolo[1,5-a]pyrimidines are proved the most cytotoxic compounds and on *S. pombe* cells compared to pyrazole incorporated heterocyclic frameworks. All complexes showed potent cytotoxicity as compared to ligands, with IC_{50} values ranging from 78 to 234 µM toward A549 human lung cancer cells. Potency of the compounds toward these cancer cells increased with pyrimidin-2-amines > bipyrazole > triazolopyrimidine.

INTRODUCTION

The studies of metal chelates, which bind to DNA strand as reactive models for protein-nucleic acid interaction, provide routes toward rational drug design as well as means to develop sensitive probes for DNA structure and to get information about drug design and tools of molecular biology[1, 2]. Binding of metal complexes with DNA has been studied extensively because DNA is the material of inherence and controls the structure and function of cells[3]. Metal complexes can bind to DNA in a noncovalent interaction mode, such as groove binding for large ligands, electrostatic binding for cations[4], intercalative mode of binding for planar ligands, and partial intercalative binding for incompletely planar ligands[5, 6]. According to the recent reports, cis-platin is one of the most widely used metal-based antitumor and anticancer drugs targeting DNA[7] through covalent bonding interaction[8]. The clinical success of cis-platin, carboplatin, and oxaliplatin[9, 10] have stimulated the search for other transition metal complexes that possess anticancer activity. New metal-based anticancer drugs may be able to widen the spectrum of treatable cancers, reduce toxic side effects, and overcome platinum resistance. Interest in bio-inorganic chemistry and the design of complexes as anticancer agents is currently increasing[11-14]. The cyclopentadienyl ligands can provide hydrophobicity of the faces of the coordination compound (which influences cell uptake and targeting)[15-17]. Most metallodrugs are prodrugs, and control over ligand substitution is vital if the complex is to reach and react with its target site. In this respect, octahedral low-spin d^6 complexes are attractive for drug design since they are often kinetically inert. Inertness increases from the first to second to third row of transition metals[18]. The lifetime for exchange of an aqua ligand on $[Ir(H_2O)_6]^{3+}$, is about 300 years[19, 20]. There are only a limited number of reported studies on the biological activity of iridium complexes. Early studies were concerned with Ir^{I} and Ir^{III} complexes[21, 22] and more recently, a few studies of organometallic Ir^{III} complexes have been reported[23-25]. Iridium^{III} complexes are generally thought to be too inert to possess high reactivity. Indeed, the inertness of Ir^{III} has allowed the design of complexes that function as rigid scaffolds and inhibit kinase enzymes[26]. The biological activity of trans-$[IrCl_4(DMSO)(Im)][ImH]$[27] and trans-$[IrCl_4(Im)_2][ImH]$ (ImH =

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Electronic Supplementary Information (ESI) available: [Figures S1–S24 contain the, ^{1}H NMR and ^{13}C NMR (APT) spectrum, S25 is mass spectrum, S26-S33 contains molecular docking images. Table S34 contain DNA cleavage data, Table S35 contain anticancer data, Table 36 MIC data and Table 37 contains cytotoxicity data]. See DOI: 10.1039/x0xx00000x

One Pot Sono-Chemical Synthesis of 2D Layered MoS_2 Nanosheets

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Abstract. Two-dimensional nanocrystals and monolayer of transition metal dichalcogenides show fascinating changes in its properties such as transition from direct to the indirect bandgap material. Due to light interaction with these monolayers optical absorption is enhanced in visible range a lot. Here, we report the synthesis of molybdenum disulphide (MoS_2) nanocrystals through a time dependent sono-chemical liquid exfoliation method and its structural and optical analysis. The prepared nanocrystals of MoS_2 have exhibited high crystalline quality with strong diffraction to the (002) plane at 14.44^0 in the X-ray diffractrogram. It was observed that the concentration of nanocrystals in the dispersion inclined by increasing the sonication time. The optical absorption study revealed an optical band gap of 1.84 eV.

INTRODUCTION

Over the last few years, two-dimensional (2D) layered semiconductors are the most investigated subfields in material sciences. The field effect transistors made from transition metal dichalcogenides (TMDCs) monolayers possesses high on/off ratios and recently used in integrated logic circuits. The extremely thin nature of single layers makes future electronics smaller and thinner [1]. The families of TMDCs form 2D layers of covalently bonded transition metal atoms, M (M= Mo, W, Nb), and chalcogen atoms, X (X = S, Se, Te), in the stoichiometry MX/X_2, such as MoS/S_2, WS/S_2, $NbSe_2$, $NiTe_2$ etc. In general these 2D layers tend to bond via van der Waals interactions, stacking to form 3D crystals. In particular, TMDCs show a wide range of electronic, optical, mechanical, chemical and thermal properties that have been studied by researchers for decades [1-3]. There is at present a resurgence of scientific and engineering interest in TMDCs in their atomically thin 2D forms because of recent advances in sample preparation, optical detection, transfer and manipulation of 2D materials, and physical understanding of 2D materials learned from graphene.

From the beginning, so many efficient methods to get few- to monolayer of TMDCs have been invented till date (i.e. micromechanical cleavage, ion intercalation, chemical vapour deposition, liquid exfoliation, etc.). However, the development of these materials has been hindered by the lack of simple methods to exfoliate them to give few-or monolayer flakes to get large yield. To bring forth enough exfoliated materials for different applications, a scalable production method is required. Micromechanically exfoliated single flakes of materials such as MoS_2 are ideal for electronic application and this process gives very efficient monolayer crystals [1]. However, the real time application of such monolayers using this method is under research and needs much sophistication in the work.

As an alternative, researchers were trying the liquid exfoliation from the bulk counterparts TMDCs using organic solvents like N- methyl 2-pyrolodine (NMP), Cyclohexyl-pyrrolidinone (CHP), dimethyl-imidazolidinone (DMEU), N, N-dimethylformamide (DMF), etc. to produce large scale monolayers and 2D nanocrystallites. Here, we report a simple one-pot and large scale sono-chemical liquid exfoliation process to synthesize nanocrystals of MoS_2 using DMF as solvent [2-6].

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Excitonic emission and absorption resonances in $V_{0.25}W_{0.75}Se_2$ single crystals grown by direct vapour transport technique

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Abstract:

A systematic study on emission and absorption spectra of vanadium mixed tungsten diselenide single crystals grown by direct vapour transport (DVT) technique is reported. The grown crystals were characterized by energy dispersive analysis of X-ray (EDAX), which gives the confirmation about the stoichiometry. The structural characterizations were accomplished by X-ray diffraction (XRD), surface morphology and transmission electron microscopy (TEM). These characterizations were indicating the growth of $V_{0.25}W_{0.75}Se_2$ single crystal from vapour phase. The optical response of this material has been observed by combination of UV-vis-NIR spectroscopy and photo luminescence (PL) spectroscopy. A detailed study of excitonic emission and absorption resonances was carried out on grown crystals. The energy band gap was calculated for indirect allowed transition with absorbed and emitted phonon. Additionally, absorption tail for grown crystal is found to obey the Urbach's rule.

Keywords: A2. Single crystal growth, B2. Semiconducting ternary compound, A1. Defects, A1. Crystal morphology.

1. Introduction:

Transition metal dichlcogenides encompasses a large class of two-dimensional layered materials, which have numerous applications in fields such as catalysis, energy storage, dry lubrication, microelectronics and optoelectronics [1-9]. The quasi two-dimensional materials, which are formed through strong in-plane covalent bonding in individual atomic layers and weak van der Waals interaction between two adjacent layers, have attracted a great deal of attention over past decade. As one of the important compound in TMDC family, WSe_2 is composed of two dimensional tri-layer Se-W-Se sandwich structures, with a W-atom plane in the middle of two hexagonal Se-atom planes [10-13]. The WSe_2 sheets are weakly bonded together by non-covalent bonds to form the crystal. A synthesis of single and few layer nano sheets using micro-exfoliation and chemical vapour deposition has opened up new opportunities for fundamental research and technical application in spintronic and photonics [14-16]. In addition, WSe_2 with desired bandgaps around 1–2 eV are suitable for FETs and optoelectronic devices rather than graphene. Recently, significant research has focused on 2D TMDCs due to their unique transformation from indirect to direct band gap semiconductors and valley polarization when confined to a single layer [17-19], fulfilling the most basic requirement for efficient light emission. The semiconducting nature of WSe_2 ensures it's on/off ratio and the presence of band gap emission, while still sharing many of graphene's advantages for electronic and optoelectronic applications. In addition, monolayer WSe_2 shows combining p-type and n-type conducting behaviour in the same material which offers the possibility to design complementary logic circuits in the same monolayer. [20, 21]. As-grown single crystal composed of huge number of tri-layers has a direct and indirect gap coexist irrespective of thickness. Direct gap exists at the K points of the Brillion zone between spin-orbit split valence band and doubly degenerate conduction band. On the other hand, indirect gap forms between a local conduction band minimum at a midpoint between Γ and K and valence band maximum at the Γ point. Above bandgap photo-excitation creates electrons and holes in the conduction and valence bands respectively. If the screening is weak enough the attractive Coulomb interaction between one electron and one hole creates a bound quasi-particle known as a neutral exciton (X^0). Excitons can further become charged by binding an additional electron (X^-) or hole (X^+) to form charged 3-body excitons [22].

Lots of research has been done on TMDC materials such as WX_2 and MoX_2 (X=S, Se, Te) but vanadium mixed WSe_2 crystal has not been reported yet. The doping of vanadium was carried out to tune some properties of WSe_2 such as band gap, conductivity, etc. and also to check the possibilities of high temperature superconductivity. Keeping all these aspects in mind author has grown $V_{0.25}W_{0.75}Se_2$ single crystal by direct vapour transport technique.

2. Special technique for crystal growth from vapour:

Single crystals of $V_{0.25}W_{0.75}Se_2$ were grown by direct vapour transport technique using constituent elements with 99.99% purity. For this, vanadium, tungsten and selenium were taken in stoichiometric proportion in quartz ampoule. The ampoule was slowly cooled, evacuated to around10^{-5} Torr and sealed off. The sealed ampoule was then placed in the dual zone horizontal furnace controlled by temperature controller with an accuracy of ±1 K. Some changes in conventional technique were made for effective growth of crystals with larger size. In present work, heating process was carried out in two steps with different rate instead of single step with same rate. In first step material in nutrient zone of ampoule was heated up to 820K with rate of 24

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Isolation, Optimization and Production of Cellulase by *Aspergillus niger* from Agricultural Waste

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Cellulases are the group of hydrolytic enzymes such as endoglucanase (CMCase), exoglucanase, β-glucosidase (BGL) and FPase which are responsible for release of sugars in the bioconversion of the cellulosic biomass into a variety of value-added products. The cellulase producing fungi were isolated from various agriculture fields. Total 21 isolates were obtained on Czapek's Dox agar medium. *Aspergillus niger* was selected as most efficient enzyme producer by screening technique. Optimization of some nutritional and environmental factors like nitrogen source, temperature, pH and fermentation time were studied under submerged culture condition for cellulolytic enzyme production. Different agriculture waste material was used as carbon source. Maximum cellulolytic activity was observed in 4.2 pH media at 28°C after 96 hours in submerge condition. Wheat straw showed maximum activity of CMCase, exoglucanase, β-glucosidase and FPase were 8.38 IU/ml, 5.21 IU/ml, 0.30 IU/ml and 8.08 IU/ml, respectively followed by baggase.

Keywords: *Aspergillus niger*, Cellulase, Lignocellulose, Wheat straw, Rice burn, Banana waste.

The importance of cellulose as a renewable source of energy has made cellulose hydrolysis the subject of intense research and industrial importance[1]. It is the primary product of photosynthesis in terrestrial environments and the most abundant organic substrate (100 billion dry tons/year) on earth for the production of glucose, for fuel and as chemical feed stock[2-3]. Cellulase enzymes, which can hydrolyze cellulose forming glucose and other commodity chemicals, can be divided into three categories: endoglucanase (EC 3.2.1.4); exoglucanase (EC 3.2.1.91) and β-glucosidase (EC 3.2.1.21)[4-5]. Scientists have strong interests in cellulases because of their various applications include starch processing, animal food production, alcohol fermentation, malting and brewing, extraction of fruit and vegetable juices, fuel, pulp and paper industry, waste management, protoplast production, genetic engineering and pollution treatment medical/pharmaceutical industry and textile industry[6-9].

The cost of production and low yields of cellulase enzymes are the major problems for industrial application. Therefore, investigations on the ability of the lignocellulose hydrolyzing microbial strains to utilize inexpensive substrate have been done[10]. The lignocellulosic biomass is mainly composed of cellulose, hemicellulose, and lignin that are strongly intermeshed and chemically bonded by noncovalent interactions and by covalent crosslinkages[11]. Because of the use of

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Nanocrystalline PbS thin films as photodetectors

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Abstract: PbS quantum dots (QDs) have tunable energy band gaps from 0.4 to 4 eV below Bohr radius of 18 nm. Thus, thin films deposited from PbS QDs serve as photodetectors with tunable spectral sensitivity. Nanocrystalline (NC) PbS films can be an easier alternative to QD films. NC PbS thin films were deposited on glass by dip-coating from a methanolic solution of lead acetate - thiourea complex. X-ray diffraction studies show that the films are pure nanocrystalline PbS with particle size of 8 nm. The band gap of the films is 1.2 eV as determined from transmission spectra. The films have dark conductivity of7 x 10^{-3} S/cm exhibiting good photoconductivity. Exploratory photoconductive detectors fabricated with these films have good sensitivity and reproducible conductivity during off-on cycles.

Keywords: Lead sulfide, Nanocrystalline, thin films, Photodetector.

1. Introduction

Bulk lead sulphide (PbS) is a IV-VI group of semiconductor having cubic crystal structure and narrow direct band gap of 0.41 eV at 300 K with high absorption coefficient of 10^5 cm^{-1}. Thin films of polycrystalline PbS are commercially utilized as short-wavelength infrared (SWIR) photoconductive detectors with sensitivity in the wavelength range 1 to 3 µm. These PbS films are generally deposited by simple chemical bath deposition and are sensitized for photoconduction.[1–4]

PbS exhibit strong quantum confinement below excitonic Bohr radius of 18 nm and hence has significant size dependent optical property.[5,6] As a consequence, the energy band gap E_g of its PbS nanocrystals (quantum dots) depends on the nanocrystals size d as shown in Figure1. In general, the band gap E_g of NC increases as d decreases. By choosing appropriate d one can tune E_g to anywhere between 0.41 (bulk) to 4 eV. In order words, the absorption band edge λ_g hence the spectral sensitivity of PbS NCs can be altered by varying their size shown in Figure 1, and also reveals that conventional PbS SWIR detector (E_g = 0.41 eV) can be easily converted to NIR or VIS detectors by decreasing the size of PbS NCs. Thus, PbS can be the sole photoconductive detector material to cover the entire spectrum of VIS-NIR-SWIR (0.4 to 3 µm) without resorting to any other semiconductor.

One of the ways of making tuned-bandgap PbS films, is to deposit them from monodispersed PbS colloidal quantum dots (CQDs).[7–9] This is rather complicated and time consuming because monodispersed CQDs have to be synthesized, isolated, washed and dispersed in a solvent. Then PbS films have to be prepared by direct coating. It is proposed that instead of CQD PbS films, nanocrystalline films with appropriate band gap can be used for photodetection. A nanocrystalline film can be envisaged as array of polydispersed QDs with majority having a particular size which results in a definite net band gap. The deposition of nanocrystalline PbS films would be easier and technically simpler than films made from CQDs. Investigation of different solution-based processes for deposition of PbS films, reported in literature, we found that the one by Chaudhuri et al.[10] yielded photoconducting nanocrystalline PbS films with band gap of about 1.2 eV. In this paper we report the preparation of nanocrystalline PbS films by dip-coating and characterization for photodetection.

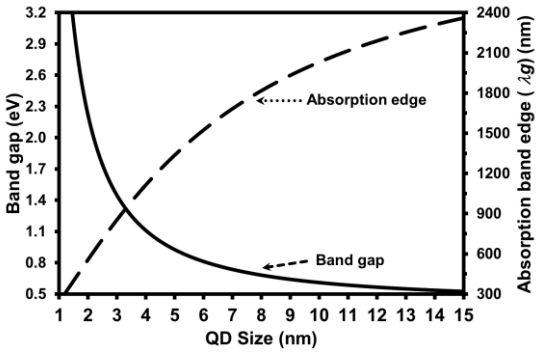

Figure 1. The variation of Band gap and absorption edge with QD's PbS size.

2. Experimental Details

The PbS thin films were deposited by dip-coating on ultrasonically pre-cleaned glass substrates (75 × 25 mm^2). The glass substrates were dipped vertically in methanolic solution of lead acetate (0.1 M) and thiourea (0.1 M) at room temperature (300K). A transparent precursor layer was formed, and then substrate was heated in an oven at 373 K for 10 min. The substrate was covered with shiny brown colored PbS film. The thickness of single coated film was about ~ 50nm.

Biodegradable Gelatin Methacrylate Gel as a Potential Scaffold for Bone Tissue Engineering of Canine Adipose-Derived Stem Cells.

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Abstract

Therapeutic potential of adipose derived stem cells (ADSCs) has widely been explored for treatment of orthopedic ailments. Transplantation of cells encapsulated in a scaffold facilitates 3 dimensional modelling of the tissue for the cases where well-defined spatial distribution of cells is desired for implantation. Present study aims to encapsulate canine ADSCs (cADSCs) in biodegradable methacrylated gelatin gel (GelMA) scaffold followed by their osteogenic differentiation for fabrication of a three dimensional bone tissue construct. Different percentages (5, 10 and 20%) and different methacrylation levels of gel ($GelMA_{high}$ and $GelMA_{low}$) were tested for degradation. Porosity of 10% GelMA was compared by SEM imaging. Gels with the fastest degradation rate (5% $GelMA_{high}$ and $GelMA_{low}$) were chosen for cell encapsulation since degradation of scaffold is of prime importance when the gel is intended to be used for implantation. Finally, cADSCs encapsulated in 5% $GelMA_{low}$ demonstrated best morphology and were differentiated osteogenically. We developed a modified protocol for isolation of RNA from cells encapsulated in GelMA. Osteogenic differentiation was affirmed by the presence of osteo-specific gene expression by reverse transcriptase PCR in addition to von Kossa staining of the construct. GelMA is an excellent biodegradable scaffold for encapsulation of cADSCs without altering their osteogenic potential. This osteo-induced cellular scaffold implant opens a new therapeutic horizon in the area of tissue engineering in orthopedics.

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An efficient DNA isolation protocol for *Cymbopogon* species suitable for diverse downstream applications

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Abstract

Extraction of DNA from medicinal and aromatic plants is often problematic, since these plants contain high levels of secondary metabolites which interfere with PCR based downstream applications and restriction digestions. Removal of these secondary metabolites requires appropriate reagents for DNA isolation. This investigation optimised an efficient DNA isolation protocol for *Cymbopogon* species that yielded sufficient quantity of DNA and could be used for diverse molecular applications. The modified protocol was also compared with the two existing DNA extraction procedures for cost effectiveness, time efficiency and quality DNA recovery. The modified protocol yields good amount of DNA ranging from 76 to 90 µg/ g of fresh tissues which was significantly higher in comparison to the other two protocols. A260/A280 ratio of the DNA obtained from the modified method ranged from 1.81 to 1.87 indicates purity of DNA and was also found to be suited for downstream applications such as restriction digestions. Subsequent RAPD, ISSR, SSR and barcode gene amplification analysis suggested the DNA isolated by our modified method was suitable for various molecular research applications. The efficiency of this method in terms of lesser time requirement and cost effectiveness makes the present method a noticeable alternative for total cellular DNA extraction for *Cymbopogon* species and could be adoptable to developing countries across the world.

Key words: CTAB; DNA fingerprinting; RAPD; ISSR; SSR; barcode gene

Introduction

Isolation of good quality and quantity of DNA is the prerequisite for various molecular studies. Successful application of polymerase chain reaction (PCR) based downstream applications requires efficient recovery of good quality and quantity of DNA (Devi *et al*., 2013).The cetyl trimethylammonium bromide (CTAB) method is the best method for extracting good quality of total cellular DNA from the plant tissues (Doyle and Doyle, 1990). Several CTAB based protocols were reported to extract pure and good quantity of DNA from different plant tissues (Khanuja *et* al., 1999; Nischita and Ravishankar, 2013; Samantaray *et al*., 2009; Sharma *et al*., 2014). But, because of the complexity of secondary metabolites, none of the reported DNA extraction protocols is universally applicable for all plant species (Porebski *et* al., 1997; Ribeiro *et* al., 2007). Various commercial DNA isolation kits are also available in the market, however the cost of these kits are the limiting factor for their use in developing countries (Ahmed *et al*., 2009). Problems encountered in the isolation and purification of large quantity of qualitative DNA from medicinal and aromatic plant species includes degradation of DNA due to endonucleases activity, co-isolation of highly viscous polysaccharides and inhibitor compounds like polyphenols and also other secondary metabolites which may directly or indirectly interfere with the downstream enzymatic experiments (Weishing *et al*., 1995). Genus *Cymbopogon* is an important member of the family poaceae (Gramineae), cultivated mainly for its essential oils. The essential oil of the species is used as pesticide, fungicide, preservative, bactericide, insect repellent and also as an ingredient in few medicines (Tyagi *et al.,* 1988). The presence of polysaccharides, polyphenols, essential oils and other secondary metabolites hinder the recovery and purity of DNA (Porebski *et al*., 1997) which demands complicated and time-consuming DNA isolation protocols in the species. Due to non availability of an efficient DNA isolation protocol for *Cymbopogon* species, the present study focused at the development of a simple, rapid, reliable and inexpensive protocol for total DNA isolation. We have also compared the newly developed method with the existing protocol (Khanuja *et al*., 1999) as well as with one of the widely used commercial kit for its validation. The quality of the total cellular DNA obtained from the newly developed method was assured by allowing it to various downstream applications such as restriction digestion, RAPD (Random amplified Polymorphic DNAs), ISSR (Inter-simple sequence repeats), SSR (Simple Sequence repeats) as well as for the plant barcode genes (rbcL, matK , trnH-psbA and ITS region) amplifications.

Material and methods

Plant material: Fresh and young leaves of six different species of the *Cymbopogon* such as *C. citratus* (DC.) Stapf, *C. flexuosus* (Nees ex Steud.) Wats., *C.martinii* (Roxb.) Wats., *C. nardus* (L.) Rendle, *C. pendulus* (Nees ex Steud.) Wats. and *C. winterianus* Jowitt ex Bor; two hybrids namely, CKP 25 [*C. khasianus* (Hack.) Staft ex Bor X *C. pendulus*] and Jamarosa [*C. nardus* X *C. jawarancusa* (Jones) Schult.] were collected from Field Gene Bank of ICAR-Directorate of Medicinal and Aromatic Plants Research, Anand, Gujarat (India) for optimising DNA isolation protocol. A minimum of ten replicates were taken from each species/ hybrids for this investigation.

Reagents and chemicals: Chemicals: Tris-Cl (1.0 M) pH 8.0, Ethylene diamine tetra acetic acid (EDTA) (0.5 M) (pH 8.0), Cetyl

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Varietal Discrimination and Genetic Variability Analysis of *Cymbopogon* Using RAPD and ISSR Markers Analysis

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Abstract *Cymbopogon* is an important genus of family Poaceae, cultivated mainly for its essential oils which possess high medicinal and economical value. Several cultivars of *Cymbopogon* species are available for commercial cultivation in India and identification of these cultivars was conceded by means of morphological markers and essential oil constitution. Since these parameters are highly influenced by environmental factors, in most of the cases, it is difficult to identify *Cymbopogon* cultivars. In the present study, Random amplified polymorphic DNA (RAPD) and Inter-simple sequence repeat (ISSR) markers were employed to discriminate nine leading varieties of *Cymbopogon* since prior genomic information is lacking or very little in the genus. Ninety RAPD and 70 ISSR primers were used which generated 63 and 69 % polymorphic amplicons, respectively. Similarity in the pattern of UPGMA-derived dendrogram of RAPD and ISSR analysis revealed the reliability of the markers chosen for the study. Varietal/cultivar-specific markers generated from the study could be utilised for varietal/cultivar authentication, thus monitoring the quality of the essential oil production in *Cymbopogon*. These markers can also be utilised for the IPR protection of the cultivars. Moreover, the study provides molecular marker tool kit in both random and simple sequence repeats for diverse molecular research in the same or related genera.

Keywords *Cymbopogon* · Discrimination · DNA fingerprinting · Genome variability · RAPD and ISSR · Unique amplicons

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Feasibility studies of time-like proton electromagnetic form factors at $\overline{\text{P}}$ANDA at FAIR

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Abstract. Simulation results for future measurements of electromagnetic proton form factors at $\overline{\mathrm{P}}$ANDA (FAIR) within the PandaRoot software framework are reported. The statistical precision with which the proton form factors can be determined is estimated. The signal channel $\bar{p}p \to e^+e^-$ is studied on the basis of two different but consistent procedures. The suppression of the main background channel, *i.e.* $\bar{p}p \to \pi^+\pi^-$, is studied. Furthermore, the background *versus* signal efficiency, statistical and systematical uncertainties on the extracted proton form factors are evaluated using two different procedures. The results are consistent with those of a previous simulation study using an older, simplified framework. However, a slightly better precision is achieved in the PandaRoot study in a large range of momentum transfer, assuming the nominal beam conditions and detector performance.

1 Introduction

The $\overline{\mathrm{P}}$ANDA [1] experiment at FAIR (Facility for Antiproton and Ion Research, at Darmstadt, Germany) will detect the products of the annihilation reactions induced by a high-intensity antiproton beam with momenta from 1.5 to 15 GeV/c. The comprehensive physics program includes charmonium spectroscopy, search for hybrids and glueballs, search for charm and strangeness in nuclei, baryon spectroscopy and hyperon physics, as well as nucleon structure studies [2]. Here we focus on the extraction of time-like (TL) proton electromagnetic form factors (FFs) through the measurement of the angular distribution of the produced electron (positron) in the annihilation of proton-antiproton into an electron-positron pair.

Electromagnetic FFs are fundamental quantities, which describe the intrinsic electric and magnetic distributions of hadrons. Assuming parity and time invariance, a hadron with spin S is described by $2S + 1$ independent FFs. Protons and neutrons (spin 1/2 particles) are thus characterized by two FFs: the electric G_E and the magnetic G_M. In the TL region, electromagnetic FFs have been associated with the time evolution of these distributions [3].

Theoretically, the FFs enter in the parameterization of the proton electromagnetic current. They are experimentally accessible through measurements of differential and total cross sections for elastic ep scattering in the space-like (SL) region and $\bar{p}p \leftrightarrow e^+e^-$ in the TL region. It is assumed that the interaction occurs through the exchange of one photon, which carries a momentum transfer squared q^2. In the TL region, this corresponds to the total energy squared s.

Space-like FFs have been rigorously studied since the 1960's [4]. However, the polarization transfer method [5,6] that was used for the first time in 1998 gave rise to new questions in the field. Recent access to high-precision measurements over a large kinematic range further contribut-

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Study of doubly strange systems using stored antiprotons

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Abstract

Bound nuclear systems with two units of strangeness are still poorly known despite their importance for many strong interaction phenomena. Stored antiprotons beams in the GeV range represent an unparalleled factory for various hyperon–antihyperon pairs. Their outstanding large production probability in antiproton collisions will open the floodgates for a series of new studies of systems which contain two or even more units of strangeness at the $\bar{\text{P}}$ANDA experiment at FAIR. For the first time, high resolution γ-spectroscopy of doubly strange $\Lambda\Lambda$-hypernuclei will be performed, thus complementing measurements of ground state decays of $\Lambda\Lambda$-hypernuclei at J-PARC or possible decays of particle unstable hypernuclei in heavy ion reactions. High resolution spectroscopy of multistrange Ξ^--atoms will be feasible and even the production of Ω^--atoms will be within reach. The latter might open the door to the $|S| = 3$ world in strangeness nuclear physics, by the study of the hadronic Ω^--nucleus interaction. For the first time it will be possible to study the behavior of $\overline{\Xi}^+$ in nuclear systems under well controlled conditions.

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original article

Family's presence associated with increased physical activity in patients with acute stroke: an observational study

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ABSTRACT | **Background:** Inherent differences in organization of stroke care and rehabilitation practices in various settings influence the activity levels of patients in the hospital. The majority of published studies have been carried out in developed countries such as the United States, United Kingdom, Australia, Switzerland and Belgium; however, data from developing countries are scarce. **Objective:** To measure the amount and nature of physical activity of patients admitted to medical wards of Indian hospitals and to assess the association between family presence and the patient and between the patient's functional status and their physical activity level. **Method:** This is an observational behavioral mapping study. A trained physical therapist recorded the patients' (N=47) physical activity level through direct observation in the ward using a predetermined observation scheme. **Results:** Participants were found inactive and alone for 19% (inter quartile range [IQR] 12-36%) and 15% (IQR 10-19%) of the time during the day, respectively. They spent 46% (IQR 31-55%) of the time in therapeutic activities and 31% (IQR 22-34%) of the time in non-therapeutic activities. The family was present with patients 50% of the time during the day. Family presence with the patient and the patient's moderate dependence in daily activities are positively associated with their activity levels. **Conclusion:** Patients with stroke admitted to Indian hospitals spent less time being inactive and alone and more time with family participating in therapeutic activities. The presence of family members with the patients during hospital stay may be a significant resource for encouraging patients to be more active.

Keywords: family support; acute stroke; physical activity status; time spent alone.

BULLET POINTS

- The characteristics of the stroke rehabilitation setting can influence physical activity levels.
- Stroke patients in India are more active and spend less time alone.
- Family presence is associated with a higher physical activity level in patients after acute stroke.

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Introduction

Increased amount of physical activity in the early phase after stroke can promote positive outcomes in the long term[1,2]. A recent review on physical activity patterns of hospitalized stroke patients reported that patients spent most of their time alone and spent less time in moderate-to-high level physical activity, such as sitting unsupported, standing, and walking (median 21.0%, interquartile range [IQR]12.8% to 27.7%)[3]. Further, there are wide variations in patients' activity levels during acute stage of stroke across different settings[4-6]. Understanding what drives these discrepancies could help us to improve stroke care and early rehabilitation[7].

Several factors were identified as sources of variation in physical activity levels observed in the acute stage of stroke[3,5,8]. Patients with severe dependence in functional activities spent more time inactive and alone (90% of the day) in bed; organized stroke care (stroke units) and longer therapy time, especially time involved in autonomous practice encouraged

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Original Article

Do Commonly Used Functional Outcome Measures Capture Activities that Are Relevant for People with Stroke in India?

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Objectives: In India, post-stroke outcomes are determined using functional outcome measures (FOMs), the contents of which have not been validated for their relevance to the Indian population. In this study, we aimed to evaluate the cultural validity of five frequently used stroke-specific FOMs by comparing their contents with the problems reported by patients with stroke in India.
Methods: Face-to-face structured interviews were conducted with 152 patients diagnosed with stroke in India. Problems and goals identified by the patients were compared to each item included in the FOMs used in stroke rehabilitation.
Results: The Stroke Impact Scale (SIS) and the Frenchay Activities Index (FAI) include items related to the most frequently identified problems. However, neither covers problems related to the need for squatting and sitting on the floor. Use of public transport and community walking are not included in the SIS. Leisure and recreational activities (e.g. gardening, reading books), cognitive and speech functions (e.g. memory, thinking) and bowel and bladder dysfunctions were the common items identified as "not a problem" or "not relevant" by the patients.
Discussion: Our findings suggest that the SIS and FAI are the most appropriate FOMs for patients with stroke in India as they include items related to the majority of problems identified by study participants. Many items on both measures, however, were identified as not a problem or not relevant. There is a need for developing culture-specific FOMs that incorporate all major concerns expressed by patients with stroke in India.

Keywords: stroke, outcome measures, functional outcomes, India, cultural validity, stroke rehabilitation, Stroke Impact Scale, Frenchay Activities Index

Background

The majority of functional outcome measures (FOMs) used in stroke rehabilitation were developed in North America and Europe for use in those specific contexts.[1–3] Subjective experiences of post-stroke disability differ from one culture to another.[4,5] In India, few formal activities are expected from older members of the community.[6] Dependence in some aspects of daily functioning, e.g., instrumental activities of daily living (ADL) or leisure activities, may not reflect the same reduction in quality of life among older adults in India as in other populations.[5] Therefore, FOM selection and use, whether for clinical practice or for research, require information on the specific content of items that should be analyzed and judged for their relevance for patients with stroke in India.[7–9] However, cultural validity of the stroke FOMs for patients with stroke in India receiving rehabilitation services has not been studied.

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Stroke is one of the leading causes of disability in India.[10–13] Use of FOMs that are relevant to the expectations and preferences of patients with stroke in India are essential to evaluate outcomes of rehabilitation services and clinical trials conducted in India. This will help stakeholders in stroke rehabilitation, including patients and their caregivers, practitioners, and health care decision-makers to make sound, patient-centered clinical and policy decisions. In India, post-stroke functional outcomes, however, are determined using FOMs which have not been validated for relevance in the Indian population.[13–16]

Therefore, in this study we aimed to evaluate the cultural validity of five frequently used stroke-specific FOMs by comparing their contents with problems reported by patients with stroke in India.

Methods

Study Design

Our study design was based on methods adopted by Coenen et al.[17] and Ewert et al.[18] involving the following three steps: (1) identification of frequently used stroke

Importance of squatting and sitting on the floor: perspectives and priorities of rural Indian patients with stroke

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Background: Identifying activities that are preferred and valued by patients' is essential to optimize rehabilitation outcomes and quality of care in stroke rehabilitation. Deep knee flexion (DKF) activities like squatting and sitting on the floor are regularly performed and preferred daily activities in many cultures. Yet few studies have investigated its importance as perceived by patients with stroke.

Objectives: To identify the magnitude of importance of squatting and sitting on the floor in carrying out daily activities in adults diagnosed with stroke.

Methods: We conducted a survey among patients with stroke using a questionnaire. A sample of convenience of 123 patients diagnosed with stroke who were receiving physiotherapy in rural rehabilitation setting in Gujarat, India participated. All patients were asked to rate the importance of DKF activities in performing various daily activities related to self care, mobility, domestic life, work and community participation.

Results: Sixty-eight percent of participants rated DKF activities as very important for carrying out their daily activities. Toileting (78%), bathing (68%), eating (68%), praying (54%) and work (51%) were the activities for which DKF activities were rated as very important by both men and women. However, higher proportion of women compared to men rated domestic life activities such as cooking, washing cloths and cleaning house as very important.

Conclusions: Because a substantial proportion of patients with stroke identified DKF activities as very important for performing major daily activities, independent performance of squatting and sitting on the floor should be considered as one of the important rehabilitation goals for patients with stroke.

Keywords: Patient preference, Deep knee flexion activity, Stroke

Introduction

Patient expectations and priorities for treatment outcomes are important, from both a clinical and scientific viewpoint. [1–3] Patients' experience of disease, especially chronic diseases are diverse; multidimensional factors such as age, gender, culture and physical and social environment influence how patients perceive their health and the impact that treatments or adjustments to lifestyle have on their quality of life. [1,2] Gaining insight from the perspective of the patient can help identify problems faced by them and their families; how this knowledge might impact on treatment decisions and adherence, and a better understanding as to how clinicians can affect outcome. [3,4]

There is a growing consensus among health care providers and researchers that patient's perspective should be included in the process of selecting treatment options and determining treatment outcomes. [3,5,6] Yet there is often a mismatch among the expectations and interests of the researchers, health care professionals, and the patients.[6–8] To understand and integrate patient perspectives into clinical decision making and more research on priorities and expectations of patients with different diseases is necessary.

Many functional activities like eating, bathing and praying can be performed without deep knee flexion (DKF) eg., through sitting on a chair or standing. However, patients' personal values and preferences, their physical environment and socio cultural norms and customs may engender a preference for DKF activities like squatting or sitting on floor for carrying out these activities.[7,8] Thus, difficulty in performing activities involving squatting and sitting on the floor can lead to substantial functional limitations.[9–12]This is especially true in Asian and African countries where squatting and sitting on

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Research productivity of Indian physiotherapists – a review of MEDLINE

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Scientific output analysis of the current research productivity of physiotherapists will allow the construction of baseline indicators in this area of knowledge and professional practice. This study aims to analyse the research productivity of Indian physiotherapists in terms of quantity and examines the trends of all types of studies published. MEDLINE database was searched to identify researches published by Indian physiotherapists during the period between January 2000 and May 2014. There is an overall upward trend in the output of Indian researchers in physiotherapy and a substantial increase is seen in the last 5 years. To advance the growth of physiotherapy, it is essential to demonstrate that physiotherapy interventions are of high quality and cost-effective. However, studies evaluating the physiotherapy treatment regime and healthcare cost of rehabilitation are lacking. Hence, Indian physiotherapists are encouraged to conduct primary researches focusing on developing cost-effective management strategies relevant to Indian context.

Keywords: India, MEDLINE, physiotherapy, research.

THE number of publications is considered as an indication of the scientific output of a group. Research productivity of different groups has increased tremendously over the years, worldwide and in India. Scientific research in health science can improve clinical practice, to make it more evidence-based[1,2]. Research productivity can also be an indicator of performance of a university[3–5], maturation of a profession[6] and identifying areas which need for research and fund allocation. Research in physiotherapy can contribute to the growth of the profession through making significant contributions to the body of knowledge, validating its current practice and thereby helping the community.

Researchers have stressed the importance of understanding research productivity of physiotherapists[6–8]. Physiotherapy research productivity around the world is well documented[6–9]. Analyses of published research in peer-reviewed physiotherapy journals can reflect the current state of affairs and some likely future trends[6]. Several bibliometric studies show evolving trends in physiotherapy research publication[6,8–10]. Earlier trend indicated greater focus on non-clinical than clinical topics[8]. Current trend indicates that there is an increased emphasis on publishing clinically based research articles[6], random controlled trials (RCTs), systematic reviews and clinical practice guidelines[10] consistent with evidence-based practice.

For the physiotherapy profession to grow and mature in developing countries like India, we need more clinically relevant and patient-centred research. Locally relevant research for the community is also required[2,10,11]. Physiotherapy is an established profession in India, with most of the universities awarding Master's (MPT) as the highest degree in the discipline and few universities awarding Ph D degree as well, which has lead to growth of research in physiotherapy. Research done in health science needs to be published in a peer-reviewed journals and indexed in a respectable database like MEDLINE[12]. However, not much is known about research productivity of Indian physiotherapists. Scientific output analysis of the current research productivity of physiotherapists will allow the construction of baseline indicators in this area of knowledge and professional practice[9]. This study aims to analyse the research productivity of Indian physiotherapists in terms of quantity and examine the trends of all types of studies published.

Methods

Eligibility and search methods

The following criteria were used for the study:

1. Studies done in Indian setting with at least one of the investigators being a physiotherapist.

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