CHAROTAR UNIVERSITY OF SCIENCE AND TECHNOLOGY

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 : 2017)**

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Book Review

Policy formation for Renewable Energy sources

Clean energy and Renewable energy both are interconnected words and applications of them can be found in everyday life - from the tiny machine to the large HVAC systems (Mistry and Lathia, 2016; Lathia and Jaymin, 2016). In contrast, with the use of Petroleum products as a basic source of energy - goal of clean energy is merely a mirage (Ashford et al., 1993). It is also true that Government initiative is needed for the betterment of the environment and that's why good governmental policy initiative becomes necessary (Patel et al., 2017). There are very few government initiatives which take proper actions through policies to promote clean energy like Hawaii Clean Energy Initiative (Lathia, 2016; Yan et al., 2011). Clean Energy from the Earth, Wind and Sun: Learning from Hawaii's Search for a Renewable Energy Strategy written by William S. Pintz and Hermina Morita published by Springer International Publishing (2017), 175 pp, Price: 74.99 $, ISBN 978-3-319-48676-5, ISBN 978-3-319-48677-2 (eBook) describes the Hawaii Clean Energy Initiative (HCEI), an ambitious program by the State of Hawaii to substitute "clean" energy, renewable sources, and energy efficiency, for imported petroleum. It is not intended to be a comprehensive or detailed policy history of HCEI; rather, this endeavour is based on the aspect s of Hawaii's experiences which may be of interest beyond the State of Hawaii. Most of this book focuses on the causes, consequences, and implications of Hawaii's attempts to formulate a clean energy strategy.

The book contains 9 chapters. Chapter 1 summarises the external factors (Expansion of US hydrocarbon because of hydraulic fracturing technology and the emergence of new oil extraction technology) and local factors (Hawaii 2000 vision, Policy forum, Sustainability report, Public vision & Political realities) which led to enactment of the Hawaii Clean Energy Initiative (HCEI). It describes the interaction of developments in the world petroleum market with local attitudes which favoured sustainable self-sufficiency energy solutions. The chapter presents an overview of the history of regulatory and institutional development and presents a general description of the perspectives of the major stakeholders toward substituting of renewable energy resources for imported petroleum. Chapter 2 presents a quantitative overview of Hawaii's energy sector. Major supply, demand, and cost characteristics are examined together with factors which are distinctive to Hawaii. Overlaid on these quantitative factors is a recent forecast on the potential impact that the HCEI strategy may have on petroleum consumption in the state. A concluding section describes policy and resource issues which will potentially influence the future directions of the HCEI. Chapter 3 is more about Anatomy of a Strategy, underlying Assumptions, Policies and Initial Resource Assessments. The HCEI strategy has many dimensions. The policy has necessitated formation of new regulatory and planning systems and involves a number of supporting agreements between major stakeholders (Ashford et al., 1993). This framework reflects Hawaii's energy resource base and the cost-effectiveness of various technology combinations in meeting the state's future energy needs. Although most early policy attention has focused on the electrical sector (Schipper, 2011), it is clear that achievement of HCEI substitution and efficiency goals must overcome daunting challenges in providing clean energy solutions for the state's important transportation sector. Development of policy options for transportation is severely constrained by the local resource base and existing fuel infrastructure. Clean energy goals in this sector are likely to be dependent on new fuels technology and consumer acceptance of higher efficiency vehicles (Bauman et al., 2008)—factors that are largely outside the direct control of the state. Chapter 4 entitled as the Negotiations: Politics, Intentions, and Institutional Capacity has an interesting content. Although the Hawaii Clean Energy Initiative policy was initiated by the Hawaii State Government, the implementation of its major elements involved lengthy negotiations between the state and the electric utilities. The actual negotiations were preceded by exploratory discussions involving national experts identified by the US Department of Energy (DOE) as well as internal staff from departmental organizations like the National Renewable Energy Laboratory (NREL). These supporting experts identified important technical and economic questions and worked with utility officials to establish a common knowledge base and eventual agenda for the negotiations. Due to the unexpected retirement of key state officials, the DOE played a significant supporting role in the direct negotiations. This chapter explores the background and motives behind the HCEI preparations and negotiations. Chapter 5 includes the conceptualization of the Hawaii Clean Energy Initiative strategy for power generation took place in the context of a number of renewable energy studies and resource assessments that had been undertaken over several years. These piecemeal studies needed to be updated in the light of current resource information and technology and put into the comprehensive policy framework. Out of this reassessment emerged a series of implementation strategies which emphasized particular renewable resources including big wind, geothermal, and biofuels (Stringer and Afionis, 2012). In addition, as a result of new (hydraulic fracturing) technology for extraction of natural gas on the US mainland, the importation of Liquid Nat-

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ural Gas attracted considerable interest from politicians and planners. In this chapter, Authors consider attempts to develop a strategic plan and reduce uncertainties in the power sector during the period from 2008 to 2015. In the next chapter, authors examine the parallel history and implementation issues in the transportation sector. Chapter 6 includes the second side of the initiation of HCEI. In parallel with the resource assessments and planning studies for the electricity sector, a rethinking of Hawaii renewable options in transportation was initiated. This work concentrated on road transport and was undertaken for the state through a cooperative agreement with the Department of Energy's Natural Energy Research Laboratory (NREL) in Colorado. With the exception of sugar based ethanol there had been only limited thought given to renewable transportation options in Hawaii. The NREL studies took a comprehensive view of developments in automobile efficiency. These included higher Federal Corporate Average Fuel Economy (CAFE) standards, ethanol and other "green fuels", electric vehicles, and methods for reducing vehicle miles travelled - can become sustainable future source (Mondt, 2000). These early transportation studies formed a framework for planning, but proved highly optimistic like Department of Business, Economic Development and Tourism (DBEDT) timelines established by Hawaii Clean Energy Initiative. Taken together, these studies suggested that there was only limited scope for state government intervention in road transport. Chapter 7 discusses the complex interaction of state energy policy and federal environmental policy. The substitution of renewable resources and energy efficiency is commonly seen as an environmentally friendly alternative to the burning of hydrocarbons (Bauner, 2011; Lathia et al., 2015). However, Hawaii's experience with the Hawaii Clean Energy Initiative strategy suggests that this assumption may be subject to significant administrative and organizational constraints. Two major environmental programs under the Federal Clean Air Act deal with greenhouse gas (GHG) emissions and with sulphur releases from power plants. Due to different implementation timeframes and local interpretation of EPA directives by the State Department of Health, HCEI planners were faced with the possibility of making very large Clean Air investments that would quickly become unnecessary under a successful HCEI energy policy. Chapter 8 includes the recent analysis of HCEI - last two years, 2014–2015 were years of uncertainty and surprises for the Hawaii Clean Energy Initiative (HCEI) planners. These years were marked by major conflicts between the PUC and the HECO companies regarding the best strategy for implementing HCEI. These conflicts led to repeated rejections of several company planning proposals and suggested that HECO and the PUC might be reading from different strategic blueprints. To compound these conflicts a mainland energy company, NextEra Energy. NextEra Inc. (NextEra), proposed to acquire HECO and bring a different expertise to local utility planning. The acquisition awaited PUC approval for over a year. During this time significant public and political opposition emerged over several resources development assumptions. In 2014 world oil prices collapsed. The collapse brought many of the economic justifications for HCEI's key renewable substitution and energy efficiency assumptions into question. This oil collapse had important consequences for the growing sentiment favouring Liquid Natural Gas (LNG) imports, and seriously undermined the projected economic benefits from LNG. It also highlighted the conflict between LNG import plans proposed by HECO and Hawaii Gas, the local gas supplier. Chapter 9 reviews the early experience of Hawaii's clean energy strategy and provide a few observations on the successes and shortcomings of the policy formulation process. Topics addressed include issues related to the structure of energy policy, how strategic questions are articulated and addressed, the problems of organizational capacity and corporate culture, and metrics for evaluating alternatives and measuring progress. Also considered are intra-governmental organizational and policy conflicts. This chapter takes a closer look at some of the important decision points in the Hawaii Clean Energy Initiative. It attempts to highlight the evolution of key policy elements which may be of relevance outside of Hawaii. This summary is not intended as a critique of Hawaii's policy process nor does it pretend to offer "lessons learned" or alternative solutions to problems. Rather, the intention here is to suggest more or less common problems that may arise in the development of comprehensive energy (and other) policy strategies. In retrospect, many of the observations contained in this Chapter seem obvious. However, they were often not obvious to policymakers faced with implementing a process to achieve ambitious objectives.

Unfortunately, in attempting to problems, a sense of criticism and negativity toward the policy process emerges. In the case of HCEI, this is compounded by the fact that the major outcomes of the process will not be evident for several years. No one associated with HCEI would assert that the process was perfect, but in many ways its shortcomings were due to the ambitions and the complexity of Hawaii's clean energy vision. The road may have had potholes, bumps, and detours but the direction was always reasonably clear. Although Hawaii's Clean Energy Initiative is a unique partnership, formulated to meet Hawaii's specific needs and resources, the policy process addressed problems that are common outside the state while the case study involves clean energy policies; many of the issues are applicable to public policy development topics in other sectors too.

The book is intended for use in graduate and senior undergraduate courses dealing with the formulation, implementation and impact of public policy. It also provides researchers involved in the development and implementation of clean energy with a guide to the hurdles likely to be encountered in moving innovation from the technical sphere to the practical real world and how to overcome them. Professional policymakers may benefit from an example of a process to create a workable clean energy policy.

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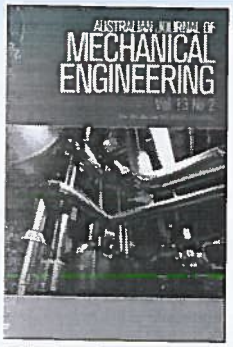

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Tribological studies of reactive magnetron sputtered titanium aluminium nitride (TiAlN) coatings

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Influence of peak current and frequency on tensile strength of Aluminum alloy 1100 during TIG welding

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Abstract- These paper aims to identify the effect of peak current and frequency on the tensile strength during the TIG welding of Aluminum alloy AA1100 sheet. For the tensile testing of welded specimens ASTM E8 standard has been followed. After the tensile testing, the regression analysis is done by MINITAB software and a regression equation has been developed.

Index Terms- TIG welding, peak current, frequency, Aluminum alloy 1100, tensile strength, regression equation.

1. BACKGROUND

Aluminum is the world's most existing metal and is the third most common element, comprising 8% of the earth's layer. Aluminum is versatile so that it is most widely used after steel. In any structural application of Aluminum alloys consideration of its weldability has very much importance as welding is largely used for joining of structural components. Tungsten Inert Gas welding process of aluminium alloy is most preferred because it is easy to be applicable and better economy. There are much TIG welding process and different for different materials; therefore for efficient use of the process it is required to identify the effect of these parameters.

Vijay Gautam (2014) conducted optimization of process parameters for gas tungsten arc welding (GTAW) of sheet samples of Aluminum alloy AA1100 using current, gas flow rate and weld speed as the process parameters with Argon as an inert gas. Tensile properties of parent and welded specimens were determined as per ASTM-E8M standard. Taguchi approach was implemented to determine most effective control parameters which will yield better tensile strength of the joints of GTAW welded Aluminum alloy AA1100.

Senthil Kumar *et al* (2007) studied influences of pulsed current tungsten inert gas welding parameters on the tensile properties of AA 6061 aluminum alloy. The use of pulsed current as a parameter was found to enhance the mechanical properties of the welds in comparison to those of continuous current welds of this alloy due to grain refinement occurring in the fusion zone.

Kumar and Sunderrajan (2009) conducted experiments on optimization of pulsed GTAW welding process parameters and studied the effects on mechanical properties of AA 5456 aluminum alloy weldments using Taguchi technique.

Indira Rani et. al (2012) investigated the mechanical properties of the weldments of AA6351 during the TIG welding with non-pulsed and pulsed current at different frequencies. From the experimental results it was concluded that the tensile strength and yield strength of the weldments is closer to base metal. Failure location of weldments occurred at Heat affected zones and from this we can say that weldments have better weld joint strength.

In the present work peak current and frequency has been set as the process parameters during TIG welding of aluminium alloy AA1100 sheet and weld specimens are prepared. After the tensile testing of the weld specimens as per ASTM E8 standard regression equation has been established using MINITAB software.

2. EXPERIMENTAL PROCEDURE

The base material employed was 5 mm thick aluminium alloy 1100 sheet. The base metal was tested for elemental composition using spectroscopy OES method. Table 1 indicates the results of spectroscopy test.

Table 1. Chemical composition of base material

Element	Si	Fe	Cu	Mg	Zn	Al
%	0.084	0.195	0.051	0.018	0.011	99.27

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Review of Process Parameters on Drilling of Natural Fiber Reinforced Composites

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Abstract

Natural Fiber Composites (NFCs) are alluring for some applications because of their prevalent properties. Typically, conventionaldrilling is an imperative last machining process for composite materials. The main purpose of this work is to exhibit a writing study on the machining of composite materials, all the more particularly on drilling of NFCs. Perspectives, for example, tool materials and geometry, drilling parameters and their impact on the thrust force and torque are examined. Furthermore, the quality of the holes created is additionally evaluated, with exceptional consideration paid to the delamination. The outcomes demonstrated that regardless of the way that a few angles, for example, the impact of cutting parameters and tool geometry on the quality of the hole have been widely examined by different scientists, the marvels related to shearing of characteristic fiber composite materials require extra studies with a specific end goal to permit a superior comprehension of the conduct of this classification of materials when subjected to drilling.

Keywords: Natural Fiber Composites (NFCs), Drilling, Delamination, Thrust Force, Torque

1. Introduction

Composite material can bemanufactured by joining two or more unmistakable materials which havedifferent properties. The two materials join together for giving composite fascinating properties. Regardless, inside the composite, its constituents (fiber and resin) can be isolated simply since they don't break down or mix into each other. Composites contained two portions mainly. One is the binder or matrix that envelops and ties second material together which is called as reinforcement and they can be either fibers, or particles. The best ideal position of advanced composite materials is their high capacity to weight extent. By picking a reasonable mix of lattice and fortress material, other material can be redone to meet the necessities of a specific application. Usually, composites give flexibility since it can be framed or tossed into intricate shapes. The physical and mechanical properties make

EXPERIMENTAL INVESTIGATION OF FOUR STROKE SINGLE CYLINDER DIESEL ENGINE WITH OXYGENATED FUEL ADDITIVES

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Abstract— *The objective of this investigation was to improve the performance of a diesel engine by adding oxygenated fuel additive of known percentages. The effect of fuel additive was to control the emission from diesel engine and to improve its performance. The fuel additive dimethyl carbonate was mixed with diesel fuel in concentrations of 1%, 3%, 5% and 7% used. The experimental study was carried out in a single-cylinder diesel engine. The result showed an appreciable reduction of emissions such as hydrocarbon, carbon monoxide, smoke density and considerable improvement in performance parameters of engine.*

Keywords— **Diesel engine, Oxygenated fuel additive, Dimethyl carbonate, Carbon monoxide, hydrocarbon.**

I. INTRODUCTION

As evidenced by recent lawsuits brought against operators of large diesel truck fleets and by the Consent Decree brought against the heavy-duty diesel manufacturers, the environmental and health effects of diesel engine emissions continue to be a significant concern. Reduction of diesel engine emissions has traditionally been achieved through a combination of fuel system, combustion chamber, and engine control modifications. Catalytic after treatment has become common on modern diesel vehicles, with the predominant device being the diesel oxidation catalytic converter. To enable advanced after-treatment devices and to directly reduce emissions, significant recent interest has focused on reformulation of diesel fuel, particularly the reduction of sulfur content. The EPA has man-dated that diesel fuel will have only 15 ppm sulfur, with current diesel specifications requiring around 300 ppm. Reduction of sulfur will permit sulfur-sensitive after treatment devices, continuously regenerating particulate traps, NOx control catalysts, and plasma assisted catalysts to be implemented on diesel vehicles. Another method of reformulating diesel fuel to reduce emissions is to incorporate oxygen in the fuel, as was done in the reformulation of diesel.

The experiment carried out by J. Wang, J. Xiao and S. Shuai explores the possibility to significantly reduce the particulate matter (PM) emissions by new fuel design. Several oxygenated blends were obtained by mixing the biodiesel, ethanol, and dimethyl carbonate (DMC), and diesel fuels. The tests were conducted on two heavy-duty diesel engines, both with a high-pressure injection system and a turbocharger. The total PM and its dry soot (DS) and soluble organic fraction (SOF) constituents were analyzed corresponding to their specific fuel physiochemical properties. A blended fuel that contains biodiesel, DMC, and high cetane number diesel fuels was chosen eventually to enable the diesel engines to meet the Euro IV emission regulation. Based on the test results, the basic design principles were derived for the oxygenated blends that not only need the high oxygen content, but also the high cetane number and the low sulfur and low aromatic contents. The fuels used in this study include a baseline diesel fuel, three types of biodiesels, and their blends with ethanol, DMC, DMM, and straight-run (or directly distilled) diesel fuel. Ethanol, DMC, and DMM are used as oxygenates to raise the oxygen content, while the straight-run diesel fuel is used to improve the auto-ignition capability of the blended fuel. When fueling oxygenated blends, the direct soot constituent in PM emissions decreases significantly as the fuel oxygen content increases. However, when the oxygen content reaches 15% or higher, reduction rate becomes slow.

Combustion and emission characteristics of a direct-injection diesel engine fueled with diesel-diglyme blends were investigated by Yi Ren, Ke Zeng and Bing liu. The results show that the ignition delay and the amount of heat release in the premixed combustion phase decrease with the increase of the oxygen mass fraction in the blends. The diffusive combustion duration and the total combustion duration decrease, while the amount of heat release in the diffusive combustion phase increases with the increase of the oxygen mass fraction in the blends. The maximum

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Examination of various characteristics for sputtered tantalum oxide-nitride thin films deposited at various oxygen flowrates

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ABSTRACT

Tantalum oxynitride thin films were prepared by reactive sputtering. The argon and nitrogen flow rate were kept stable whereas oxygen flow rate was incremented periodically. The effect of oxygen flow rate on various properties of tantalum oxynitride thin films is reported in this research paper. XRD patterns of tantalum oxynitride thin films displayed peaks commonly as for nano-crystalline materials. Surface topography observed to be smooth and exhibited smaller grain structure. Wettability test showed promising results for hydrophobicity. Wear test was done on uncoated and coated tantalum oxynitride thin films on 10 mm diameter cylindrical pins of brass and mild steel.

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KEYWORDS
Tantalum oxide-nitride; wear; hydrophobic; wettability

Introduction

A thin film is a layer of material deposited onto substrate and thickness ranging from fractions of a nanometer (monolayer) to several nanometers. Transitional metal oxynitride is new class of materials with properties that can be implemented in industrial applications [1]. Tantalum-based thin films have been a mainstay in the microelectronics industry for several decades and have been studied for the fabrication of long-term stability resistors, diffusion barriers and as an adhesion promoter layer in platinum films used for high-temperature applications [2]. Tantalum nitrides are used in a wide variety of applications such as diffusion barrier [3], wear and corrosion resistant materials, high-speed thermal printing head as well as in thin film resistors [4]. Combining the valuable properties of nitrides and oxides gives the possibility to enhance in resulting oxynitride by varying content of oxygen and nitrogen [5]. The effect of oxygen in addition to transition metal nitride on the

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Materials Performance and Characterization

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Assessment of Sputtered Chromium Oxide-Nitride Coatings

Reference

Dave, D. P., Patel, N. P., Chauhan, K. V., and Rawal, S. K., "Assessment of Sputtered Chromium Oxide-Nitride Coatings," *Materials Performance and Characterization*, Vol. 7, No. 1, 2018, pp. 49–58, https://doi.org/10.1520/MPC20170053. ISSN 2379-1365

ABSTRACT

The main purpose of this research work is to explore the formation of chromium oxide-nitride coatings by radio frequency (RF) magnetron sputtering using chromium as a target, oxygen and nitrogen as reactive gases, along with helium as an inert gas. The consequence of temperature variation on the formation of chromium oxide-nitride coatings and their properties is reported in this paper. The identification of respective oxide/nitride phases of chromium was done by X-ray diffraction. A wettability study of chromium oxide-nitride coatings was done using a contact angle–measuring system. Initially, at a lower deposition temperature of 200°C, the deposited films were amorphous. However, when the temperature was increased from 200°C to 600°C, the formation of crystalline films was observed, and its wettability behavior was transmuted from hydrophilic to hydrophobic. The influence of temperature variation on the tribological properties of mixed chromium oxide-nitride coatings is examined.

Keywords

chromium oxide-nitride, sputtering, transmission, tribological properties, wettability

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Introduction

Physical vapor deposition (PVD) methods are extensively applied for the deposition of transition metal oxide-nitride as a thin film on substrate. Binary, ternary, or multi-component compounds are presently formed from alloyed, composite, or segmental targets [1–5]. To fabricate different metallic oxides, nitrides, or inorganic compound films with the help of a metallic target and a reactive gas mixture (argon-oxygen,

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Contact angle hysteresis, wettability and optical studies of sputtered zinc oxide nanostructured thin films

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Zinc oxide (ZnO) nanostructured thin films are deposited by RF magnetron sputtering on corning glass substrates. The effects of RF power and deposition temperature on ZnO nanostructured thin films are investigated. The structural characterization is done by X-ray diffraction; the deposited ZnO nanostructured thin film is amorphous at 30W RF power. The increase of RF power to 90 W and 150 W leads to evolution of (100), (002) and (101) textures of ZnO nanostructured thin films. A well intense (002) peak of ZnO nanostructured thin films is evolved and (100) peak diminishes with increase in deposition temperature from 200ºC to 600ºC. The wettability studies of ethylene glycol are rarely done, so we have investigated contact angle hysteresis and wettability properties of two liquids; water and ethylene glycol on deposited ZnO nanostructured thin films measured by contact angle goniometer. The motivation of this research work is to explore the wettability studies specifically for ethylene glycol on zinc oxide nanostructured thin films as it is used as antifreeze agent and coolant in industry and commercial applications. The contact angle formed by water and ethylene glycol varies as a function of RF power and deposition temperature. The optical properties were measured by UV-Vis-NIR spectrophotometer.

Keywords: Zinc oxide, Sputtering, Contact angle hysteresis, Wettability, Ethylene glycol, Optical properties

The requirements for existing thin film techniques coatings have encouraged the improvement of various deposition techniques. These makes achievable to control the chemical and phase composition as well as microstructure of thin film, thereby observing their performance and properties. Zinc oxide (ZnO) has fascinated a widespread research interest for use in mechanical, optical, electrical and biomedical devices as a result of its adaptable characteristics. It has been reported that the properties of ZnO are diligently reliant on their crystalline density crystal size, orientation, dimensions, morphologies and aspect ratio[1,2].

Zinc oxide is a very expedient material for electronic and photonic application and is mainly auspicious in nanodevice applications because of its inclusive direct band gap of 3.37 eV and large exciton binding energy allow to different fields like photo-detectors, thin film gas sensors and light emitting diodes especially for UV region[3,4].

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 is very useful for many applications it would be constructive to be able to modify between hydrophilicity and hydrophobicity[5]. Hydrophobicity and transparency are complicated properties that are inversely proportional to each other. Translucent hydrophobic coatings may be used in several industrial applications such as anti-rusting, anti-wetting, anti-fogging, anti-ice adherence, and moderated friction resistance coatings[6]. Ethylene glycol is used as a medium for convective heat transfer in automobiles[7].

The studies of wettability property of ethylene glycol on ZnO nanostructured thin films are limited in literatures. This paper aims to explore specifically the wettability properties of ZnO nanostructured thin films with water and ethylene glycol. The objective of the current work is to improve transparent hydrophobic zinc oxide nanostructured thin films by reactive RF magnetron sputtering using argon as inert gas. Zinc oxide nanostructured thin films were deposited on corning glass substrate at different RF power and deposition temperature; their effect on structural, wettability and optical properties of deposited films have been investigated in this present work.

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CFD Analysis of Sputtered TiN Coating

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Abstract

A three dimensional Computational Fluid Dynamics (CFD) study has been carried out using Fluent-ANSYS analysis package to predict the velocity profiles, pressure profiles, density profiles and concentration distribution of the process gas species (argon and nitrogen) across the sputtering chamber. Multiple species gas flow analysis has been performed to visualize the mixing behaviour of the process gases inside the deposition chamber. The results show that the location of gas inlet port and substrate has a greater influence on the gas distribution inside the chamber and over the substrate where the reactive gas will react to form coating. The numerical predictions done provides useful understanding of the multiple species process gas distribution and mixing behaviour at various gas flow rates in the sputtering chamber.

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Keywords: CFD; Concentration; Sputtering; ANSYS

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Numerical Investigation of performance for Car Radiator Oval Tube

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Abstract

Today's demand is an optimized system to minimum fuel consumption, higher powered engine in compact size. Current performance radiator has become a restricting the development of the cooling system. Therefore, a better design and manufacturing performance, smaller radiator, internal combustion engines to meet the needs of functioning in various operating conditions, will certainly be the future trend. In this paper heat transfer rate is studied for radiator with coolant mass flow rate 4.00 LPM to 9.00 LPM. The numerical study on Ansys workbench platform is carried out to evaluate heat transfer through the radiator for water based CuO nano fluid. As the volume fraction of CuO increases heat transfer performance was improved but it is observed the pumping power is also increased. Using design of experiment method optimum length is found to improve the heat transfer performance without affecting pumping power.

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Keywords: Radiator, Heat transfer, Pressure drop, Nano fluid

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A Parametric Study for Optimization of Gas Injector Orientation and Its Effect on Duel Fuel Engine Using CNG as Fuel

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Abstract

The expansion and explore of injection system has always been influenced by the availability and the form of fuel. This research paper is about the revise of the injection nozzle effect of compressed natural gas engine. In this paper study and replicate different location of sequential injection nozzle at different locations using Computational Fluid Dynamics software to find the best air and fuel mixing in the combustion chamber of the engine. The other effect of the Modified injection nozzle is the velocities of the fuel in combustion chamber that can be determine using the software. The length of bore and stroke of the engine is base on the actual diesel engine and been model using Gambit. The air and fuel mixing is very good and better compare with the original injection nozzle. The velocity of fuel in combustion chamber is the highest compare with other design. A methodology for optimization of gas injector orientation for better thermal efficiency is emerged from this study.

Keywords: Compressed natural gas, alternative fuel, engine development, mixture formation

INTRODUCTION

Diesel engines are used for power generation, mass and passenger transportation and off- road application due to higher thermal efficiency [1]. The great problems of the world in the diesel engines usage until today are focuses on environment protection and economically fuel consumption. The problems need the new design, research and technology to find the new engines or its components so it can use of the alternative fuels another gasoline and diesel fuel, protect and friendly with the environment, high power and efficient in fuel consumption. The first choice of alternative fuel is compressed natural gas. By using compressed natural gas (CNG) as an alternative fuel for internal combustion engine will be reduce the engine performance, but the exhaust gas emission and economic operational by using compressed natural gas (CNG) as a fuel is lower than diesel fuel and gasoline fuel[2]. This study will focus on augment dedicated compressed natural gas (CNG) engine development based on computation and experimental[3]. The project is to design and development of sequential injection dedicated CNG engine based from four stroke direct injection diesel engine.

In sequential injection compressed natural gas (CNG) engines, natural gas fuel is injected by fuel nozzle injector via intake port into combustion chamber and mixing with air must occur before ignition of the gas fuel. Once ignition occurs, there is a rapid energy release resulting from the combustion of the fuel mixed during the ignition delay followed by a slower energy release limited by the availability of gaseous fuel and its mixing rate with air [3]. To improve the perfect of mixing process of compressed natural gas (CNG) fuel and air in combustion chamber, for example with arranging of nozzle hole geometry, modification of piston head, arranging of piston top clearance, letting the air intake in the form of turbulent and changing the compressed natural gas (CNG) fuel angle of spray[4,5]. The compressed natural gas (CNG) fuel spraying nozzle is the level of earning variation so that can be done by research experiment and computational of engine power, cylinder pressure, specific fuel consumption and exhaust gas emissions which also the variation of them have been researched the sequential injection of compressed natural gas (CNG) offers several advantages to increase the compressed natural gas (CNG) engines performance [6]. Dual fuel engines combine diesel cycle CI combustion and Otto cycle combustion. The diesel engine under development uses excess air, high compression ratio (17:1) and a direct injection combustion chamber design. During dual fuel operation the gas is injected into the inlet air immediately prior to the inlet manifold, the air-fuel ratios are controlled within the lean burn range (21:1 to 27:1 air fuel ratios) and ignition is achieved by pilot injection of diesel. Compressed natural gas can be used in modified Diesel cycle engines [3]. The equipment required

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ORIGINAL PAPER

Effect of Fenton process on treatment of simulated textile wastewater: optimization using response surface methodology

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Abstract A large portion of water is consumed during various textile operations thereby discharging wastewaters with pollutants of huge environmental concern. The treatment of such wastewaters has promising impact in the field of environmental engineering. In this work, Fenton oxidation treatment was engaged to treat simulated textile wastewater. Box–Behnken design and response surface methodology were employed to optimize the efficiency of Fenton process. Iron dose, peroxide dose and pH were considered as input variables while the responses were taken as chemical oxygen demand and color removal. A total of 17 experiments were conducted and analyzed using second-order quadratic model. The quadratic models generated for chemical oxygen demand and color removal efficiencies were validated using analysis of variances, and it was found that the experimental data fitted the second-order model quite effectively. Analysis of variances demonstrated high values of coefficient of determination (R^2) for chemical oxygen demand and color removal efficiencies with values of 0.9904 and 0.9963 showing high conformation of predicted values to the experimental ones. Perturbation plots suggested that the iron dosage produced the maximum effect on both chemical oxygen demand and color removal efficiencies. The optimum parameters were determined as Fe^{2+} dose—550 mg/L, H_2O_2 dose—5538 mg/L, pH—3.3 with corresponding chemical oxygen demand and color removal efficiencies of 73.86 and 81.35%. Fenton process was found efficient in treatment of simulated textile wastewater, and optimization using response surface methodology was found satisfactory as well as relevant. From the present study, it can also be concluded that if this method is used as pretreatment integrated with biological treatment, it can lead to eco-friendly solution for treatment of textile wastewaters.

Keywords Analysis of variances · Box–Behnken design · Color removal · Chemical oxygen demand · Azo dye

Introduction

The accelerated development of textile industries is enhancing higher rate of water pollution in the environment (Nidheesh et al. 2013). Dye molecules consist of two key segments: chromophores, helps in producing color and auxochromes which are accountable for enhancing affinity toward the fiber and render the molecule soluble in water (Nidheesh et al. 2013). The most significant chromophores are azo (–N=N–), carbonyl (–C=O), methine (–CH=), nitro ($–NO_2$) and quinoid groups. The most important auxochromes are amine ($–NH_3$), carboxyl (–COOH), sulfonate ($–SO_3H$) and hydroxyl (–OH) (Dos Santos et al. 2007). The auxochromes can be owned to the classes of reactive, acid, direct, basic, mordant, disperse, pigment, vat, ingrain, sulfur and solvent dye (Welham 2000).

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Flip flop of Day-night and Summer-Winter Surface Urban Heat Island Intensity in India

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The difference in land surface temperature (LST) between an urban region and its nearby non–urban region, known as surface urban heat island intensity (SUHII), is usually positive as reported in earlier studies. India has experienced unprecedented urbanization over recent decades with an urban population of 380 million. Here, we present the first study of the diurnal and seasonal characteristics of SUHII in India. We found negative SUHII over a majority of urban areas during daytime in pre-monsoon summer (MAM), contrary to the expected impacts of urbanization. This unexpected pattern is associated with low vegetation in non-urban regions during dry pre-monsoon summers, leading to reduced evapotranspiration (ET). During pre-monsoon summer nights, a positive SUHII occurs when urban impacts are prominent. Winter daytime SUHII becomes positive in Indo-Gangetic plain. We attribute such diurnal and seasonal behaviour of SUHII to the same of the differences in ET between urban and non-urban regions. Higher LST in non-urban regions during pre-monsoon summer days results in intensified heatwaves compared to heatwaves in cities, in contrast to presumptions made in the literature. These observations highlight the need for re-evaluation of SUHII in India for climate adaptation, heat stress mitigation, and analysis of urban micro-climates.

The urban heat island (UHI)[1] is a phenomenon whereby urban regions experience warmer temperatures than their rural, undeveloped surroundings[2]. The differences of the land surface temperature (LST) between urban and surrounding non-urban areas is known as surface urban heat island intensity (SUHII)[3–5]. Global analysis[5] of 419 big cities shows positive SUHII with a diurnal variation, as computed from Moderate Resolution Imaging Spectroradiometer (MODIS) data[5,6]. The average annual daytime SUHII (1.5 ± 1.2 °C) is reported to be higher than the annual nighttime SUHII (1.1 ± 0.5 °C) ($P < 0.001$), with no correlation between the two[5]. Regional analysis of SUHII in the United States indicates its dependence on variation in the efficiency with which urban and rural areas convect heat to the lower atmosphere[7]. The SUHII in Europe depends on the size of urban regions with seasonal variations[8]. An analysis of UHI based on LST derived from satellite observations in Asian megacities shows strong negative associations with the urban normalized difference vegetation index (NDVI) and positive associations with built-up areas, although the relative contribution of these two factors has not been investigated[9]. This list of megacities also did not include any Indian cities, which altogether have the population of 380 million[10]. Overall, the global and regional studies suggest warm urban region compared to the nearby rural areas[11–14], with differential long term trend[15]; however a detailed analysis on the characteristics of UHI in Indian cities is yet to be performed.

Growth of populations, along with industrial and economic development, has led to the conversion of natural forests and vegetation to urbanized regions with highly built-up areas and infrastructure[16]. The impacts of urbanization on the climate include higher emissions and associated perturbations[17,18], higher temperatures and more frequent heat waves[19,20], and extreme precipitation with a higher risk of urban flooding[21,22]. There are similarities among urban heat islands in different regions across the globe, with 1–4 °C differences between the temperature of urban and nearby non-urban regions[5,6]. Higher temperatures in urban areas may be associated with higher occurrences of heat waves, health impacts related to heat stress[23], intensification of local convections and extreme

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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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Efficient and Scalable Multitenant Placement Approach for In-memory Database over Supple Architecture

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Abstract

Of late Multitenant model with In-Memory database has become prominent area for research. The paper has used advantages of multitenancy to reduce the cost for hardware, labor and make availability of storage by sharing database memory and file execution. The purpose of this paper is to give overview of proposed Supple architecture for implementing in-memory database backend and multitenancy, applicable in public and private cloud settings. Backend in-memory database uses column-oriented approach with dictionary based compression technique. We used dedicated sample benchmark for the workload processing and also adopt the SLA penalty model. In particular, we present two approximation algorithms, Multi-tenant placement (MTP) and Best-fit Greedy to show the quality of tenant placement. The experimental results show that Multi-tenant placement (MTP) algorithm is scalable and efficient in comparison with Best-fit Greedy Algorithm over proposed architecture.

Keywords: Multitenancy, In-memory Database, Best-fit Greedy Algorithm, MTP (Multi-tenant Placement), Supple Architecture

1. Introduction

Conventionally, in-memory databases have been in use for applications which were performance sensitive such as financial services markets. In-memory database claim to provide an alternative to the OLAP. Instead of pulling the data from a disk, keeping it in memory (RAM) speeds up the processing and response time of data by order of magnitude. This is the reason why in-memory Database is booming in industry these days. With the expeditious increase of Software-as-a-Service (SaaS), it has become important to operate services at a faster response time for SaaS providers.

With the aim of to reduce operational cost, multi-tenancy provides methods for combining multiple tenants of hosted application into the same system. Multi tenancy can be employed in the database layer in such a way that a single database can be used by multiple customers i.e. tenants. A cloud uses technology of multitenancy to share IT resources among multiple applications and tenants securely. Virtualization-based architectures is used by some clouds to isolate tenants and some uses custom software architectures to get the job done

In this paper we have shown the proposed architecture for standing tenant placement for query request with sample HR benchmark design combined both approaches in-memory and multitenancy. To improve sever utilization and resource profit, tested two algorithm(s) (1) Best-Fit Greedy (2) MTP. In Supple architecture it consists mainly three components (1) Cluster head: maintain placement information over in-memory database. (2) Router: based on cluster map it forwards query request to the suitable instance manager and (3) Instance Manager: distribution of requests across the tenant user. The supple architecture adopt Microsoft Azure Platform and also provide physical machine that turned into virtual disk pool.

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Fog Computing:
Applications, Concepts, and Issues

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ABSTRACT

The Internet of Things could be a recent computing paradigm, defined by networks of extremely connected things – sensors, actuators and good objects – communication across networks of homes, buildings, vehicles, and even individuals whereas cloud computing could be ready to keep up with current processing and machine demands. Fog computing provides architectural resolution to deal with some of these issues by providing a layer of intermediate nodes what's referred to as an edge network [26]. These edge nodes provide interoperability, real-time interaction, and if necessary, computational to the Cloud. This paper tries to analyse different fog computing functionalities, tools and technologies and research issues.

KEYWORDS

Applications, Cloud, Fog Computing, Internet of Things

1. INTRODUCTION

At a really generic level of understanding it is said that Internet of Things (IoT) may be the network infrastructure where the physical and virtual objects are all equipped with sensing and communication capabilities in order that they will use the Pervasive Internet for data transmission and other controlling and monitoring purposes. This definition could seem rather dubious at the primary scan. The inferences and the implications of the definition are going to be clearer as we have a tendency to move forward with the content of this text.

To put this simply, "IoT is a scenario in which objects, animals or people are provided with unique identifiers and the ability to automatically transfer the data over a network without requiring human-to-human or human-to-computer interaction". Explosive growth of Smart Devices and PCs brought the amount of devices connected to the Internet to 12.5 billion in 2010, while the world's human population exaggerated to 6.8 billion. It is estimated by CISCO that IoT was "born" between 2008 and 2009 (see Figure 1).

'Fog Computing' is the computing directly at the edge of the network, which might deliver new applications and services particularly for the longer term of web. This computing relies on the basis that process jobs, which can be executed on edgy nodes (located in between the cloud and user devices) to reduce communication latencies. Thus, fog computing provides higher Quality of Service (QoS).

In fog computing, fog nodes offer resources/services at the edge of the network. They will be devices with limited capability like set-top boxes, access points, routers, switches, base stations, and end devices, or devices with lots of capability i.e. machines like Cloudlet and IOx.

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TCP M-Start: A New Slow Start Method of TCP to Transfer Data Over Long Fat Pipe Network

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Abstract: Transmission control protocol have gone through various revisions to develop new method of responding to network congestion control as per past, present and future requirements. In cloud computing moving large size of a VM from one data center to another data center over WAN is a challenging task. To regulate data flow, sending of data is carried out in three phases iteratively. Slow start, congestion avoidance and fast recovery. All these methods are functions of ACK reception. Specially in slow start, initially it is very slow but it progresses aggressively as times increases. Because of a slow start, it suffers from low network resource utilization in the high bandwidth delay scenario. At every receipt of ack, the congestion window is either step up by one or a zero. In this paper, efforts are made to improve slow start behavior by changing step up count (scnt) to improve network resource utilization. Experiments and results, observed during the slow start phase, show that throughput has increased to 51.23%, time to reach epoch has reduced to 40%, the position of epoch point has increased to 4 times higher than traditional but it leads to increased 30% of packet drops.

Keywords: TCP congestion control, Slow start, Step-up count, Epoch point, VM migration, Cloud computing, Data centre.

1. Introduction

About 2.6 billion mobile devices will be connected by the 2020 over the Internet [1]. It will raise the need of more services from data centre. Users also need data in a short response. Data Centre (DC) has to provide those services in very less time as per user needs. To achieve that DC needs to perform load balancing either by moving or copying VM nearest to clients [2]. This will reduce long distance traffic on the Internet as well as fast access to the required resources hosted nearby user.

To mitigate above service requirements data center has to provide VM migration efficiently over WAN. There are three types of VM migration [3] developed in local area network environment. It transfers VM over short distance with very high bandwidth i.e. 100 Gbps. WAN VM migration has issue of a latency and a resource occupancy for long time. To support same method in WAN, TCP protocol needs to be modified. Fiber optic network has solved the problem of backbone bandwidth over WAN. WAN has inherent problem of propagation delay. To support WAN VM migration along with LAN migration, data centre need of two types of hypervisor is suggested. One hypervisor takes care of internal VM migration. Other hypervisor takes care of external VM migration. In this kind of architecture, external hypervisor will take care of transferring VM on the high bandwidth and high delay where internal hypervisor is engaged to transfer VM internally in a very high bandwidth and very low delay network. Additionally, fiber optical network has reduced external interference while transferring data in WAN environment.

In TCP/IP protocol stack, network layer is engaged to transfer data from one end to the other end. TCP is responsible for regulating the flow between the end devices. TCP works at the transport layer, one layer above the network layer. The major concern of transport layer is to provide connection oriented and connection less services.

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Personal and Intelligent Home Assistant to Control Devices Using Raspberry Pi

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Abstract: "*Personal Assistant-The word itself means assistant working exclusively for one particular person*." Purpose of this type of Automation System and Artificial System is to reduce human labour, effort, time and errors due to their intelligence. Main work is to design and implement this personal home assistant in same device, which can access internet and can control to home devices. All tasks and services working on user related information are available to online sources at present location. Sensor devices in this system are used to control devices, to improve system security and to make accurate decisions. Personal Assistant is designed for making a user's life easier. This system uses voice recognition system to control different types of devices based on personal assistant. This type of system is a very important and useful today's worlds for the physically debilitated peoples. They are not capable to do different activities and to work to do efficiently at any place.

Keywords: Home Automation, Amazon voice service, Personal Voice Assistant, Raspberry Pi.

1. INTRODUCTION

Internet of Thing [26, 27, 28, 29] is the system equipped by all items on the earth that can recognize gadgets or machine effortlessly clear identifiers and it is change day by day life. IoT is combination of both hardware as well as software. Internet is main thing available in IoT. In the IoT we can access, control from anywhere and anytime. In the IoT, there are Machine-to-Machine communication, Machine to Human Communication and Human to Machine Communication are possible. Embedded devices are more important in IoT because of Data collection, Network Resource Preservation and Closed Loop Function. Growth of IoT is day-by-day increasing. "The Internet of Thing is the interconnection of uniquely identifiable embedded computing devices within` the existing Internet infrastructure. IoT is mainly concerned with making devices work with connected data over an internet. The data can be from different types of sensors, which are embedded with real environments. This data is then carried over the internet to its respective controllers. The controllers then process the data and send relative commands to the actuators. The sensors and the actuators both work on different environments. Therefore, they need to communicate with each other.

There are many applications based on IoT like Home Automation, Smart Agriculture, Smart Parking, Smart Education, and Smart Grid. In the IoT we are using IPV6 for the IP address. All devices in an IoT environment communicate with each other. The to-and-fro communication between sensors and actuators uses different protocols such as MQTT, CoAP, XMPP, REST, 6LowPAN etc. These devices are connected to the internet through capillary networks. From above data we can conclude that Internet of Things consists of multiple specialized hardware and software that perform specific functionalities through web APIs which uses various protocols to create seamless connection to internet so that sensory data system sense that data and control system can take action on actuators set on specific environment. The data sensed by the respective sensors can also be stored virtually in cloud from where it can be used by the user remotely to perform analytics and to derive the results. IoT is mainly developed into two technologies: wearable and embedded. The wearable devices are mainly developed using their own platforms depending on the developer.

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Recognition of Facial Expressions using Local Mean Binary Pattern

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Abstract

In this paper, we propose a novel appearance based local feature descriptor called Local Mean Binary Pattern (LMBP) for facial expression recognition. It efficiently encodes the local texture and global shape of the face. LMBP code of a pixel is produced by weighting the thresholded neighbor intensity values with respect to mean of 3 × 3 patch. LMBP produces highly discriminative code compared to other state of the art methods. The micro pattern is derived by thesholding on mean of the patch, and hence it is robust against illumination and noise variations. An image is divided into M × N regions and feature descriptor is derived by concatenating LMBP distribution of each region. We also propose a novel template matching strategy called Histogram Normalized Absolute Difference (HNAD) for comparing LMBP histograms. Rigorous experiments prove the effectiveness and robustness of LMBP operator. Experiments also prove the superiority of HNAD measure over well-known template matching methods such as L2 norm and Chi-Square. We also investigated LMBP for expression recognition in low resolution. The performance of the proposed approach is tested on well-known datasets CK, JAFFE, and TFEID.

Key Words: Local Binary Pattern, Local Direction Pattern, Local Mean Binary Pattern, Histogram Normalized Absolute Difference, Support Vector Machine.

1 Introduction

Facial expression plays a vital role in communicating emotions and intentions [1]. Visual clues and information lead towards a better understanding in a conversation. Application area of FER covers a broad spectrum, including grading of physical pain, smile detection [2], [3], [4], driver fatigue detection [5], patient pain assessment [6], video indexing, robotics and virtual reality [7], depression detection [8] etc. Mental state is imitated on the face in the form of various expressions; affective computing models them in an appropriate computer actions [9]. Interpretation of facial expression through the machine can become a driving force for the future automation interfaces such as car driving, robotics, driver alert systems, human-computer interfaces etc. [7], [10].

Investigation of the Physiognomy and facial expression dates to the era of Aristotle (4th century). Physiognomy is the Greek word, in which *physis* means "nature" and *gnom* means "judge". It corresponds to judging people's character from their external appearance, especially from the face [11]. In 1872, the first

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RESEARCH ARTICLE

Improved Image Pansharpening Technique using Nonsubsampled Contourlet Transform with Sparse Representation

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Abstract Multispectral (MS) and panchromatic (PAN) images contains complementary information. High spatial and spectral resolution is a prerequisite for images to be useful, which can be achieved through image pansharpening. In this paper, we propose a new pansharpening technique which is a combination of nonsubsampled contourlet transform (NSCT) and sparse representation (SR), called NSCT–SR. NSCT is a shift-invariant version of the contourlet transform which combines nonsubsampled pyramid (NSP) and the directional filter banks. NSP splits input MS and PAN images into low-pass and high-pass sub-bands. Fusion of high-pass sub-bands is done using local energy information while low-pass sub-bands are fused using SR. Finally, fused low-pass and high-pass sub-bands are combined to obtain image with high spatial and high spectral resolution. We have quantitatively compared NSCT–SR with other multiresolution algorithms by calculating spatial and spectral quality parameters. It is observed that spatial quality is improved by 0.93 % (for seaside image) and 1.54 % (for urban image). While spectral quality is improved maximum up to 31.39 and 40.47 %, for respective images. NSCT–SR also compared with other state-of-art algorithms by calculating various performance parameters including *quality with no reference*. It is found that, overall; NSCT–SR performs better compared to algorithms considered in work.

Keywords Pansharpening · Nonsubsampled contourlet transform · Sparse representation

Introduction

Spaceborne sensors deployed in the various earth observation satellites for global coverage of earth surface. IKONOS, Quickbird, Worldview-2, Landsat, etc. satellites provide images at different spatial, temporal and spectral resolutions.[1] The spatial resolution of image is expressed as area of the ground covered by one pixel of the image. As pixel size is reduced, objects in the image are delineated with high accuracy. The instantaneous field of view (IFOV) is the portion of the ground, which is sensed by the sensor. Spatial resolution depends on the IFOV (Liu 2000).[2] Multispectral (MS) observations, exhibit limited ground resolution may be inadequate for specific object identification. Images taken using MS bands contain coarser resolutions. Panchromatic (PAN) band contains reflectance data that covers a broad spectral range while maintaining a high signal-to-noise ratio, which allows smaller detectors to be utilized. Therefore, images captured in MS bands and PAN band contains complementary information. Pansharpening is an approach to enhance spatial resolution to that of PAN image with spectral resolution of original MS image maintained (Sirguey et al. 2008; Bovolo et al. 2010). High

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[1] Satellite imaging corporation web page: http://www.satimagingcorp.com/gallery.

[2] The Online Resource for Research in Image Fusion website http://www.imagefusion.org.

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Realization of Various Error Mitigation techniques for SRAM based FPGA

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***Abstract*— SRAM based FPGAs are useful in harsh radiation environments. These type of reconfigurable devices are susceptible to radiation effects which causes faulty outputs, which will lead the system to malfunction or some time system failure. Single Event Upsets(SEUs) are the most general consequence for FPGAs which is based on SRAM, as it might modify the user logic which uses the memory cells as well as memory which is being configured.. Different mitigation techniques are realized for SRAM based FPGAs to mitigate SEUs. The general approach to mitigation is redundancy techniques which are based on hardware, software and information redundancy. In this paper, widely used mitigation techniques such as TMR, DWC-CED, RPR, Quadded logic are explained in brief and implemented on Xilinx Spartan 6 FPGA. A thorough comparison of resource utilization by the techniques has been done, applying all the techniques on single design problem. A concluding remark is presented at the end of the paper.**

Keywords— Radiation effects, Single event upsets, TMR, DWC-CED, RPR, Quadded logic

I INTRODUCTION

Electronic on board modern payloads can be composed of a substantial number of field programmable gate array devices. Many payload data processing applications such as Earth observation, Science, Military surveillance and deep space exploration take advantage from an efficient realization in hardware using programmable logic devices. For example Static Random Access Memory based Field Programmable Gate Array(SRAM based FPGA). This type of FPGA offers many advantage such as vast amount of logic resources, permit speedy clocking, low price and can be rapidly reconfigured which is suitable for signal processing application and this devices are more attractive then Application Specific Integrated Circuits(ASIC) because of increasing capacity.

SRAM based FPGA are more sensitive to emission effects. At high operating frequencies and varying of voltages the device is shrinking correspond to significantly reduced noise margins that happen in both space as well as at the ground level [1]. In this ASIC devices, the routing and logic is considered intensive to Single Event Upset(SEU) and so only the latches need to be protected [2]. In an FPGA, on the other hand , the latches, logic and routing must all be protected [3]. Furthermore, since any added mitigation circuitry is itself implemented in these radiation soft resources, can must be taken to eliminate or minimize the potential sensitivity introduced by the mitigation circuitry itself [3].

Due to the growing additional concentration FPGA components are getting affected to radiation effects in space, which is caused by Trapped radiation, Solar energetic particles and Galactic cosmic rays during solar flares. This type of radiation revelation origin of the bit error in the configuration memory and user memory cells through single and multiple event upsets. Therefore, design techniques to moderate this type of radiation property must be useful to FPGA devices.In mission-critical systems require fault tolerant and correction techniques for the application of SRAM based FPGAs devices to protect them from errors which is caused by high energy radiation, and this is known as single event upsets (SEUs [4].

Single event upsets(SEU) caused by ionizing particles are a problem for these devices because SEUs change values stored in SRAM, SEUs could cause changes in the programmable logic and routing, which could potentially cause the user circuit to malfunction. SEUs can disrupt the communication or control function of the spacecraft. To diminish SEUs belongings to the SRAM based FPGA used in space radiation environment, different type of failure masking and failure recovery techniques were used.

This paper is structured as follows. Module 2 gives the detailed literature survey of the factors through which faults occur in devices and their effects. Then, in Module 3, various mitigation techniques are outlined. In Module 4, the comparison of different mitigation techniques are discussed. Finally, Module 5 Concludes the paper.

II LITERATURE SURVEY

A. Overview of emission effects in SRAM based FPGA

The space radiation surrounding contains a huge collection of active particles and this particles contains energies from numerous keV up to GeV and further than. The classification of common emission effects that should be mitigated in SRAM based FPGA is given in Figure 1 [5].

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Chemistry SELECT Full Papers

Catalysis

Cucurbit[6]uril-Stabilized Palladium Nanoparticles as a Highly Active Catalyst for Chemoselective Hydrogenation of Various Reducible Groups in Aqueous Media

Sekhar Nandi,[a, b] Parth Patel,[a, c] Ajay Jakhar,[a, b] Noorul H. Khan,*[a, b, c] Ankush V. Biradar,[a, b] Rukhsana I. Kureshy,[a, b] and Hari C. Bajaj[a, b]

Herein, we report the synthesis, characterization, and application of uniformly dispersed palladium nanoparticles supported on cucurbit[6]uril. The 2.56 wt% Pd was loaded on cucurbit[6]uril by impregnation method. Cucurbit[6]uril is a macrocyclic compound in which six glycoluril units are joined with twelve methylene bridges which not only act as support but also helped in stabilizing Pd nanoparticles. The synthesized catalyst was thoroughly characterized by various physicochemical methods. The high resolution transmission electron microscopic analysis revealed the uniform distribution of Pd nanoparticles with average size of ~3 nm over the cucurbit[6]uril surface. Furthermore, the synthesized catalyst was used for the chemoselective hydrogenation of various reducible (epoxide, olefin, carbonyls, nitrile, azo, imines and nitroarenes) groups with excellent conversion, selectivity (> 99%) and high turnover frequency (up to 2,05,882 h^{-1}) in aqueous and in some cases with water-THF mixture. Also, the catalyst was successfully recycled several times (>10 times) without losing any significant conversion and selectivity. Moreover, the leaching results were confirmed by analyzing reaction mixture by inductively coupled plasma atomic emission spectroscopy. Furthermore, the kinetic studies reveal the reaction rate depends on substrate concentration. The reaction mechanism was investigated by studying the reaction through drift FTIR studies.

Introduction

Since the discovery of hydrogenation reaction by *Sabatier*, this reaction was well explored in the industry as well as in the academia.[1–4] A significant amount of research has been carried out to develop atom efficient catalyst by designing to activate/polarize hydrogen and targeted site of the substrate simultaneously with minimum possible energy inputs. Many noble metals like rhodium,[5–6] ruthenium,[7–9] palladium,[10–11] and platinum[12–13] or in combination with non-noble metals like nickel[14–15] and iron[16–19] have been used as hydrogenation catalysts. Among all, palladium is one of the most studied metal due to its very high affinity towards hydrogen as well as toward π-bonds of the substrate under heterogeneous and homogeneous reaction conditions.[20] Pd on various organic and inorganic supports has been well documented for the hydrogenation of alkenes and alkynes, carbonyls, nitro, azo, epoxides and other reducible groups.[21–32] Pd/C is one of the most frequently used hydrogenation catalyst under organic solvents, but due to its very high activity, it always leads to poor selectivity and leaching of active Pd is the major problem. To address this issue different basic inorganic supports like MgO,[26,33] hydrotalcite,[34] alumina[35–36] and silica[37–38] have been used with fair success. Besides these, nitrogen-rich organic polymers were also successfully employed as a support for palladium catalyzed hydrogenation of various substrates.[39–40] However, all these systems are designed to do mostly substrate specific hydrogenation with little or no variation in substrate scope, except for very limited citations where a single support but with some variation in the catalyst preparation was able to handle a variety of substrates.[21,23] Further, there are very few reports where water has been used as reaction medium using specially designed nitrogen-containing support modified with a long-chain alkyl group (dodecane) for Pd-catalyzed chemoselective (terminal) hydrogenation of alkenes.[39–40]

Selective hydrogenation of nitro group in the presence of other reducible groups is very challenging, yet necessary to produce desired amines which are required in bulk chemicals, pharmaceuticals, pesticides, dyes, pigments and agrochemical industries.[41–44] Among all the industrially important aromatic amines, aniline is needed in bulk with an annual consumption of more than 5.8 MT (2014), estimated to reach 8.1 MT in the year 2019.[45] Presently; aniline is produced by vapor or liquid

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MP-Index: A Multi-Predicate Publish/Subscribe Mechanism for Internet of Things

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***Abstract*—The IoT (Internet of Things) is a network of physical devices (i.e. objects like Vehicles, Machines, Buildings, Furniture, and so on) that helps achieve better service and value. Large amounts of data is generated while connecting these devices and communicating between them. Faster capturing, processing and forwarding of this data certainly requires an efficient technique during each stage of communication. The Publish/Subscribe communication paradigm is a powerful medium for IoT devices to connect and communicate with each other. It offers anonymous, many-to-many and asynchronous communication which plays a very significant role in designing highly scalable distributed systems. Event matching is one of the key aspects of Publish/Subscribe paradigm where an event that has occurred is matched against the large volume of subscriptions to find the appropriate subscribers that need to be notified.**

The existing event matching solutions are based on the assumption that an assignment (group of events) will be generated and matched against a large number of subscriptions. In the real world, events do not get generated together and hence considering them as an assignment is not the best way to handle them. We are proposing a solution based on the temporal, causal and spatial properties of events, which overcomes the assumption of assignment generation. Our proposed solution, MP-Index (Multi-Predicate Index) allows the Publish/Subscribe system to match individual events occurring at different time stamps against a large volume of subscriptions. The proposed solution was implemented and its results were compared with two of the existing algorithms. The results of the comparison show that the proposed Multi-Predicate Index algorithm outperforms the other two algorithms in terms of matching time. We have also implemented the proposed solution in Mosquitto which is an open source implementation of the MQTT (Message Queuing Telemetry Transport) protocol. The result of this implementation clearly confirms the support for multi-predicate subscription match against events occurring at different time stamps.

***Keywords*-Internet of Things; Event Matching; Event Filtering; Publish/Subscribe; Communication Paradigm; Temporal Events; Causal Events; Spatial Events**

I. Introduction

The IoT (Internet of Things) is network of physical devices, e.g. vehicles, machines, buildings, furniture and so on. The number of such connected devices are increasing day by day [1][2]. The location and behavior of the devices may significantly vary throughout the life time of the system. This decoupled and dynamic nature of the system requires an efficient, fast, flexible and scalable communication paradigm. The point-to-point and synchronous communication paradigm, i.e, Request-Response model would lead to a rigid and static system [3].

The Publish/Subscribe communication paradigm is a powerful medium for IoT devices to connect and communicate with each other [4] [5]. Publish/Subscribe is a communication paradigm that supports many-to-many asynchronous communication in a distributed environment. This ability to provide many-to-many, asynchronous, loose coupling (i.e, space, time, and synchronization) and anonymous communication plays an important role in providing high scalability in a distributed environment. Event matching is one of the key aspects of Publish/Subscribe paradigm where an event that is occurring is matched against the large volume of subscriptions to find the appropriate subscribers to be notified of the occurred event [6].

The existing event matching solutions [7], [8], [9], [10], [11], [12] are based on the assumption that an assignment (group of events) is generated and matched against a large number of subscriptions. In the real world events are not generated together and hence considering them as an assignment is not the best way to handle them. Suppose a subscriber S has subscribed with subscription s_1 as $(HTemp = 10 \quad AND \quad HLock = ON)$ and events $e_1(HTemp = 10)$, $e_2(HLock = ON)$ which occur at time t_1, t_2 respectively. Now if an assignment a_1 is generated by this grouping of events e_1 and e_2 then and only then it will successfully match against subscription s_1. In real world, generation of an assignment a_1 is not possible; hence events e_1 and e_2 will individually fail to match against the subscription s_1. If we look at the events e_1 and e_2 carefully both are ideal candidates for a subscription match with s_1. We have investigated the multi-predicate event matching problem for Publish/Subscribe IoT and proposed a solution MP-Index, based on temporal (i.e. events of interest may occur across time), causal (i.e. occurrence of an event effects end result) and spatial (i.e. events of interest may occur at different geographical locations) event properties which overcomes the assumption of assignment generation. The proposed solution allows the Publish/Subscribe system to match individual events occurring at different time stamps or at different locations against a large volume of subscriptions.

The rest of the paper is organized as follows. In section

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Performance Evaluation PL330 DMA Controller for Bulk Data Transfer in Zynq SoC

Apurva Choudhary, Jaimin B Chavda , Amit P Ganatra, Rikin J Nayak

Abstract— **This paper provides performance evaluation of PL330 DMA in Zynq SoC based device. Direct Memory Access is the feature that allows computer hardware to access system memory for data movement in bulk without CPU intervention. The I/O devices operate at a slower speed than CPU, but using DMA the CPU can be available for performing other computing tasks while data is transferred, as CPU has to only initiate the read/write of data. The direction of transfer can be from device-to-memory, memory-to-device, memory-to-memory and device-to-device. This paper describes the hardware setup and sequence of operations for transfer of bulk volume data at high speed using PL330 DMA controller in Zynq SoC based system.**

Keywords—***Data Acquisition, PL330 DMA, Zynq SoC, Device driver.***

I. INTRODUCTION

Data Acquisition is the process of sampling signals that measure real world physical or electrical phenomenon such as voltage, current, temperature and converting the resulting samples into digital numeric values that can be manipulated by a computer [1]. It is an integral part of almost all application today. The Process is required even in a small application which just acquires a single bit to working in video and audio files. There must be tradeoff between the amount of data to be transferred and the total time required to transfer the data. The requirement is to develop a DAQ system that performs data transfer at a high speed using DMA and also minimizing utilization of available resources. The data must be acquired at a speed such that system performance and throughput increases. This paper discusses about the technique to employ high speed and high volume of data transfer using efficient mechanism.

A DAQ system combines many devices like peripheral I/O devices and CPU. For communication between devices they must be connected using a communication channel called system bus. CPU works as the master and controller of the system bus. The devices must first be registered with the CPU to perform required operation.

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II. DIRECT MEMORY ACCESS(DMA)

There are three major data transfer methods for computer-based data acquisition 1. Polling 2.Interrupts/Programmed I/O 3. Direct memory access (DMA).

A. Need for DMA:-

Movement of bulk data among system components (RAM, CPU, Storage, Controllers etc.) involve CPU for transfer which provides an overhead for CPU and system performance is hindered, so DMA provides CPU with less overhead of just assigning the work and continue with some other task while transfer is in progress and return to the previous task to free the resources once notification is received. DMA also minimizes latency in servicing a data acquisition device because the dedicated hardware responds more quickly than interrupts, and transfer time is short [2]. Direct memory access (DMA) allows devices to transfer data with less processor overhead, whereas without DMA processor has to transfer data continuously which would keep all the resources like bus busy the whole time, throttling the bandwidth.

For a device to use DMA, it must be assigned to a DMA channel. Each device comes under a broad category of ports, each type of port on a computer has a set of DMA channels that can be assigned to each connected device. The task of copy operation is performed by DMA controller (dmac).

Basic steps for transfer using DMA are [3]:

1) CPU programs the DMA controller.
2) DMA requests transfer.
3) Data transferred using DMA.
4) Once data transfer is complete an acknowledgement is received to dmac.
5) The dmac then interrupts the CPU that transfer is complete and to schedule the next job.

The CPU programs the DMA controller by allocating channel for dedicated transfer and setting the DMA capacity. The DMA transfer is then requested first by allocating DMAble buffers in memory that are visible to controller and channels for transferring the data. Once the buffers for allocated the data is transferred and acknowledged once transfer is complete for freeing the utilized resources.

III. XILINX ZYNQ SOC

Current generation of computing devices focus on SoC based systems for rapid prototyping and engineering. Zynq SoC (System on Chip) is an integration of processor and FPGA architectures into a single board. Melding the two technologies provides a variety of benefits including higher integrity, lower power, smaller board size, and higher bandwidth communication between the processor and FPGA.

Xilinx Zynq-7000 all programmable system on chip combines the dual Cortex-A9 processing system with

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An efficient technique for subpixel accuracy using integrated feature based image registration

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***Abstract*—Image registration which is frequently required in Medical, Computer vision and remote sensing field is used to align two images geometrically. This paper presents efficient method for providing speedup and more accuracy in compared to current state of the art existing methods. This paper focuses on Feature detection using Harris detector which gives best result based on performance and has firm invariance to scale, rotation angle, illuminance and noise compare to other feature detection algorithms. Also Feature vector is generated for each detected interest point using Histogram of gradient. Generated feature vector are matched in both image using Best bin first (BBF) to generate accurate Interest point pair and to align the sense image. An additive step is applied to remove outliers and to improve registration accuracy. An experimental result shows that the present method using Harris detector, Hog descriptor, BBF and RANSAC provides higher precision and also it is more robust**.

Keywords*—image registration, Harris, Hog, feature matching, Geometry.

I. INTRODUCTION

Image registration deals with translating different data set in one co-ordinate scheme and to estimate the geometry transformation [1].Image registration is key step in various image processing applications that expect proper alignment of same images taken at different period of time, from different outlook or by different detector [2].It calculates spatial transformation and geometrically align reference image with sense image [2]. Reference image that kept as unchanged and sense image is geometrically transformed to align with reference image [3].Typically registration is required in image mosaicing, creating super resolution image, change detection, integrating information in to geographic information system, computer vision, remote sensing etc [3] .

Registration task can be done either automatically or manually [4]. In manual image registration human operators have to select the matching features in images for registration. Problem arises in manual image registration due to limited accuracy and inconsistent result [4].Because of above mention problem and based on quality image registration methods divided in Area based and feature based methods [3][4][5][6]. Area based method directly works on image intensity values without detecting salient objects [6] and predefined size of window is used to determining the geometry transformation [6]. Area based methods are aggregates feature detection step with feature matching step. It performs well when images does not contain complex transformation [5][6].Feature based method is generally used to detect salient features of images such as line, edges, corner points etc [7][8][9].Accuracy of feature based registration is higher compare to area based registration.

Various image registration techniques were published in 1992 by Brown [10]. The central idea about evolving image registration technique till date and compares the current evolution of image registration. In previous few years several papers were published on image registration each having unique feature are analyzed in this paper.

This paper focuses on existing image registration techniques (Area based and Feature based) which are described based on four steps of image registration in section II A novel efficient Proposed technique is discussed in section III. Experiment results are discussed in section IV.

II. IMAGE REGISTRATION STRATEGY

Before demonstrating existing techniques referred by authors, some staple phrasing have to preferred such as,

Reference image: Image that act as main image. And it is used as the base for other images.

Sense image: shifted image or template image which is geometrically regulates each pixel with the reference image.

Image registration is broadly classified according to their applications, based on necessity and based on nine dimensional scheme.

A. Basic Image Registration Techniques

Image registration determines transformation that aligns sense image. Generally two types of transformation may be estimated such as geometric transformation and photometric transformation. Geometry transformation that alters pixel position in images. Image registration mainly deal with geometry and non-rigid transformation. Photometric transformation alters pixel colour and models the illumination changes.

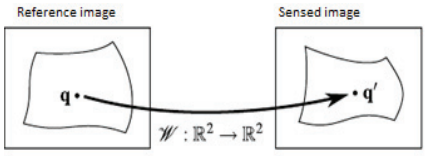

Fig. 1. General Principle of image registration is to estimate geometry transformation that modifies sense image so that it matches with reference image.

Improve performance of ORM caching using In-Memory caching

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***Abstract* - ERP application performance can be complicated, as it's ought to satisfy the prerequisite and desires of some of the greatest and most refined enterprises inside the world. Odoo is in vogue ERP application comes into picture, Odoo-ORM framework written in python. This paper concentrates on essential component of Odoo-ORM i.e. caching. Caching can be one of the important parts of an ORM application. This paper presents a way for the caching strategy of ORM using query caching with In-Memory caching. By using this approach for the ORM, it's potential to reinforce performance and increase throughput.**

Keywords— Dictionary, Enterprise Resource Planning, Object Relational Mapping, Multilevel Caching, Query Caching

I. ODOO INTRODUCTION

Odoo(Once in the past known as OpenERP and before that TinyERP) is an open source ERP application which manages modern enterprise management software odoo application depends on Open Object, an isolated, adaptable structure written in python.

ODOO – Three layer architecture

Odoo adopts the MVC (Model View Controller) architecture pattern. So we can say Odoo is basically three layer architecture; database layer for data storage, application layer for processing and functionalities and presentation layer providing user interface.

A classic arrangement of Odoo is shown figure 1. This distribution is called Web Embedded Deployment. [1] As shown, an Odoo system consists of four main modules:

A PostgreSQL database layer contains and it also maintain Odoo database related operation. Databases server comprises all application data, and additional to that most of the Odoo System configuration element.

Odoo – ORM

ORM framework is one of the salient features of the Odoo application. ORM is the central part of Odoo. Odoo – ORM is scripted in Python language and uses PostgreSQL as a database.

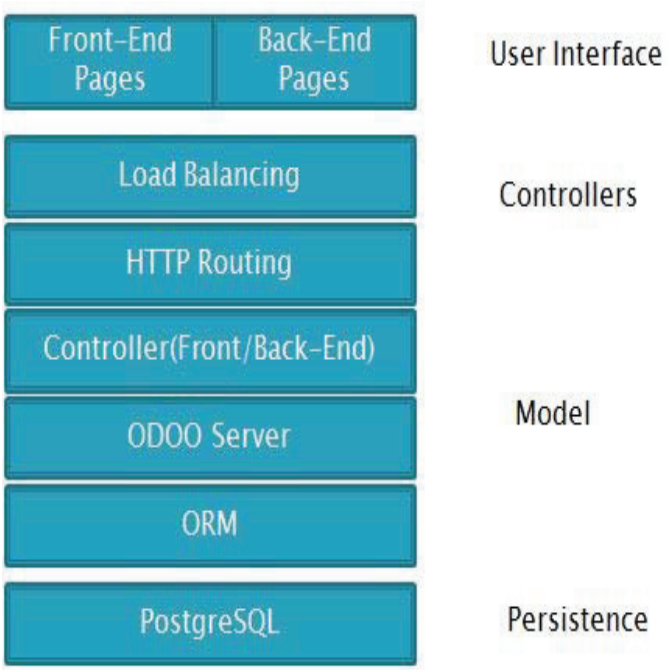

Fig. 1. ODOO as multitenant three-tier architecture.

For example, arbitrary constraints written in python can be added to any model.

So we can say that ORM task is a bridge to fulfill the gap – as its potential for the developer is very transparent – between Python and the fundamental relational database – postgreSQL .

As mentioned above Odoo follows the MVC Architecture pattern, here MVC defined as Model: The PostgreSQL database.

View: XML files in Odoo.
Controller: all object of Odoo.

Analysis – Where to start?

In Odoo – ORM there are various factors which makes and impact on its performance.

- Caching mechanism

An Efficient Deconvolution Technique by Identification and Estimation of Blur

Rikita Chokshi, Dippal Israni, Nishidh Chavda

Abstract—**Distortion in images is a biggest challenge now-a-days. This affects in many areas ranging from photography to medical imaging, astronomy, remote sensing and microscopy. Images get obscured due to many reasons like vibration due to hand movement as well as launch of vehicle (Satellite), Noise in image, Adverse Image/Environment condition, and Quick movement of objects. A technique is required which can solve the above mentioned problems and make possible steps to keep image obscureness as minimum as possible.**

Out of several steps of restoration, blur detection is a primary step required for any blind image restoration. In this paper comparison of various techniques are proposed which finds out type of blur from the corrupted/degraded image using features like Moment Invariants, Histogram of Oriented Gradients, Zernike Moment. This paper also describes comparison of different linear and nonlinear restoration techniques. The analysis and comparison was yielded out based on types of blur, estimation of blur,Structural Similarity Index (SSIM), Peak Signal-to-Noise Ratio (PSNR).

***Keywords*—Image Restoration, Degradation, Point Spread Function(PSF), Blur Type Estimation, PSF Estimation.**

I. INTRODUCTION

Images captured through different imaging devices are known to have dissolute representations of the real images due to the improper imaging and capturing process. Such dissolution can occur because of lens distortion, de-focus blur and blur because of proportional motion between the subject and the camera throughout the photographic exposure anddifferent kinds of noise. To recover this type of degraded image is a challenging problem. The process of recovering an image into original form is defined as image restoration, which is an inverse process of image degradation. It is useful in different areas like astronomy, remote sensing, medical imaging, and microscopy.

Lots of work has been done in this area. D. Singh et al. have proposed a survey on various image deblurringtechniqueswhich highlights that restoring average blur is tricky [1]. K. Sakthidasan et al. have intended iterative method for non local image restoration [2]. B. Zhang et al. suggested image restoration based on kalman filter, to gain theoreticalvalue of ofline spread function, this approach firstly uses Gaussian fitting. Then it uses kalman filter to obtain the correct value of line spread function from its theoretical value and measured value [3]. A. Kumaresh et al. gave image restoration using IIST algorithm which shows the advantage of IIST over ISTA in terms of number of iterations used [4].

R. Lagendijk et al. have proposed basic methods for image restoration and identification which gives introductory idea about image restoration, different types of blur and various image restoration algorithms[5].M. Poulose et al. have proposed survey on image deblurring techniques which gave comparison about blind deconvolution techniques and non blind deconvolution techniques [6]. C. Khare et al. have proposed image restoration technique with non linear filter [7]. Bojarczak et al. have given image deblurring – Wiener filter versus Tikhonov singular value decomposition approach for image restoration [8].

This paper focuses on various existing image restoration/deblurring techniques (Blind and Non-Blind, Linear and Non-Linear), blur detection; blur estimation approaches and challenges for image restoration.

II. RELATED WORK

A. *Image Restoration Process*

A degraded or blurred image can be depicted by this equation:

$$g(x, y) = PSF*f(x, y)+ \eta(x, y) \quad (1)$$

Where g is the blurred/degraded image, PSF is Point Spread Function which causes distortion, f is the original true image and ŋ is additive noise [7].

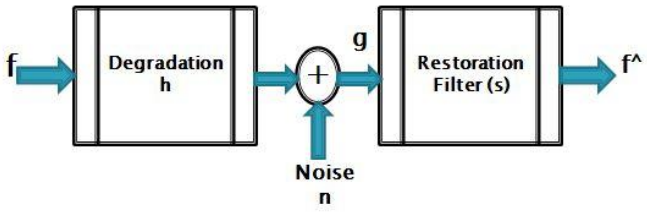

Fig 1. Image Restoration

As shown in the Fig.1 initially input image is degraded by some factors like blur, noise, camera misfocus, etc. Then noise is appended to the degraded image. After adding noise, restoration is required for converting an image into its original form.

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Hardware Design of an Efficient High Speed Multi Channel Data Acquisition Using DDR

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***Abstract*—A Data Acquisition System (DAQs) is an indispensable part to receive, store and further analysis of data. This paper focuses on Data Acquisition from multiple channels using Dual Data Rate (DDR) techniques. Multiple Channels of data source which are source synchronous are initially configured using Serial Peripheral Interface (SPI) commands. The Proposed technique gives an advantage of storing data received from multiple channels in parallel form. The proposed approach is divided into two parts. First is to acquire data from multiple channels of single data source into XILINX sparten-6 Field Programmable Gate Array (FPGA) followed by storing the same onto high speed storage device such as Static Random Access Memory (SRAM).**

Keywords—Multi Channel, Dual Data Rate (DDR), Data Acquisition System (DAQs), FPGA, SRAM, VHD

I. Introduction

Data acquisition is process of acquiring a real-world signal as input, such as a voltage, current or any electrical input to process, analyze, store or data manipulation or conditioning in computer or any other device. Now-a-days High speed data acquisition has become one of the most important component of demanding applications in the electronics world [1]. High-speed digital signal processing systems, high speed image information conversion, real-time processing system, radar, communications, military, medical and chemical industry are areas which are frequently required to sample multiple analog/digital signal synchronously [2]. As accuracy and data transfer rate are needed to be higher and higher, data acquisition system have been developed to fulfill requirement [3]. Existing Data Acquisition System can acquire single channel or multichannel signals.

Based on the processing tool used, data acquisition methods are classified in three types: (1) Computer Based (2) Micro controller based and (3) FPGA based. In Computer based DAQ, computer microprocessor is utilized for processing, storing and manipulating the acquired data [4]. Micro Controller based DAQ is a Control device which incorporates a microcontroller based processing [5]. Lastly reconfigurable FPGA is classified under acquisition system. As the name suggests, it can be reconfigured onboard [1]. Various Protocol uses DAQs like UART (Universal - Asynchronous Receive / Transmit Protocol), SPI (Serial Peripheral Interface) and I2C (Inter Integrated Circuit).

Various techniques like SDR (Single Data Rate), and DDR (Dual Data Rate) are used for DAQs.

One of the recent focal research topic is Multi channel data Acquisition system. In current technology, multi-channel data acquisition is having vast application [6]. Data Sensor used is CMOS image sensor. First reason to choose CMOS sensor is that it does not require any complex driver circuit [7]. Moreover it has compact size, minimal power consumption and high anti-radiation ability device [7]. SRAM has been used to store data.

In Section II data acquisition is briefly analyzed. In Section III tentative approach of data acquisition system is discussed. Section IV gives implementation setup and results. Section V gives the conclusion which is followed by future work and references.

II. DAQ Analysis

Many research papers have focused on DAQ systems. In this portion, analysis of DAQ systems have been represented. Firstly analysis of DAQ systems category is being discussed. After analyzing different types of DAQs, Protocols used in DAQs have been explained. Lastly algorithms of DAQs have been shown.

A. DAQs Method

Classification of DAQ method is as given below.

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Neural network with deep learning architectures

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Abstract

Deep Learning is a field included in to Artificial Intelligence. It allows computational models to learn multiple levels of abstraction with multiple processing layers. This Artificial Neural Networks gives state-of-art performance in various fields like Computer Vision, Speech recognition and different domain like bioinformatics. There are mainly three architectures of Deep Learning Convolution Neural Network, Deep Neural Network and Recurrent Neural Network which provides the higher level of representation of data at each next layer. Deep Learning is required to classify high dimensional data like images, audio, video and biological data.

Keywords: *Neural Network, Deep Learning, Deep Neural Network, Stacked Autoencoder, Convolution Neural Network, Recurrent Neural Network.*

Mathematics Subject Classification 2010: *92B20*

1. Introduction

Machine-Learning becomes vitally important in this era used for the decision making systems, Recommendation systems, to identify objects from the images, in web searching extra to make human beings life easier. Machine learning algorithms use training examples to uncover underlying

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Intelligent Tourist Information System

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ABSTRACT
This paper proposes a model for implementation on intelligent tourist information system. It uses the concept of knowledge-base. The model will be based on the study of human behavior as tourism guide. It builds the relationships between the knowledge based system and the guide, so that it provides service for any visitor which meets their needs and the objective of gaining information of places. There are different modules, different path finding systems and shortest path finding algorithms of artificial intelligence in this thesis. The proposed system should be designed in such a way that it runs on most of devices i.e. palmtop and mobiles. Thus it can be useful while visiting new places. This system would find a route using user criteria. The Shortest path finding algorithm should work efficiently and optimally in most of the cases. The system should find a path that fulfills user criteria, show name of objects, related photos and short description about the place. It should also be able to find distance, time and cost to travel particular destination.

Keywords
Recommendation technique, Shortest path algorithm, Intelligent tourist system, A* algorithm.

1. INTRODUCTION
People love to travel. For travelling, a person must select the destination city. After selecting he/she must decide the places which they want to visit such as resorts, amusement parks, art gallery, restaurants etc. Sometimes people do not have time to plan out these things before, so they ask their relatives, friends who have visited the place earlier and organize it accordingly. Generally we do not have any valuable information except phone number and address, which can make us decide that we want to visit such place. This work basically concentrates on designing systems that provide us the short description about the places. So that we can decide which place we want to visit. This system determines the aspects of knowledge base system which helps to provide all features in the application. The system should be designed in such a way that it should be able to run on all platforms and devices.[2]

2. OBJECTIVES
- The main objective of the research paper is to design a knowledge base system which will be built on the study of human's behavior and adopting the human intelligence in the machine.
- To help in designing the efficient, fast path searching algorithms with optimization.
- To provide the structured database, each place with its short description, timings, ratings etc with GPS and GPRS. The geographical database of the places should also be built.
- To find shortest path between two points (location) in map i.e. navigation systems.

3. EXISTING SYSTEM
In the existing system, people who want to travel searches lots of tourism websites. They need to know the information about the place of interest. They visit certain travel websites or hire a tourist guide which may consume a lot of time. The existing system gives the details like phone number, address, ratings. If a person wants to decide which place he/she wants to visit first, they need to know the information about the place, which the existing system is unable to provide.[1]

4. RECOMMENDER SYSTEM
A recommender system is a subclass of information filtering system that seeks to predict the preference that a user would give to an item. It is used in variety of areas including the research articles. It typically produces a list of results in one of the two ways- collaborative and context based filtering.[1]

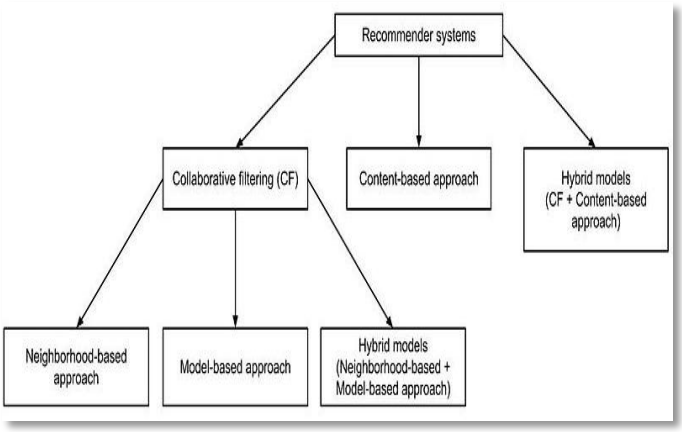

Figure 1 Recommender System Classification

5. ARCHITECTURE
The term artificial intelligence means to embody the human intelligence into machine. The machine should have the capabilities that a human possess. The capabilities such as smart, solving unstructured and complex problems like human does. The machine should understand the language spoken by humans, able to analyze data and information. For example when some expert delivers lecture to student, student learns from it, does hard work and performs activities after learning it. In the same manner machine is made to embody the expert knowledge into some computer program for carrying out some task. The keyboard will be replaced by speech through natural language processing. Human can solve algorithmic and non algorithmic problems. There must be some methods to solve non algorithmic problems, in the form that machine can solve. This capability is the most important thing in artificial intelligence and we are concentrating on them. It includes various functional modules such as user interface, knowledge base, dynamic database, Inference engine[8]

A Survey of Information Retrieval on Microblog

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ABSTRACT
Twitter is most popular microblogging site. It provide us with real time data. This article Provide survey of techniques for retrieving information from twitter stream. This techniques aim is finding real world and most relevant information with respect to the query. For retrieve most relevant information used query expansion techniques. Twitter data contain large amount of information. Information rank retrieval techniques find important data and gives the final score to that information with respect to user interest profile

Keywords
Real time data, relevance information, microblog, twitter stream.

1. INTRODUCTION
1.1 Introduction
Microblog is a broadcast medium that allows user to post short and frequent message [8]. It's a new communication medium compared with traditional data, micro blogging has gained increased attention among user, organization, research scholars in different disciplines.

Twitter is currently fastest growing micro blogging services, with more than 140 or 150 million users producing over 400 or 500 million tweets per day [8]. It's an unable to user update status or tweets, no more than 140 characters to a networks of followers using various communication service. Tweets size are limited, Twitter is updated millions of time a day by user all over the world[8], and its data varies hugely based on user interest and behaviors. So twitter data have large amount of information scaling from latest news, events etc.

Twitter Provides timely information of any event. Observing, keeping and analyzing this content of user-generated data can yield new unprecedented important information, which not available from traditional media [8]. Tweets do the live reporting of event [13] means finding the information what people are talking away from some conferences, debates, sporting events etc.

This Article provides a survey of retrieve information from microblog using various techniques and gives the most relevance score.

1.2 Challenges
Twitter have reported everything from daily life story to real word event. Millions of tweet updated so people have no time to visualize all those tweet.

A major problem is there is no any restriction to post a tweet, update information or status so many people provide false, incorrect information about some events. Large number of spellings and grammar error, and the use of not a proper sentence structure and mixed language so people can't distinguish important data from unused data. Not all tweets are relevant to the user query or interest profile.

One way communication. Twitter often acts as a one-way communication platform. Twitter used by celebrities, TV shows, companies and websites to simply get the word out. It is not used for relationship building.

2. MICROBLOG REAL TIME FILTERING
A user has interest in real time topic, events and they wants to stay up to date in that topic using stream of microblog posts [2].

Main goal of real time filtering is monitoring stream of microblog with respect to user interest profile (query) and find relevance score.

Provide interesting content to user by [1, 2]

1. Push notification on a mobile phone: Interest content might be shown to the user through mobile phone notification.
2. Periodic email digest: user interested profile might be aggregated into an email form that periodically sent to a user [1]. In that case a user could read a longer story about content.

2.1 System Overview
In this section introduce system architecture for retrieve tweets and do the scoring of tweets based on query.

A Survey on Sentiment Analysis

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ABSTRACT
Sentiment analysis is process of extracting information from user's opinions. Every person shares his or her information on social network sites, blogs, product review websites and web-forums. Thus, we get familiar with the thinking of the other people. People's thinking that provides an information that helps in decision making process. This Paper describe different applications of sentiment analysis, techniques and challenges of sentiment analysis.

Keywords
Sentiment analysis, classification, Machine Learning

1. INTRODUCTION

1.1 Introduction
Estimation investigation is a data gathering assignment to accomplish client's sentiments. Utilizing opinion investigation Researchers can examining huge quantities of archives, these sentiments can be communicated into various way positive, negative and neutral routes as remarks, inquiries and solicitations. [1, 2, 4]

Generally, sentiment analysis is classification of the give text polarity in these three levels sentence Level, Document level or Aspect level. Fundamental point of sentiment analysis is to decide the mentality of creator or speaker with respect to some subject or overall polarity of an opinion. Because of the exponential upgrade in the Internet usage and substitution of popular conclusions, opinion examination turns into a vital procedure in today's life. For ordered and unstructured data The Web is a huge depository. [1]

Assumption investigation should be possible at three levels that are document level, sentence level and Aspect level. [1] Sentiment analysis is additionally called opinion extraction, opinion mining, sentiment mining, affect analysis, review mining, emotion analysis etc. [1] these are the many names of it and slightly different tasks as per their name. [1]

Sentiment analysis is field of study that investigation of individuals assessment, estimations, disposition and emotions towards entities for example items, services organizations individual events issues, subjects and their attributes. [3]

1.2 Challenges
Twitter have reported everything from daily life story to real word event. Millions of tweet updated so people have no time to visualize all those tweet.
A major problem is there is no any restriction to post a tweet, update information or status so many people provide false, incorrect information about some events. Large number of spellings and grammar error, and the use of not a proper sentence structure and mixed language so people can't distinguish important data from unused data. Not all tweets are relevant to the user query or interest profile.

One way communication. Twitter often acts as a one-way communication platform. Twitter used by celebrities, TV shows, companies and websites to simply get the word out. It is not used for relationship building.

2. DIFFERENT LEVELS OF SENTIMENT ANALYSIS
Different three levels in sentiment analysis which is document level, sentence level and aspect level. In document level i.e. identified that is the review is positive or negative. In sentence level i.e., identified every sentence is positive or negative and in aspect level entities and their features/aspects Sentiments is positive and negative. [2]

2.1 Document level
In Document level analysis task is characterize whether an entire opinion of document level communicates a positive or negative supposition For instance, given thing audit, the framework figures out if the survey communicates a general positive or negative decision about anything. This undertaking is regularly known as document level sentiment classification. [2, 15]

2.2 Sentence level
In Sentence level the fundamental undertaking is goes to the Sentence and makes sense of if every sentence communicated a positive, negative, or neutral sentiment. Neutral means no opinion about any sentence. This level of investigation is immovably related to the subjectivity arrangement. which is recognizes sentences (called target sentences) [2] that is express genuine information from the sentences (called subjective sentences) that express subjective perspectives and opinions.in any case, we ought to observe that subjectivity is not comparable to supposition the same number of target sentences can suggest feelings for e.g., "We purchased new car a month ago and the windshield wiper has tumbled off". [2, 15]

2.3 Aspect level
In Aspect Level both the document level and the sentence level analyses do not discover what exactly people liked and didn't like. Aspect level performs better-grained investigation. Aspect level is directly looks at the opinion itself. In the Aspect level is depend on the possibility that an opinion consists of a sentiment positive, negative or neutral or an objective of sentiment.[2, 15]

For e.g. Sentence is "The Sony telephone's call quality is amazing, yet its battery life is short" assesses two focuses first is call quality second is battery life, of Sony (component). The conclusion on Sony's call quality is certain in sentence however the opinion on its battery life is negative. Sony telephone's call quality and battery life of Phone are the feeling targets. In this level of investigation, an organized of assessments about elements and their viewpoints can be created, which turns unstructured content to organized

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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

DEFECTED GROUND STRUCTURE BASED WIDEBAND MICROSTRIP LOW-PASS FILTER FOR WIRELESS COMMUNICATION

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ABSTRACT: *This article represents microstrip low-pass filter using defected ground structure (DGS) for the wireless communication application. DGS is used as the basic building block for the realisation of a low-pass filter. A low-Pass filter with a −3 dB cutoff frequency of 3.5 GHz has been designed and simulated using high frequency structure simulator. Tuning of frequency is carried out by changing the dimension of DGS. An equivalent LC circuit of proposed structure is derived and simulated it with advanced design system software. Proposed low-pass filter has been fabricated and provides better performance with compact size; it can be used in wireless communication application such as PCS-1900, UMTS, Bluetooth, WLAN, Wi-max, IMS, and RFID etc.* © 2017 Wiley Periodicals, Inc. Microwave Opt Technol Lett 59:993–996, 2017; View this article online at wileyonlinelibrary.com. DOI 10.1002/mop.30456

Key words: *low-pass filter; microstrip line; defected ground structure (DGS); high frequency structure simulator (HFSS); advance designing system (ADS)*

1. INTRODUCTION

Low-pass and bandpass filters are generally used to suppress higher order harmonics or spurious signal in microwave and millimeter wave system [1,2]. The realization of these components should be such that they provide high performance with compact size and low cost. Numbers of techniques are adopted to design filters such as microstrip-line, waveguide [1], substrate integrated waveguide [3,4], photonic band gap structure, defected ground structure, ground plane aperture, low temperature co-fire ceramic technology. The function of low-pass filter is to pass low frequency up to certain frequency called as a cut-off frequency. It is used for the suppression of higher order harmonic.

There are various techniques available for the design of low-pass filter among like defected microstrip line (DMS), defected ground structure (DGS), etc. An overview of DGS is presented in the literature [5,6], the basic transmission characteristics,

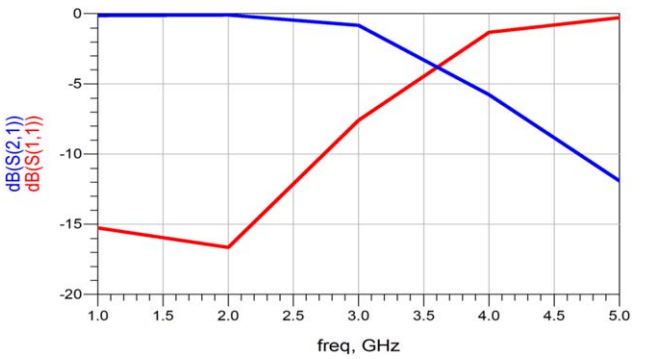


Figure 2 Scattering parameters of equivalent LC circuit. [Color figure can be viewed at wileyonlinelibrary.com]

conceptions of DGS and the equivalent LC circuit model of DGS unit is also presented. A compact low-pass filter and reconfigurable bandpass filter is presented in literature [7]. Moreover, low-pass and bandpass filters are also realized by T type DGS resonator.

A novel ultra wideband bandpass filter based on DGS with the fractional bandwidth of 110% is presented in literature [8]. Bandpass filter is designed with the use of low-pass and high pass filter. Four rectangular type defects have been created on the ground plane to attenuate higher stop band frequency. It provides pass band from the frequency range of 3.1–10.6 GHz. A low-pass filter with the two semi circle defected area is investigate in Ref. [9] for wideband low-pass filter.

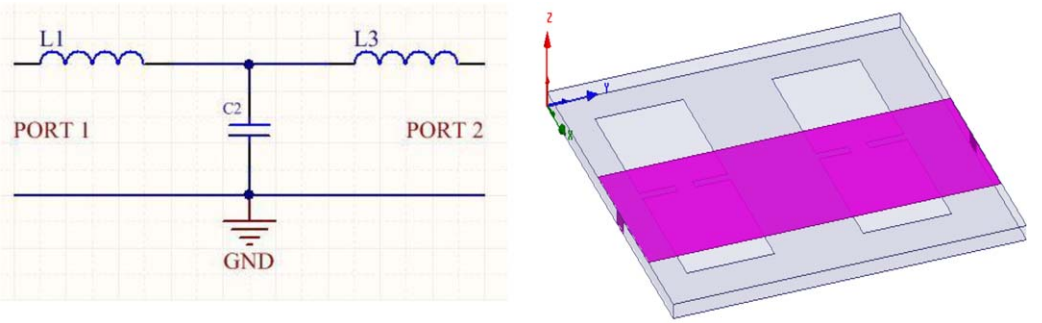
In this article, low-pass filter using DGS is presented for the wireless communication applications. This article is organized as follow, in Section 2 basic theory of microstrip line and DGS is presented. Simulation results of the proposed structure are presented in Section 3. In Section 4 contains the results of proposed structure with different area of defect plane. Finally conclusion is reported in Section 5.

2. THEORY

2.1. Microstrip Structure and Defected Ground Plane

Microstrip line structure generally consists of dielectric substrate, conductive strip line on top of the dielectric substrate and metallic ground plane in bottom of the dielectric substrate. The characteristics impedance of the microstrip line is given as

$$Z_0 = \left(\frac{87}{\sqrt{\varepsilon r + 141}}\right) \ln\left(\frac{5.98h}{0.8W + t}\right) \quad (1)$$



(a) The electric equivalent model (b) its corresponding microstrip structure

Figure 1 (a) The electric equivalent model and (b) its corresponding microstrip structure. [Color figure can be viewed at wileyonlinelibrary.com]

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SIW Based Wideband Horn Antenna

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Abstract: In this paper, we have proposed CSRR (complementary split ring resonator) loaded Substrate Integrated Waveguide (SIW) horn antenna. The whole system is designed on a single substrate, having advantages of small size, low profile, and low cost, etc. The design process and simulation results of a CSRR-loaded SIW horn antenna at K-band and Ka-band are presented. The proposed antenna is an outstanding choice for K, Ka bands and even higher frequency synthesis. It has well-behaved gain and suitable reflection coefficient value less than 1.5 (-10dB S11 and VSWR<1.5). The simulated gain of antenna attains 7.48±1dB over majority of the bandwidth and with radiation efficiency of 85%. The simulation has been done using full-wave package, High Frequency Structure Simulator Software (HFSS) based on Finite element method (FEM).

Keywords: Substrate integrated waveguide (SIW), CSRR (Complementary Split Ring Resonator), bandwidth, insertion loss, High Frequency Structure Simulator.

1. INTRODUCTION

To facilitate enrich the demands of a wider bandwidth in support of exploding data transmission, the operating frequency of satellite and wireless communication systems have been increasing to the high range frequencies [1]. To migrate from low frequency bands to high frequency bands provide wider bandwidth and low atmospheric absorption. It also gives the capability of long range wireless data transmission for point to point communication. There are various applications, such as Imaging and communication satellites, uplink in the Ka band and downlink between Ku-band. All these type of applications require light weight, low cost, and high gain antennas, which constitute most critical parts of such systems.

Most suitable antennas for such kind of applications are from planar structure. However, this type of antennas like microstrip antennas suffers from serious losses particularly at bends and discontinuities by increasing frequency [2]. Although numerous planar antennas have been studied for Ka band communication and radar systems in which the increasing of frequency accompanied with the decreasing of radiation efficiency due to the inherent losses on the microstrip feeding network. Non-planar structure is the alternate for planar structure that provides low losses and high power handling capacity. However, it is difficult to configure the non-planar structure to planar active components.

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Structural Reduction in Front End Memory Requirement of Tree Based Interleaver Method Using the Concept of Invert Tree Based Interleaver in Multiuser Interleave Division Multiple Access Scheme

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Abstract

Interleave division multiple access (IDMA) scheme, uses interleavers for user separation. The selection of interleaver along with optimum design methodology for IDMA system leads to satisfactory results. An efficient interleaver must be easy to generate and should require low memory along with low correlation among interleavers. Existing Tree based interleaver has distinct advantage of low computational complexity but it suffers with the problem of higher memory requirement due to inherent transmission of two randomly generated interleavers. In this paper, a novel interleaver called Invert Tree Based Interleaver (ITBI) is proposed, which reduces the front-end memory requirement of Tree Based Interleaver by carrying out structural modifications. BER performance and correlation analysis of different interleavers for generating user specific interleaving sequences for different users in IDMA system is analyzed. To achieve similar BER performance, ITBI has simulated with lesser memory requirement and computational complexity compared to random and tree based interleaver in IDMA scheme.

Keywords: IDMA, Tree Based Interleaver, low memory, computational complexity, Bit Error Rate, low correlation

INTRODUCTION

DS CDMA has become one of the most popular multiple access in recent years. After the success of CDMA in IS-95, CDMA 2000, WCDMA and TS-SCSMA have utilized the CDMA technique [1]. In DS-CDMA communications, users are distinguished by distinct code waveforms. Due to Multiple Access Interference (MAI) from other users and Inter Symbol interference (ISI) by multipath fading the performance of DS-CDMA is restricted. Various equalization and multiuser detection technique [1][2] have been proposed to suppress these two interferences, but their high computational complexities restrict the practical implementation. After the introduction of turbo codes [3,4]the turbo principal has been widely applied in multiuser detection and thus produce a variety of iterative multiuser detection algorithm such as Parallel interference cancellation[5][6]SIC and PDA[7][8]turbo maximum a postetori probability(MAP) based multiuser detection[9],turbo MMSE based multiuser detection[3][10-14]. However achievable performance is still of concern and loss in the spectral efficiency is not negligible due to fixed frame structure of DS-CDMA system. Therefore, it is necessary to make adequate modification in the transmitter structure of CDMA system. All the above stated problems are due to the technique used for user separation in CDMA systems- PN-sequences. These sequences are orthogonal to each other. Spreaded data may lose its orthogonality in case of higher user count. As a solution to this problem a new scheme known as interleave division multiple access (IDMA) is introduced for user separation. In this scheme interleavers are used to differentiate signals from other users. The impending advantage of this scheme is fully discussed in [15][16-18].In [9] possibility of using interleavers for user separation in coded system is discussed. In [15] narrow band coded modulation schemes based on trellis code structures for is discussed. For wideband system,

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Performance Evaluation of Invert Tree Based Interleaver with Receiver Diversity in Interleave Division Multiple Access

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Abstract

Transmitting multiple copies of signal to minimize fading effect is known as diversity. It is effectively and very commonly used in communication systems to overcome performance degradation due to interference and fading. In this paper, receiver diversity technique is used to overcome fading effect in IDMA scheme with random interleaver, tree based, and Invert tree based interleaver (ITBI). Simulation results illustrates significant performance improvement of IDMA system with receive diversity. It has been observed that ITBI gives comparable performance to that of random and tree based interleaver, however, it presents noteworthy reduction in bandwidth and memory requirement.

Keywords: Fading, Diversity, Invert Tree Based Interleaver

INTRODUCTION

Due to rapid growth in technologies and market oriented demands, mobile communication has entered in 4G stage. The distinctive features of 4G systems in comparison to 3G systems are inherited with technology of packet switched high-rate data transmission along with voice services. The ultimate user needs reliable, cheaper, secure, and low-delay voice & data services anytime and anywhere [1]. The additional features of the future wireless communications include high-speed data and the above features are imposing technical challenges on system design and stimulate various researches to work on topics related to capacity, complexity and performance of the communication systems [2-4]. Wireless communication systems are performed by sending signals through radio propagation environment. But radio propagation environment has some limitations of its performance because of natural and constructive obstacles. The parameters responsible to the sufferings of radio propagation are Path-loss, Shadowing-loss, Interference, Noise, Channel Spreading and Fading of channels [5]. The overall performance of system degraded severely due to the above problem. Fading is a major problem of wireless communication network. The reception of a signal in a channel transmitted through any type of fading channel degrades in quality if the signal level attenuation is below the expected operation region of the receiver [6]. In this situation, the received signal power is not expectedly enough comparing with signal noise and interference power for reliable reception. The solution to overcome the channel attenuation because of fading problem in channel is to increase the transmitted power adjusted to the attenuation which is called power control (PC) [7]. Using PC, the fading can't be overcome completely but the attenuation may compensate considerably. Another approach to minimize fading effect in a system is space diversity and it is effectively and commonly used to overcome degradation in performance due to interference and fading without need of extra bandwidth. If we want to get benefit from diversity technique, then we must need to combine some diversity technique to get advantage. Maximal ratio receiver combining (MRRC) diversity technique, is suitable technique to combat fading [8]. This is the best combining process used with IDMA which achieves the best performance improvement comparing to other methods. IDMA systems has less complex receiver than CDMA [5]. In this paper, MRC as diversity combining scheme is utilized to reduce fading effect in IDMA with various interleavers.

RELATED WORK:

Diversity technique is used to reduce the fading effect [8]. The effect of inter symbol interference can be mitigate by combining technique [15]. A comprehensive study of the combining methods is explained in [10]. Performance Evaluation of Maximal Ratio Receiver which combines Diversity with Prime Interleaver for is given in [11], also the performance of MRRC diversity in IDMA system using Prime Interleaver with Zigzag coding with 1:2 antennas is presented in [12]. The study of IDMA scheme in underwater fading acoustic environment with MRRC diversity is reported in [13]. Various diversity scheme for underwater IDAM communication is also reported in [14].In [15] performance of IDMA scheme with various coding scheme with receiver

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Performance of Nonlinear Detectors in Spatial Multiplexing for Spatially Correlated Channels

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Abstract—Spatial multiplexing is used in multiple input multiple output (MIMO) wireless systems to increase the data rate. Some nonlinear detectors, such as minimum mean square error (MMSE) Vertical Bell laboratories layered space-time (VBLAST), Maximum A-Posteriori (MMSE VBLAST MAP), and MMSE Improved VBLAST detectors are used in place of a over more complex detector, such as maximum likelihood detector or singular value decomposition based detector. We have presented simulation results of MIMO symbol error rate versus average SNR for MMSE VBLAST MAP and MMSE Improved VBLAST schemes assuming spatially correlated channels for *M*-ary QAM. We have observed that the performance of MMSE VBLAST MAP and MMSE Improved VBLAST detectors is almost identical in spatially uncorrelated channels. However, in the case of spatially correlated channels, MMSE Improved VBLAST outperforms MMSE VBLAST MAP. We have also seen that complexity of the Improved VBLAST algorithm is higher than the complexity of VBLAST MAP algorithm.

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1. INTRODUCTION

Current demand of high data-rate in wireless communication can be satisfied by using spatial multiplexing in multiple input multiple output (MIMO) systems [1, 2]. Spatial multiplexing can be implemented by using the channel state information available at the transmitter. However, it needs a dedicated feedback link, which increases complexity of the overall system. Therefore, to avoid the feedback link, the Maximum Likelihood (ML) detection or sphere decoder (SD) is used. However, it substantially increases the complexity of the receiver, when we increase the number of antennas or use higher order modulation schemes [3–10].

The Vertical Bell Laboratories layered space-time (VBLAST) architecture is a nonlinear detector in spatial multiplexing with reasonable practical implementation complexity [11]. However, the bottleneck in the performance of VBLAST detector is the reliability of detection of the symbol with the weakest layer, i.e. with the lowest SNR (signal-to-noise ratio). Therefore, various modifications of VBLAST, such as Improved VBLAST detector [12] and VBLAST MAP (maximum a posteriori) detector [13] have been proposed to improve the performance. In [12, 13] the underlying channel is assumed spatially independent. However, in the real scenario of having less spacing between adjacent antennas and nonuniform scattering in wireless propagation, the channels are usually spatially correlated [14, 15]. In this case, the performance of the system is degraded.

In this paper we have presented the MIMO Symbol Error Rate (MIMO SER) versus Average SNR performance of MMSE Improved VBLAST detector [12] and MMSE VBLAST MAP detector [13] for spatially correlated Rayleigh fading channels. The results show that the performance of MMSE VBLAST MAP and MMSE Improved VBLAST is almost identical in case of uncorrelated channels, whereas the MMSE Improved VBLAST detector outperforms MMSE VBLAST MAP in spatially correlated channels.

This paper is organized as follows. Section 2 briefly reviews the MMSE Improved VBLAST and MMSE VBLAST MAP algorithms. Section 3 presents the system model. Section 4 shows simulation results. Section 5 presents the complexity analysis and finally section 6 contains conclusions.

Notations: small and capital letters in bold denote vector and matrix, respectively. $\mathbb{Q}$, $|Q|$, $E\{\cdot\}$, and $||\cdot||$ denote Quantizer (Slicer), Cardinality of signal constellation, Expectation operator and Euclidean norm, respectively; $\mathbf{I}$, $(\cdot)^{-1}$, $(\cdot)^{H}$, and $\mathbf{G}$ denote identity matrix, inverse matrix, Hermitian matrix and weighting

Interactive Head Control of Embroidery Machine using Embedded Web Server

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Abstract—This paper proposes the design and implementation of prototype model to control embroidery machine using single board ARM processor. Wilcom is the software largely used for embroidery design. Designs prepared using Wilcom software are printed and supplied to the machine for further process. The proposed prototype model extracts the design data from this software by avoiding the printing and/or scanning of the user design and the design data are supplied to ARM based prototype embroidery machine for printing. In proposed model, the pencil is used as printing head and A4 size paper is used for the printing. Further to control the head, Use of web server design is also proposed using ARM processor.

Keywords— Wilcom software, Embroidery machine, ARM Processor, embedded web server

1 Introduction

This paper proposes the concept of single board computer based embedded web server design for embroidery machine control application. General web server are developed using general-purpose computer such as NT server or UNIX/Linux workstation. This web server requires large memory, fast processing multi-tasking operating system with other resources. In contrast, embedded web server is designed using embedded system with support of internet software suit as well as application code to monitor and control the system. It is system which monitors and calibrates the sensors and devices using web pages through fast Ethernet communication media. In this paper, use of embedded web server to control embroidery machine using ARM processor is proposed with implementation of prototype model.

For the decoration and branding, the embroidery design is largely utilized in every common place including houses and places work. They are widely used in textile industries. In comparison with print, embroidery is more three dimensional offering high texture effects. Today, varieties of embroidery machines are available in the market. Computer controlled embroidery machine have multiple needles whose position is fixed. This fixed multiple needle is called "Embroidery head". A framed product i.e. a garment like shirt is placed on frame holder which moves under the embroidery head. This frame holder is also known as "pantograph". Thus it is similar to

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Design and Development of Detector Simulator for Total Ionized Dose and ground checkout system of radiation monitoring instrument

Keyur Mahant, Chintan Bhatt

***Abstract*—This Paper describes the simulator development for the Total Ionizing Dose (TID) measurement of radiation monitoring instrument. The TID Detector (UDOS001-micro dosimeter) is a compact hybrid microcircuit which directly measures Total Ionizing Dose absorbed by an internal silicon test mass. The developed detector simulator, simulates the equivalent Total Ionized Dose absorbed from the space radiation and Ground checkout simulator receive the data from Radiation monitoring Instrument through UART and process it for the functional verification of the Radiation monitoring Instrument, which is discussed in the paper.**

***Keywords*—Radiation, Total Ionizing Dose, LabVIEW**

I. INTRODUCTION

THERadiation is energy that comes from a supply and travels through space and should be able to penetrate numerous materials [1]. Light, radio, and microwaves are varieties of radiation that are known as non-ionizing. The sort of radiation mentioned during this document is named ionizing radiation as a result of it will turn out charged particles (ions) in matter. Ionizing Radiation is made by unstable atoms. Unstable atoms disagree from stable atoms as a result of unstable atoms have excess of energy or mass or each. Radiation also can be made by high-voltage devices. Atoms with unstable nuclei are said to be radioactive. So as to achieve stability, these atoms give off, or emit, the surplus energy or mass. These emissions are called radiation. The sorts of radiation are electromagnetic and particulate (i.e., mass given off with the energy of motion). Gamma radiation and x rays are samples of electromagnetic radiation. Gamma radiation originates within the nucleus while x rays come from the electronic part of the atom. Beta and alpha radiation are samples of particulate radiation. Curiously, there is a "background" of natural radiation all over in our environment. Ubiquitous background radiation comes from space (i.e., cosmic rays) and from naturally occurring radioactive materials contained within the earth and in living things. Space radiation consists of particles trapped within the Earth's magnetic field, Particles shot into space during solar flares (solar particle events) and Galactic cosmic rays, which are high-energy protons and substantial ions from outside our scheme [2]. Solar Flares additionally contribute varying quantities of electrons, protons, and lower energy substantial ions.

When these radiations comes into the contact with electronics it causes Non-destructive or destructive damages to the electronics like Heavy ions of various energies cause single event effects (SEE) [3]. Non-destructive or "soft-error effects" momentarily or permanently change the state of a device or cell/node, affecting its functionality [3]. Total Ionized Dose (TID) effect is accumulation of ionizing dose deposition over a long time on electronics. The TID, largely due to protons and electrons, can result in device failure. TID will be measured in terms of the absorbed dose, which is a measure of the energy absorbed by matter [4]. Absorbed dose is quantified using a unit called the RAD. Here, UDOS001 is used as TID detector for the measurement of absorbed radiation dose.

II. BACKGROUND

A. Standard Radiation Environment Monitor (SREM) [10]

A decision was done by the ESA management board to develop and fly a Regular Radiation Environment Monitor on future ESA projects with the subsequent objectives [9]:

- To assist satellite performance, anomaly and failure investigations.
- With preloaded radiation thresholds to act as a warning / warning arrangement for the spacecraft.
- To assist within the improvement of design of future spacecraft.
- To permit the creation and maintenance of a European radiation database.

Fig. 1. SREM Model

SREM is an enhanced version of a previous Radiation Environment Monitor (REM) flown on the MIR space station and the micro-satellite STRV. The first SREM flight is planned on STRV1-C. The SREM energy resolution for electrons is

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Letter to the Editor

Synthetic plasma and silicon tubular harness-based pure biological transistor amplifier circuit

Dear Editor:

Kosta *et al.*[1–4] first ever reported the development of biologic electronic components viz resistance R, capacitance C, diode D and transistor T using human tissues and human skin. In our early study[5], we have demonstrated the feasibility of liquid medium (synthetic blood plasma) to develop bio-transistor, bio-resistor, and bio-capacitor and combined them to form an amplifier using the metallic harness (the interconnecting copper wires and pieces).

In this paper, we replaced copper wire used in the earlier study by appropriate silicon rubber tube of appropriate length and diameter filled with synthetic plasma. This silicon rubber tube contained an electrically conducting liquid with both positive and negative ions formed by the components of synthetic plasma and was equivalent as a wire made of copper.

In this study, silicon rubber tubes of various lengths with different diameter were filled with synthetic plasma. Tube capacitance C and resistance R were realized by capacitor meter and multimeter. ***Fig. 1A*** and ***B*** show the realization of resistance variation with varying distance with tube diameter 1 mm and 2 mm, respectively. Resistance increased with increment in distance when the tube diameter remained constant. Capacitance was 4 nF for tube 1 mm in diameter and 2.3 nF for tube 3 mm in diameter and remained constant with distance. A pure biologic transistor amplifier circuit is shown in ***Fig. 1C***. This configuration shows pure biologic electronic circuit made from silicon rubber tubular harness. It consists of a main 5-mm silicon rubber tube containing synthetic plasma with the interconnecting harness made of tubes 2 mm in diameter, which were filled with synthetic plasma behaving as metallic interconnecting wires. Resistances R1, R2, Rc and Re were realized on the main tube by inserting two 2-mm diameter tubes with varying distances between two terminals. Resistances were observed due to the collision of charged material particles of the plasma. Capacitances C1 and C2 were also realized because of the property of synthetic plasma to form positive ions as well as negative ions and creating a parallel plate combination. Here, we used purely human implantable materials for the electronic

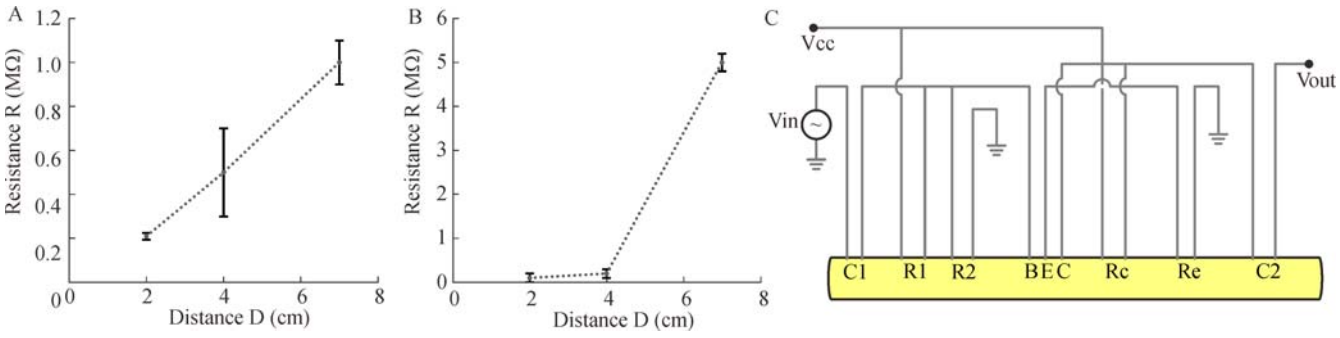

Fig. 1 **Graphical representation of resistance against distance and biological circuit layout.** (A) and (B) Effect on Resistance due to variation in distance with error bars (C) biologic electronic circuit. Experiments were done three times independently and data were expressed as mean +/- SD. A: Tube diameter 1 mm; B: Tube diameter 2 mm; C: Pure biological electronic circuit made using silicon rubber tubular harness.

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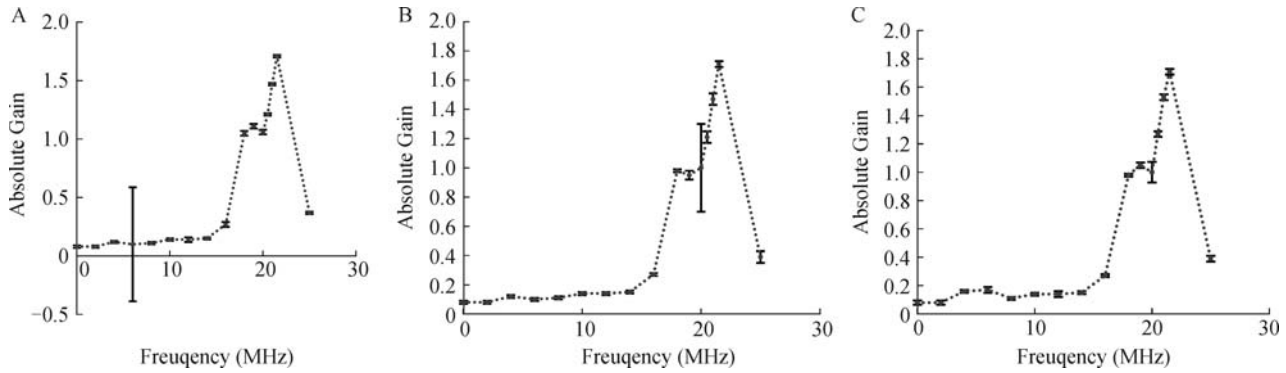

Fig. 2 **Graphical representation of absolute gain against frequency.** Experiments were done three times independently and data were expressed as mean ± SD. A: 1 L density; B: 1.3 L density; C: 1.5 L density.

circuit. This experimental study demonstrated a feasible pure biologic amplifier circuit consisting of different diameter silicon rubber tubes filled with plasma. This has enormous application in implanting electronic circuits inside the human body. One can put battery (power supply of the circuit) on the nearby human body skin surface[6].

The circuit was investigated with synthetic plasma of three different densities (1 L 1.3 L and 1.5 L) in order to realize the general behavior of the circuit. ***Fig. 2A***, ***B*** and ***C*** show graphical representation of absolute gain for plasma 1 L, 1.3 L and 1.5 L in density, respectively over a large frequency range. By keeping frequency variation in a similar manner, the circuit gives an almost similar response. So similar types of circuit could be worked as an amplifier circuit for certain range of frequencies. This behavior strongly supports the innovative idea to apply the similar liquid physics theory to other different density liquid which has similar chemical composition.

Yours

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Designing and Implementation of Liquid Electronic Circuits Using Implantable Material-First Step towards Human-circuit Interface

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Abstract

Biomedical engineering is the immerging domain which applies the concepts of engineering into biomedical science. A first step towards development of pure biological human implantable electronic circuit has been effectively proposed in this paper. A resistor transistor logic circuit using liquid medium (synthetic plasma) has been successfully developed, analyzed and presented in this paper. To justify the stability of the liquid, different density synthetic plasma has been analyzed with similar experiments. Once desired response from liquid circuit has been achieved, a novel biological resistor transistor logic integrated circuit has been proposed and analyzed. Presented work claims about implantation of similar kinds of circuits in to the human body with proper mechanical instrumentation and clinical care.

Keywords: Biomedical science, synthetic plasma, liquid electronic circuits, human body, liquid integrated circuit

1. Introduction

Shivprasad Kosta and his team (2011) presented a liquid memristor concept which claims that liquid based electronic circuits are feasible with proper instrumentation [1]. Shivprasad Kosta et al(2013) [2] used human body parts like skin, live tissues to realize a memristor circuit. The authors (2012) have given the novel idea to develop human

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A review and visionary design of human tissue blood serum based low pass filter circuit for disease detection

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***Abstract*—A "Filter" is very common terminology used by electronic circuit design engineer for implementing various circuits and system. General understanding of filter itself indicate that it removes unwanted part of input data. This concept has been developed in analog filter as well as in digital filter. It is also used in designing of medical instrumentation that used for various diseases diagnostic. The medical treatment of patient and working of instruments is combining at the point we can called sensor. Electronics in medicine has a wide range of applications, from diagnostics to therapy, always aiming to provide new tools to improve the well-being of the population. Moreover, some blood taste also working on the concept of filtering. The fundamental electronic component's characteristic has been already observed in human tissues like blood serum, skin etc. By combining filter concept with these human tissue components, we have achieved specific characteristics as a result of our experiments. This article indicates the important behaviour and realisation technique for such bio-electronics filter. It is also helpful to understand biological signal analysis. Additionally comparison of electronic filter and serum filter is represented in result section.**

Keyword- Bio-electronics, Liquid State Electronics, Biological signal analysis and low pass filter.

I. INTRODUCTION

In Electronic System, use of filter is very common. The detail functioning, technical parameter and designing of various filter starting from vary simple low pass filter with first order to microwave filter are easily available as well as understandable from engineering references. There are many advanced software which provides the facility of filter designing and analysis of it like GENESYS, WEBENCH, FilterCAD etc. For this experiment all these technical details are not required so just brief about fundamentals of filter explained in next section.

Today medical science has grown up so much with basis of available medicine and treatment methodologies. The Bio-medical engineering and biotechnology are always helpful branches to develop this level till at better position. In addition to this are electronics science and engineering are core stream for this grownup. The latest technology for laparoscopy, sonography, X-Ray, ECG etc has increase the importance of this knowledge. Human body tissue based experiments is also going on in this era. A brief notes for such practical with published result is mentioned in latter section. After that experiment setup for low pass first order filer using sample of human blood serum is presented. For accuracy and precession of readings, result section is given with graph as well as in tabular data form. A short conclusion indicates important of this study with analysis of comparison of ideal electronic filter and human tissue based filter.

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II. FUNDAMENTALS OF FILTER

Basically, an electrical filter is a circuit that can be designed to modify, reshape or reject all unwanted frequencies of an electrical signal and accept or pass only those signals wanted by the circuit designer. In low frequency applications, passive filters are generally constructed using simple Resistor Capacitor (RC) networks, while higher frequency filters are usually made from Resistor-Inductor-Capacitor (RLC) components. The output is always less than the input because filters have no gain or no amplifying components. They are known according to the frequency range of signals that they allow to pass through them, while blocking or attenuating the rest. The most commonly used filters designs are as below:

The Low Pass Filter – the low pass filter only allows low frequency signals from 0Hz to its cut-off frequency to pass while blocking those any higher.

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Compact Planar Dual Band Antenna for WLAN Application

Riki Patel* and Trushit Upadhyaya

Abstract—A miniaturized dual-band microstrip antenna has been designed and analyzed for Wireless LAN application. The proposed antenna comprises a $29 \times 29\,\text{mm}^2$ radiating patch, fed by a microstrip line on a 1.6 mm thick FR4 dielectric material substrate. The antenna measurement illustrates impedance bandwidth of around 10% at 2.4 GHz resonance and 6% at 5.5 GHz resonance. The measured stable return loss and radiation patterns are presented for the proposed dual-band electrically small microstrip antenna for wireless applications.

1. INTRODUCTION

Electrically small antennas are becoming very popular due to their compact dimensions, and as a result, they are frequently used in many wireless applications. These antennas are also known as electrically small antenna (ESA), physically small antenna (PSA), physically constrained small antenna (PCSA) and functionally small antenna (FSA) [1]. The basic function of an antenna is to act as a transducer which converts alternating current to radio frequency waves and vice versa. Printed microstrip patch antennas offer competitive solution in day to day life, due to very wide spread wireless communication and various types of wireless technologies. They are popular due to low cost, low weight, less troublesome fabrication, ease of integration in communication system, very compact size and multi-frequencies. However, miniaturized microstrip patch antenna suffers from very narrow bandwidth typically in the order of 1%–2%. Typically, antenna compactness is achieved by engineering the antenna dimensions with antenna parameters tradeoff. Techniques such as fractal geometry [2], negative refraction [3–5] and defected ground plane [6, 7] are frequently utilized for size reduction. Available literature has addressed a few challenges of antenna gain, bandwidth and limiting Q-factor [8–12]. Many antennas are presented in literature to be mechanically and electrically compact for both near-field and far-field applications [13–16]. Essentially, antenna performance and size are significantly interconnected. To cope with demand of compact present and future wireless communication services, cost effective miniaturized microstrip antennas possessing fair radiation characteristics are fundamentally required.

Elementary method to achieve the dual-band characteristic in a microstrip patch antenna is to create slots in patch geometry. In this article, a miniaturized, low profile microstrip patch antenna is proposed for dual-band operation. The proposed antenna has an impedance bandwidth in the range of 6%–10% with respect to the corresponding resonance frequencies. In the proposed ESA, radiation characteristics are optimized by height of substrate and engineered feed line. In addition, good impedance bandwidth is achieved at dual frequencies. A note on antenna radiation efficiency (η) and Q-factor is presented for understanding the effect of antenna dimensions on antenna bandwidth and Q-factor.

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Near Optimum Detection Algorithm for Quasi Orthogonal Space Time Block Code with Four Transmit Antenna

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Abstract

We consider multiple input single output (MISO) system with quasi-orthogonal space-time block code (QOSTBC) equipped with four transmit antennas and one receive antenna under quasi-static spatially uncorrelated rayleigh fading channels. We propose a low complexity detection algorithm with a view to improve symbol error probability (SEP) performance of the system.This algorithm uses QR decomposition (QRD) of channel matrixin the detection. We present SEP performance of the system using simulations with QPSK constellation. We also compare the performance of the algorithm with the performance of prevailing algorithms such as QR decomposition based interference cancellation (QRD-IC) method, lower and upper triangular versions of the QR decomposition (LU-QRD) method and optimal detection i.e. maximum likelihood (ML). It shows that the proposed one out performs the prevailing techniques. We also compare complexity of the proposed technique with complexity of prevailing ones in terms of search time of the modulation symbols with constellation size.

Keywords: Multiple input single output (MISO), Quasi orthogonal space-time block code (QOSTBC), QR decomposition based interference cancellation (QRD-IC), QR decomposition (QRD), detection complexity

1. Introduction

Multiple transmit antennas are used in wireless communication to combat the adverse effect of fading by exploiting transmit diversity gain. One of the transmission schemes in multiple input single output (MISO) system is orthogonal space time block code (OSTBC) with simple detection, which provides full diversity gain without having overhead of feedback channels. However, the full rate i.e. one, can be achieved with only two transmit antennas [1]. For more than two antennas, full diversity can be achieved but full rate is not possible with OSTBC [2]-[3]. To overcome this bottleneck, Quasi Orthogonal Space Time Block Code (QOSTBC) are proposed, which can provide full diversity with full rate. However, QOSTBC uses joint detection of symbols in a code matrix instead of detection of individual symbol in a code matrix used in OSTBC. Therefore, complexity for detection of QOSTBC code matrix is very high. For example, with four symbol the conventional ML detection, the complexity in term of search time is C_s^4, where C_s is size of constellation symbols.

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Dual-Band Polarization-Insensitive Metamaterial Inspired Microwave Absorber for LTE-Band Applications

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Abstract—In this paper, the design, simulation and measurement of a dual-band polarization-insensitive metamaterial inspired microwave absorber are presented. The unit cell is composed of two concentric closed ring resonator (CRR) structures forming octagonal rings which are carved on an FR-4 dielectric substrate to give maximum absorption at dual frequencies of 2.09 GHz and 2.54 GHz. At these frequencies, the minimum reflection coefficients of −29.15 dB and −18.76 dB are achieved with absorption rates of 99.88% and 98.67% and narrow 10 dB bandwidths of 2.62% and 2.76%, respectively. Microwave absorption property of the proposed absorber structure is simulated by setting the perfect electric boundary conditions in four planes whose surface normal vectors are directed perpendicular to the wave propagation direction. These numerical computation settings replicate the rectangular waveguide to be used in the experimental measurements for the comparison between the simulated and experimental results. It is experimentally verified by the waveguide measurement method that the absorption rates about 99% are achieved for dual bands with polarization insensitivity thereby meeting the absorption requirements of LTE-band frequencies for a real time microwave absorber based energy harvesting systems.

1. INTRODUCTION

Electromagnetic (EM) metamaterials (MTMs) [1–3] are basically artificial or manmade materials. Recently, MTMs have gained wide attention in the field of research due to their unusual properties which are not available in naturally existing materials. The popularity of MTM arises from the fact that its properties can be altered by merely changing the geometrical parameters of a unit cell. The frequency selective surface (FSS) structures are normally designed in a periodic arrangement of unit cells, which have geometric sizes comparable to sub-wavelength. The sub-wavelength unit cells should have dimensions much less than the guided wavelength in the structure (λ), typically less than $\lambda/4$ [4] for MTMs to operate as natural materials. Some of the potential applications of MTMs include EM cloaking [5, 6], super lens [7, 8], antenna [9–11], bolometer [12], microwave absorbers [13–39] and energy harvesting system [40]. N. I. Landy in 2008 [13] has proposed the first MTM microwave absorber with simulated absorbance of 96% and experimental absorbance of 88% at 11.5 GHz frequency. MMAs are developed and studied for potential applications like sensors, radar cross section (RCS) reduction, medical imaging, spectroscopic detector and solar cell applications, to name a few. As a result of these magnificent properties, the MMAs are explored from single-band [14, 15], dual-band [16–18], triple-band [19–22], quad-band [23, 24] in the form of multi-band [25–27] up to narrow band [28, 29] and broad band [30, 31] with frequency ranging from microwaves [29, 30] to terahertz [32]. Any EM absorber performance is determined by how efficiently it absorbs the input EM signals. The key parameter which

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Designing four-Channel High Rate TDM Passive Optical Network with NRZ Scheme for Wired Environment

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Abstract

It is advantageous to think about the innovations accessible for presenting time division multiplexing (TDM) in PONs, This strategy is utilized to get the coveted points of interest of PON. Examination is made between past innovations to choose which gives better execution under certain given criteria like power, data transmission, no of clients, cost, adaptability and unwavering quality. The capability of PONs to convey high data transmissions to clients in get to systems and their favourable circumstances over current access innovations have been generally perceived. PONs have gained solid ground as far as institutionalization and sending in the course of recent years. This paper basically covers fundamental design of TDM-PON network with multiple inputs or channels. Chanel can use different coding scheme at input side. Data can be transferred using wired environment which used nonlinear fiber.

Keywords: Optical network, WDM, TDM, PON, Nonlinear fiber.

INTRODUCTION

In the TDM PON, the CO devotes schedule opening to the numerous endorser (ONU) associated with the PON. Each ONU would then be able to utilize the full upstream data transfer capacity of the optical connection for the span of it's doled out schedule vacancy. Since the TDM PON can commonly benefit N = at least 32 supporters, the normal devoted transfer speed to each ONU is typically just a couple of percent of the channel limit. To interface the different ONUs to a solitary feeder fiber. This couples N:1 of the power from every endorser into the feeder fiber for transmission back to the OLT at the CO.

There are three institutionalized forms of the TDM-PON: Ethernet PON (EPON), broadband PON (BPON), and Gigabit PON (GPON). They all utilization one wavelength for downstream transmission and another wavelength for upstream transmission as represented in figure 1. One essential qualification between the three sorts of TDM-PON is operational speed. BPON is moderately low speed with 155 Mbps upstream/622 Mbps downstream operation. The EPON bolsters 1.0 Gbps symmetrical operation. The GPON guarantees 2.5/1.25 Gbps topsy-turvy operation. Two Types of Time Division Multiplexing Techniques are utilized (a) Fixed Time Division Multiplexing (b) Statistical Time Division Multiplexing. In Fixed time division multiplexing technique a settled measure of time moving or delay is presented between two OLTs while in Statistical time division multiplexing the moving time is chosen by activity at input side and measure of information to be sent from OLTs.

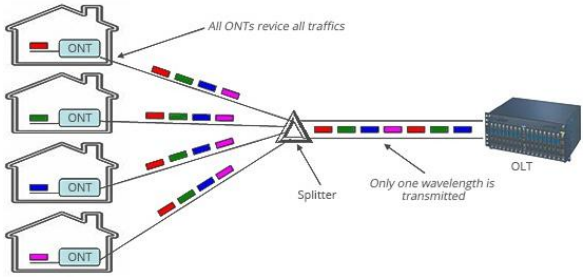

Figure 1: TDM-PON Diagram

The OLT is situated in a local office and controls the bidirectional stream of data over the Optical Distribution Network (ODN). In the down connection bearing the limit of an OLT is to take in voice, data, and video gushing activity from a long separation or metro system and communicate it to all the ONT framework segment on the ODN. A product is to be presented at splitter stage. ONT is found specifically at the client's premises. There its motivation is to give an optical association with the PON on the upstream side and to interface electrically to the client gear on the opposite side [21]. A more assortment of ONT helpful plans and frame outlines are open to suit the necessities of various bases of prerequisite. The traverse of an ONT can extend from an

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A MULTI METRIC PRIORITY BASED ENERGY CONSERVING ROUTING PROTOCOL FOR MOBILE AD HOC NETWORK

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Abstract

The conventional routing protocols in ad hoc networks are not well suited for the present communication networks and associated applications. The energy consumption of each mobile node is increasing drastically because of varieties of applications. Also, the mobility of nodes is increasing because of infrastructural changes in the world and density of mobile node is also increasing endlessly. The lack of response to these changes in the network of conventional routing protocol keeps them out from the operations. Furthermore, saving energy is a key parameter in designing a new routing protocol for ad hoc networks. Many a times mobile nodes have limited battery power and power consuming applications of nodes reduce energy of a node continuously which affects lifetime of node and thus, the overall

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Low Power Differential CMOS Schmitt Trigger with Adjustable Hysteresis

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Abstract. *This paper proposes a novel differential CMOS Schmitt trigger with adjustable hysteresis. The hysteresis of the proposed circuit is generated using cross-coupled pMOS or nMOS transistors, which can be tuned by engineering cross-coupled transistors current. By changing input voltage, the hysteresis window can also be adequately adjusted. Negative feedback has been introduced through CMOS differential amplifier which makes the circuit less sensitive to process, supply voltage and temperature (PVT) deviations. The proposed configuration uses TSMC 0.18 µm CMOS technology with 1.8 V supply voltage. Simulation results show that the switching voltage of the circuit can be tuned for target applications.*

Keywords

Adjustable hysteresis, low power, Schmitt trigger, self-biasing.

1. Introduction

A CMOS Differential Amplifier (CDA) is extensively used in analog and mixed-signal applications. CDA configuration is fully complementary and biased with negative feedback, which differs from the conventional CMOS differential amplifier. Moreover, CDA configuration comprises less die area, consumes less power and negative feedback that make the circuits less sensitive to Process, supply Voltage and Temperature (PVT) variations [1].

Schmitt trigger is a bistable circuit which is extensively used in both analog as well as digital signal processing systems to improve the circuit immunity against noise and disturbances [2] and [3]. The traditional Schmitt trigger is generally realised using operational amplifiers and resistors connected in positive feedback, which has the drawback of high-power consumption. Dokic [4] proposed three different designs of single-ended Schmitt trigger. In his two designs, three transistors are connected between power and ground rails while in third design, four transistors are connected between power and ground rails. This particular stacked design became a basic building block to prepare many complex Schmitt trigger circuits but is not preferable for the application where the supply voltage is low. Steyaert et al. [5] introduced a novel CMOS Schmitt trigger comprising of two inverters with an extra feedback transistor. Wang [6] proposed a low-power adjustable Schmitt trigger circuit. The most significant feature of this circuit is the hysteresis adjustment. Pfister [7] proposed a minor modification of [4] and converted it to the controllable hysteresis configuration. Kim et al. [8] introduced a new waveform-reshaping circuit which is considered as an alternative to the conventional Schmitt trigger. This configuration is suitable for high-speed system design because it uses the ratioless inverters, and these inverters do not require extra standby current. Al-Sarawi [9] proposed a Low power Schmitt trigger circuit which consists of six transistors set in a complementary MOS structure. Zhang et al. [10] presented CMOS Schmitt trigger circuits with the help of a substrate-bias technique which is suitable for low voltage applications. Pedroni [11] introduced an open-loop approach for designing a Schmitt trigger circuit which allows low voltage and high-speed operation compared to other traditional approaches. Vipul [12] proposed two new inverter-based designs, which are immune to kickback noise arise from the subsequent blocks. Sapawi et al. [13] presented

Context Aware Algorithm

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***Abstract*—Context-Aware Algorithm has been developed for Human Physical Movement Activity Recognition. This Algorithm internally takes the data from the different sensor devices as an input and provides classified data as an output to the application layer. The Algorithm shall have the capability to contain different context aware algorithms. This Context-Aware Algorithm is flexible and modular enough to be ported to any platform with minimal efforts. The Algorithm has been tested and developed on TI Sensor Tag which is based on CC2650 wireless MCU. In this paper, we have made this algorithm to be able to run on Android Platform as nowadays smart-phone platforms are equipped with a diverse and powerful set of sensors. This work is significant because the Human Movement activity recognition permits us to gain useful knowledge about the habits of millions of users passively just by having them carry cell phones in their pockets. Our work has a wide range of applications enabled by activity recognition, like automatic customization of the mobile devices behavior based upon a user's activity (e.g., sending calls directly to voice-mail, if a user is running) and generating a daily activity profile to determine if a user is performing a healthy amount of exercise.**

Keywords—Android, Smart phones,Mobile Sensors,Context Aware, Accelerometer Sensor, Human Activity Recognition, Machine Learning.

I. INTRODUCTION

Context awareness is one of the important research area in Artificial Intelligence and/or machine learning field. Context Aware computing is the ability of computing devices to detect and sense, interpret and respond to aspects of a user's local environment. A system is said to be context-awareness system if it uses context to provide relevant information and/or services to the user, where relevancy depends on user's task. There are various context aware computing. Generally, user context means user's activity, location, preference, situation, emotion, etc. Recognizing human activities automatically has become an important research area which plays a vital role in creating or developing an improved innovative applications providing activity monitoring. The ability to record and recognize individual daily activities is essential to determine the degree of functional performance and general level of activity of a person. These systems have a vast range of real world applications. Such technologies are mainly useful in health care and fitness monitoring. In health care field, analysis of human activity could be helpful in early detection of diseases also it is helpful to encourage people to improve their activity level.

The purpose of this paper is to make Context Aware Algorithm run on Android Platform. As nowadays smart-phone comes with a rich set of sensors. And almost everyone has a smart-phone all time. Therefore they are excellent devices to monitor daily activities.

The paper is organized in following sections: Section II presents the Existing System in which Context Aware Algorithm has been established on the TI's micro-controller based Wearable device. Section III introduces the proposed system in which Context Aware Algorithm is made to run on Android platform. Finally, the conclusion is in Section IV.

II. EXISTING SYSTEM

The Context Aware Algorithm has been developed for Human Movement Activity Classification. The Algorithm is able to classify one of these three activities - Run, Walk and Rest and calculate steps according to the activity. It is also able to classify Fall Detection. It is modular enough that it can be portable on any platform. The context aware Algorithm is the interface between the user application and the sensors. The Algorithm gets the data from the sensor devices, process the data and run algorithm on the same and provides the classified data to the end user application. The Context Aware Algorithm maintains the communication with sensor to configure required characteristics of sensors like sampling rate, clip of sample rate, etc. Some OS like android comes with some specific interface library layer which communicates with all the hardware sensors available on the device. In such cases, the user application needs to pass through this layer to communicate with sensors.

The Context Aware Algorithm consists of below modules.

1. User Interface
    a. This is a simple interface layer from which the context aware algorithm is able to communicate with the user application.
2. Sensor Interface

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Optimized coordinated control of frequency and voltage for distributed generating system using Cuckoo Search Algorithm

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ABSTRACT

The distributed generating system may employ hybrid power system consists of diesel and wind power generating units based on synchronous and induction generator (IG), respectively, to supply small isolated load. Frequency and voltage controls are major problems for such system as smaller synchronous generator (SG) offers lesser inertia and IG draws reactive power for its operation. In this paper, the voltage control loop governed by automatic voltage regulator of SG has been integrated with frequency control loop to yield optimized transient responses for frequency and voltage deviations. The linearized model of hybrid system with coordinated control of voltage and frequency has been developed. The dynamic responses of frequency and voltage deviations are compared for different active and reactive load disturbances. The gains of controller of SG and Static Var Compensator (SVC) at the terminal of IG have been optimized with Cuckoo Search Algorithm to minimize frequency and terminal voltage deviations.

1. Introduction

The continuous promotions of power generation from renewable energy sources have become essential as they are clean sources of energy, sustainable and eco-friendly. The solar and wind power generations have become popular in recent years [1]. The intermittent nature of power generation from these energy sources limits their penetration in the system in order to observe the reli-.bility in system. The use of these renewable energy sources can be explored at the larger scale if they are operated in parallel with conventional power generations. The conventional diesel engine-driven synchronous generators operating in parallel with non-conventional wind turbine-driven induction generator form the hybrid wind–diesel electrical power generation system. This type of hybrid wind–diesel electrical power generation system can either be integrated with electrical grid or be operated in stand-alone mode [2].

The hybrid system must be capable to maintain frequency and voltage regulation in the allowable range against the disturbances caused by load variations and wind velocity changes. Generally, fixed speed squirrel cage induction generator shave been employed for wind power generation which itself a sink for the reactive power, thus imposes serious issues for maintaining the nominal voltage in case of reactive power deficit. Similarly, the low inertia of the stand-alone system may create severe frequency excursion in the event of active power unbalance.

The control strategies based on orthogonal filters for frequency estimation is proposed in [3] to provide coordinated frequency and voltage control for inverter fed distributed generation (DG) systems. Consideration of variable real and reactive power demand with operational constraint has been presented in [4] for optimal design procedure of hybrid wind-diesel system. The paper also presents a strategy for real and reactive power demand sharing in real time for optimally designed wind and diesel generators. The reactive power balance condition which is a prime requirement of voltage control for stand-alone system has been obtained with non-linear constrained optimization technique for yielding maximum wind turbine power output.

In [5], the sizing of micro-hydro-PV hybrid system is proposed as per the seasonal variations in both solar and hydro resources. The simulation was carried out in HOMER software and the complementary solution was found out to explore the necessity of operating diesel generator in parallel for hybrid system. However, dynamic study for voltage and frequency control of hybrid study was not carried out.

The reactive power control of an isolated wind-diesel hybrid power system has been addressed in [6]. The mathematical

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Analysis of sensorless control of brushless DC motor using unknown input observer with different gains

Mitesh B. Astik,* Praghnesh Bhatt,** Bhavesh R. Bhalja***

A sensorless control scheme based on an unknown input observer is presented in this paper in which back EMF of the Brushless DC Motor (BLDC) is continuously estimated from available line voltages and currents. During negative rotation of motor, actual and estimated speed fail to track the reference speed and if the corrective action is not taken by the observer, the motor goes into saturation. To overcome this problem, the speed estimation algorithm has been implemented in this paper to control the dynamic behavior of the motor during negative rotation. The Ackermans method was used to calculate the gains of an unknown input observer which is based on the appropriate choice of the eigenvalues in advance. The criteria to choose eigenvalue is to obtain a balance between faster convergence rate and the least noise level. Simulations have been carried out for different disturbances such as step changes in motor reference speed and load torque. The comparative simulation results clearly depict that the disturbance effects in actual and estimated responses minimizes as observer gain setting increases.

K e y w o r d s: back EMF estimation, BLDC motor, observer design, observer gain, sensorless control, speed estimation

1 Introduction

The use of Brushless DC Motors is extensively increasing for various applications due to their compact and robust structures. Compared to Permanent Magnet Synchronous Motors; the BLDC motors have higher power/weight and higher torque/current ratio [1]. A BLDC motor requires an inverter and position sensors to perform commutation process as the motor does not have commutator and brushes. However, the position sensors present many disadvantages like increase in machine size, reduction in reliability and higher noise. Thus, many researchers have suggested application of sensorless drive which can regulate speed and position without using shaft-mounted position sensors [2]. Main types of sensorless control methods are the back-EMF measurement, third harmonic sensing of back EMF, back EMF integration, flux linkage estimation, freewheeling diode and estimator-based approach [3-12].

The method for measurement of back EMF requires additional power supply for a comparator to detect freewheeling current [3, 4]. Shen et al [5] proposed a scheme to detect the third harmonic of back EMF. This scheme is only valid for high speed as third harmonics detection is difficult due to constant addition of noise signal at minimum speed range. Additional hardware is required to detect the third harmonic of back EMF at minimum speed. In integration of back EMF method, commutation instants can be detected by comparing the threshold value with the integration of the back-EMF waveforms of the unexcited phase. Due to integration process, this method gives an error at low speeds [6-8]. In the flux linkage estimation method, rotor position can be obtained by estimating the flux. As integration of voltage is done for comparatively large time, this scheme also give estimation error at low speeds [9, 10]. Ogasawara and Akagi [11] proposed an estimation scheme in which rotor position is estimated by detecting switching status of freewheeling diode. In this scheme, current flow through the freewheeling diodes are used to identify the zero crossing of back EMF. This method requires six comparators and six isolated power sources.

Above mentioned methods are not suitable where the high estimation accuracy of speed and position are required as they cannot provide continuous rotor position estimation. Terzic and Jadric [12] proposed a new scheme for estimation of speed and rotor position of a BLDC motor using Extended Kalman Filter (EKF). Only using stator voltages and currents measurements, EKF can estimate the motor state variables. In this method, filtering of voltage and current signals do not required but this method needs complex computing algorithm and it suffers from the initial-value problem.

In this work, sensorless control of the brushless dc motor has been proposed by designing unknown input observer. The observer design requires the input voltage and current signals of BLDC motor to estimate back EMFs which eliminate the need of rotor speed measurement. The observer should be designed to give the optimal performance over wide speed range and in case of reversal of the motor rotation. Generally, the observer fails when the motor reverses its direction of rotation. The perfect

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Improved Direct Power Control of Shunt Active Power Filter with Minimum Reactive Power Variation and Minimum Apparent Power Variation Approaches

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Abstract – Direct Power Control technique has become popular in the grid connected Voltage Source Converter (VSC) applications due to its simplicity, direct voltage vector selection and improved dynamic performance. In this paper, a direct method to determine the effect of voltage vector on the instantaneous active and reactive power variations is developed. An alternative Look Up Table is proposed which minimizes the commutations in the converter and results in minimum reactive power variation. The application of suggested table is established for Shunt Active Power Filter (SAPF) application. The Predictive Direct Power Control method, which minimizes apparent power variation, is further investigated to reduce commutations in converters. Both the methods are validated using 2 kVA laboratory prototype of Shunt Active Power Filters (SAPF).

Keywords: Direct power control, Synchronous reference frame, Active power filters

Nomenclature

v_{pcc}	Grid voltage vector at point of common coupling
i_c	Compensating current vector
s_{inj}	Instantaneous complex power injected by SAPF
^	Complex conjugate of vector
v_{inv}	Inverter voltage vector
V_{dc}	DC link voltage
ω	Angular frequency of grid voltage vector
V_m	Amplitude of grid voltage vector at PCC
S_1, S_2, S_3	Switching states of inverter legs
R_f	Resistance of smoothening reactor
L_f	Inductance of smoothening reactor
$\Re()$	real component of complex vector
$\Im()$	Imaginary component of complex vector
p_{inj}	Instantaneous active power injected by SAPF
q_{inj}	instantaneous reactive power injected by SAPF
p_L, q_L	Instantaneous active and reactive power of load
$v_{pcc,a}$ $v_{pcc,b}$ $v_{pcc,c}$	Instantaneous three phase voltages of grid
i_{ca}, i_{cb}, i_{cc}	Instantaneous three phase compensating current of SAPF
$v_{pcc,d}$, $v_{pcc,q}$	d and q axis component of grid voltage vector
i_{cd}, i_{cq}	d and q axis component of compensating current vector
*	Reference quantity
h_{Lx}, h_{Ux}	Lower and upper limit of hysteresis band
S_p, S_q	Quantized signal of instantaneous active and reactive power errors
k	k^{th} instant of digital control
T_s	Sample time of digital controller

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1. Introduction

Now-a-days, the demand of energy efficient system has forced users as well utility to process the power with Power Electronic Converters. It is expected that Power Electronic Converters will process more than 85% of the power available to the user. On the contrary, use of Power Electronic Converter raises serious concern over the Power Quality since a power converter controls power in the time domain. The control of power using power electronics is the main source of harmonics and other issues. An SAPF is widely accepted and popular solution for compensation of harmonics.

A Shunt Active Power Filter (SAPF) as shown in Fig. 1 consists of Voltage Source Inverter (VSI), coupling inductors, sensing units and the controller. The performance of such a filter largely depends on the type of compensation scheme applied and control of compensating current. While control of compensating current is obtained using inner current loops, the satisfactory performance of converter is achieved when it is operated at appropriate DC link voltage. In one way, a Pulse Width Modulated Inverter

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A Novel Approach for Optimum Coordination of Directional Overcurrent Relays Including Far-End Faults in Interconnected Power Systems

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***Abstract*— The aim of optimum coordination of Directional Overcurrent relays (DOCRs) is to obtain optimum relay settings - Plug Setting (PS) and Time Multiplier Setting (TMS) - for minimizing the operating time of relays while adhering to various coordination and boundary constraints. In this paper, Improved Harmony Search Algorithm (IHSA) is proposed to solve relay coordination problem with three different cases on IEEE 14-bus and IEEE 30-bus systems. The first case considers only near-end fault, as reported in most literature, to demonstrate the violation in coordination constraints of Primary/Backup (P/B) relay pairs for far-end faults. In the second case, the coordination constraints for far-end faults are also included in the problem. This results in increase of operating time of primary relays. The third case presents a new formulation of objective function to reduce the operating time of relays for both near-end and far-end faults. The results obtained using IHSA are compared with Genetic Algorithm (GA), Particle Swarm Optimization (PSO) and HSA to demonstrate its effectiveness for all cases.**

Keyword- Directional overcurrent relay coordination; Far-end faults; Improved harmony search algorithm; Objective function; Optimization; Power system protection

I. INTRODUCTION

The primary protection in distribution and sub-transmission networks and backup protection in transmission networks are usually provided using DOCRs [1]. For reducing the chances of excessive power outages, only faulted section of the power system is isolated using primary relays as quickly as possible. As long as the primary relay fails to operate, the backup relays have to instigate to clear the fault after the prescribed time interval. This practice is called relay coordination. The proper coordination of primary and backup relays is essential to ensure the reliability of protection scheme, which is achieved by locating the optimal values of PS and TMS. In modern multi-loop and multi-source interconnected power systems, finding the optimal PS and TMS using analytical methods becomes very hard. Alternatively, it can be easily solved by optimization techniques [2].

In the last few years, several optimization techniques are employed to solve the relay coordination problem. Among the conventional methods, Linear Programming (LP) technique gained good recognition to solve this problem, including simplex, two-phase simplex and dual simplex methods [3-5]. The LP methods involve assumptions in PS, allowing for operating time of each relay as a linear function of TMS. In [6, 7], Sequential Quadratic Programming (SQP) has been used in order to optimize both TMS and PS. Afterwards, Artificial Intelligence (AI) techniques are studied more to solve the coordination problem such as GA [8], modified real coded GA [9], Modified PSO (MPSO) [10, 11], Seeker Algorithm (SA) [12], group search optimization algorithm [13], chaotic firefly algorithm [14], enhanced backtracking search algorithm [15], ant colony algorithm [16], Modified adaptive teaching learning based optimization [17], etc. In [18], the comparative study of GA, PSO, Differential Evolutionary (DE), HSA and SA is presented with the same initial condition to identify the best performed method for the relay coordination. To reduce the search space and computational time, hybrid methods are also utilized for relay coordination problem, including hybrid GA-LP [1], GA-NLP [19], Biogeography-Based Optimization algorithm-LP [2], Gravitational Search Algorithm (GSA)-SQP [20] and PSO-GSA [21].

The HSA is one of the metaheuristic optimization methods which is developed by Z.W. Geem [22]. It has the characteristics of fast convergence speed, easy in concept and simple in implementation with only a few parameters and mathematical requirements [22, 23]. Same as other metaheuristic methods, the performance of the HSA experiences a serious problem of sensitive parameters setting. Hence, fine tuning of the parameters are required, which can help the HSA to maintain a balance between diversification and intensification and to explore the population in the evolution process [24]. To improve the performance of HSA, IHSA is presented in

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Coordination of directional overcurrent relays in the interconnected power systems using effective tuning of harmony search algorithm

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ABSTRACT

In the optimum coordination of Directional Overcurrent Relays (DOCRs), the appropriate relay settings, namely, Plug Setting (*PS*) and Time Multiplier Setting (*TMS*), are selected to minimize the operating time of relays subject to various coordination and boundary constraints. In the large interconnected power systems, the key issue with DOCRs protection is to achieve correct relay coordination with satisfying all coordination constraints. In this paper, the parameters of Harmony Search Algorithm (HSA) are tuned to effectively solve the relay coordination problem on five different test cases. Also, the relay coordination problem is formulated as Linear Programming Problem (LPP), Non-linear Programming Problem (NLPP) and Mixed-Integer non-linear programming Problem (MINLPP). In addition, the superiority of proposed method is demonstrated by comparing the obtained results with those obtained by the Genetic Algorithm (GA), hybrid GA-Nonlinear Programming (GA-NLP), Firefly Algorithm (FFA), and Cuckoo Search Algorithm (CSA).

1. Introduction

Due to the easy of functionality and the cost effectiveness, the Overcurrent Relays (OCRs) are commonly used for providing primary protection in distribution and sub-transmission systems and as a backup protection in a transmission system as well [1,2]. The non-directional OCRs can be used only for the plain radial feeder as they provide tuning of time and pickup setting irrespective to the direction of the current flow. However, the DOCRs can be required to obtain the fault zone discrimination in multi-looped, parallel feeder, and ring main systems. Using the DOCRs, the uninterrupted power supply can be made possible at all load points connected in the parallel or ring system [1]. The operating time of DOCRs mainly depends on *TMS* and *PS*. The proper selection of these settings under various system conditions play vital role in timely removal of the faulty part of the power networks [3]. Thus, the coordination of DOCRs is a very important stage for any protection design.

1.1. Definition of problem and motivation

In the process of coordination of DOCRs, such relay settings are selected so that the primary relay operates faster than any other relay of the system for the fault in its protection zone. In case of the failure of primary relay, the backup relays have to operate to clear the fault. In order to achieve the reliability of protective system, backup protection should operate after a certain duration of time known as the coordination time interval, providing enough chance for the primary relay to operate. It is because the primary relay isolates only faulted part of the system, whereas backup relays remove the healthy part along with the faulted part, affecting the larger portion of power system from unnecessary power outage. Therefore, the accurate relay coordination is required to improve the electric power service to the consumer by isolating the minimum possible part of the system. In addition, any relay of the system has to work as a primary relay for its protection zone, and the same relay has to work as a backup protection of some other primary relay in the system. As the power network becomes a larger and more complex, the numbers of relays increase and hence it becomes very hard to find the optimum settings of relays for accurate coordination. Therefore, there is an evident need to improve the relay coordination problem which motivates the work reported in this paper.

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RESEARCH ARTICLE

Molecular Docking and *In Silico* ADMET Study Reveals Flavonoids as a Potential Inhibitor of Aromatase

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Abstract: Aromatase is an enzyme that plays a critical role in the development of estrogen receptor positive breast cancer. As aromatase catalyses the aromatization of a drostenedione to estrone, a naturally occurring estrogen, it is a promising drug target for therapeutic management. The objective of the present study is to evaluate the binding interaction of flavonoid compounds with cytochrome P450 enzyme aromatase and also checked ADME/T properties of best scored compounds. To examine different molecules for this purpose, test ligands like Flavonoids derivatives were docked against our target protein aromatase enzyme retrieved from protein data bank (PDB Id: 3S7S), considering Exemestane as the positive control. Docking results revealed that, with respect to their free binding energy 6B, 6K, 4K and 2K compounds have the lowest binding energy compared to positive control. In silico ADME/T predictions revealed that all best scored compounds had good absorption as well as solubility characteristics. The present findings provided valuable information on the binding process of flavonoid compounds to the binding site of aromatase. These compounds may serve as potential lead compounds for developing new aromatase inhibitors in breast cancer treatment.

Keywords:

1. INTRODUCTION

Breast cancer is the second leading cause of cancer death in women in the developing and developed country as per world health organization [1]. About 2/3rd of breast cancers are termed hormone-dependent breast cancer, which contains estrogen receptors (ER) and requires estrogen for tumor growth. Aromatase is the cytochrome P450 enzyme, the pivotal enzyme involved in the last step of the biosynthesis of estrogens from androgens, are potential targets for the prevention and treatment of this type of breast cancer [2, 3]. The enzyme complex is bound in the endoplasmic reticulum of the cell and is comprised of two major proteins [4, 5]. One is cytochrome $P450_{arom}$, a hemoprotein that converts C19 steroids (androgens) into C18 steroids (estrogens) containing a phenolic A ring and it is *NADPH*-cytochrome P450 reductase, which transfers reducing equivalents to cytochrome $P450_{arom}$, where three moles of NADPH and three moles of oxygen are used in the conversion of one mole of substrate into one mole of estrogen product [6, 7] (Fig. **1**).

Aromatase inhibitors that have been used clinically can be categorized either by generations or by mechanism of action, described as first, second and third generation inhibitors according to the order of their clinical development. They can also be classified as type I or type II according to their mechanism of action. Type I and type II inhibitors are also known as steroidal and non-steroidal inhibitors respectively [8-10].

Flavonoids have structural and functional similarities to endogenous estrogens, flavonoids have attracted considerable interest as alternative estrogens, termed phytoestrogens, and extensively studied for their potential role in many estrogen-dependent diseases including breast cancer [11, 12]. Several flavones like Chrysin (IC_{50} 4μM), Apigenin (IC_{50}

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Research Article

SYNTHESIS OF FLAVONES FROM 2-HYDROXY ACETOPHENONE AND AROMATIC ALDEHYDE DERIVATIVES BY CONVENTIONAL METHODS AND GREEN CHEMISTRY APPROACH

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ABSTRACT

Objective: Flavones occupy a special place in the realm of natural and synthetic organic chemistry owing to their diversified biological activities. In this study, a series of chalcone derivatives were synthesized and after cyclization of chalcone to synthesized various substituted flavone derivatives (2A-2L).

Methods: The reaction of 2-hydroxy acetophenone with substituted aromatic aldehydes produced chalcone by trituration (NaOH) and conventional methods (KOH/EtOH), which upon further cyclization with dimethyl sulfoxide/I_2 resulted to form flavone derivatives.

Results: The purity of compounds was ascertained by melting point and thin-layer chromatography. The synthesized compounds have been characterized by mass, infrared, and ^{1}H nuclear magnetic resonance spectral analysis.

Conclusion: Based on spectral data, it was proved that all synthesized chalcones and flavones derivatives meet the standard values of various spectral techniques and further it will be evaluated for pharmacological activities.

Keywords: Chalcone, Flavone, Trituration, Conventional, Claisen-Schmidt condensation.

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INTRODUCTION

Flavonoids are a group of more than 4000 polyphenolic compounds that occur naturally in foods of plant origin. These compounds possess a common phenylbenzopyrone structure (C6-C3-C6), and they are categorized according to the saturation level and opening of the central pyran ring, mainly into flavones, flavanols, isoflavones, flavonols, flavanones, and flavanonols [1,2]. Flavones occupy a special place in the realm of natural and synthetic organic chemistry owing to their useful biological activities such as antioxidant [3-7], anxiolytic [8], anticancer [9-11], analgesic and anti-inflammatory [12-14], antimicrobial [15], antiulcer, and thrombosis [16].

Chalcone is a starting material for the synthesis of flavones and chalcones can be synthesized by many methods. In general, chalcones were prepared by Claisen-Schmidt condensation of electrophilic substituted benzaldehyde with substituted acetophenone as nucleophile in the presence of bases such as NaOH, KOH, $Ba(OH)_2$, LiOH, NaH, hydrotalcites, Zeolites, Na_2CO_3, K_2CO_3, magnesium t-butoxide, alumina, MgO, KF/natural phosphate, calcined $NaNO_3$-natural phosphates, and piperidine. Chalcones are also prepared by ultrasonic vibration and microwave irradiation techniques [17-19].

Green chemistry is the need of the day and hence it was planned to synthesize some chalcones in an eco-friendly way without using solvents. Thus, the synthesis involves the solvent-free solid state trituration methods involved Claisen-Schmidt reaction between acetophenone derivatives and substituted benzaldehydes in the presence of NaOH. The remaining chalcone was planned to synthesize by taking KOH as a base. Using these chalcone derivatives, it was contemplated to synthesis of some flavone derivatives from the corresponding chalcone by using dimethyl sulfoxide (DMSO)/I_2 [14].

METHODS

All the chemicals were obtained from commercial sources and used without further purification. Melting point was measured in digital melting point apparatus (Veego, VMP-DS) model. Infrared (IR) and mass spectra of synthesized compounds were taken by using IR spectrometer (NICOLET 6700, Thermo Scientific) and mass spectrometer (Advion Compact Mass Spectrometer) by ESI Techniques, respectively. ^{1}H nuclear magnetic resonance (NMR) spectral was recorded at room temperature on a 400 MHz liquid state NMR spectrometer in DMSO-d6 (Brüker Biospin, Switzerland) using tetramethylsilane as internal standard. The reactions were monitored by thin-layer chromatography (TLC) using precoated plates (Merck). All solvents used in thin layer chromatography were distilled before use.

General procedure for the synthesis of substituted chalcone (1A-1L, Scheme 1)

Method 1 (1A-1E)

About 24 mmol of aryl aldehyde (1.2 equivalent) were taken in mortal pestle triturated with NaOH powder added in portion wise with continuous trituration. 20 mmol 2-hydroxy acetophenone (1 equivalent) was added with continuous trituration. A solid yellow mass was formed with continuous trituration. The reaction was monitored by TLC. The formed yellow solid was immediately washed with hot methanol to get crude chalcone.

Method 2 (1F-1S)

2-Hydroxy acetophenone (1 equivalent) and benzaldehyde derivatives (1.2 equivalent) were dissolved in EtOH and KOH pallet (3 equivalent) was added. The reaction mixture was stirred at RT for 6-12 hrs until reaction completion was indicated by TLC. The reaction was worked up the mixture was poured onto crushed ice and acidified with dilute HCl (pH 5). The solid was recrystallized from dilute ethanol to get crystalline chalcone.

General procedure for the synthesis of all substituted flavones (2A-2L)

Synthesized 2-hydroxy arylchalcone (5 mmol) was taken in radial basis function, and 6 ml of DMSO was added in it. Then, catalytic amount

INDIAN DRUGS

Article Details

PROTECTIVE ROLE OF FICUS RACEMOSA IN DIABETES INDUCED NEUROPATHY: STRUCTURAL AND FUNCTIONAL EVIDENCES

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ABSTRACT

Ficus racemosa is used in traditional system of medicine for various health problems and diseases, and is commonly known as Gular fig. The main objective was to study its effects against streptozotocin induced diabetic neuropathy by structural and functional marker. Investigation of diabetic neuropathy was carried out through functional and structural assessment in streptozotocin induced in diabetic rats. Diabetic rats were treated for 28 days in dose dependent manner of Ficus racemosa aqueous extract (250 mg/kg and 500 mg/kg) and ethanolic extract (200 mg/kg and 400 mg/kg). Study showed marked protection observed by Ficus racemosa in hippocampus region of brain and sciatic nerve tissues. Ficus racemosa treatment showed improvement in functional and structural markers, which strongly suggest its protective role in diabetic neuropathy.

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Research Article

FORMULATION OPTIMIZATION AND CHARACTERIZATION OF GANCICLOVIR LOADED DRY CHITOSAN NANOPARTICLES

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ABSTRACT

Objective: The objective of this work was to formulate, optimize, and characterize ganciclovir (GCV) loaded dry chitosan nanoparticles (CSNPs).

Methods: The GCV loaded CSNPs was prepared by ionic gelation method. Box–Behnken design was employed to optimize the influence of independent process and formulation variables like drug to polymer ratio, concentration of sodium tripolyphosphate, and stirring time (min) on the dependent variables such as particle size (PS) and drug encapsulation efficiency (% EE). The optimum conditions were determined by regression analysis of the output data.

Results: The independent variables had interactive effects and they affected both the responses. The optimum formulation had PS within the range of 100-120 nm and % EE between 85% and 86%. The prepared GCV loaded CSNPs were dried by fluidized bed drying method. Fourier transform infrared spectra showed there was no physicochemical interaction between GCV and CS. Powder X-ray diffraction study showed less intense crystalline peaks indicated that GCV may exist in the formulation as amorphous nanodispersion or molecular dispersion form. Differential scanning calorimetry study was performed which indicated that the drug was molecularly dispersed inside the matrix of CS. Higuchi model was the best to fit the *in vitro* release data for the GCV loaded CSNPs.

Conclusion: From the results, it can be concluded that the GCV loaded dry CSNPs were formulated, optimized, and characterized using desired pharmacotechnical properties.

Keywords: Chitosan nanoparticles, Box–Behnken design, Sodium tripolyphosphate, Ionic gelation.

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INTRODUCTION

Polymeric nanoparticles (NPs) have been studied as promising drug delivery systems. Different NPs have been formulated and characterized with the use of natural as well as synthetic polymers. Based on the physicochemical and biological properties, chitosan (CS) a natural polymer attracts the researchers to work with Hamidi *et al.* [1].

CS has been proved to have many other intrinsic properties, such as low toxicity (lethal dose 50% in mice is 16 g/kg body weight) [2], biocompatibility and biodegradability (Cordova *et al.*, 2008). It is mucoadhesive polymer and can increase the residence time at the site of absorption and has favorable controlled drug-release abilities [3]. It has been demonstrated that CS (when protonated) affects cell permeability and enhances paracellular permeability of drugs across the mucosal epithelia by opening the intercellular tight junctions.

Ganciclovir (GCV) 9-(1,3-dihydroxy-2-propoxymethyl) guanine, is a Biopharmaceutics Classification System Class III drug. GCV (log p = −1.7) having molecular weight 255.2 g/mol. It is the first antiviral drug that proved to be efficacious in the treatment of *Cytomegalovirus* (CMV) disease in humans [4]. GCV is also used for maintenance therapy and prophylaxis of CMV. Oral bioavailability of GCV is ~5%. Possible reasons for the poor bioavailability are poor permeability through the gastrointestinal tract (GIT) and P-glycoprotein substrate activity [5]. Therefore, it is necessary to develop a drug delivery system for GCV which can enhance the absorption of GCV. Different drug delivery systems for GCV have been developed these days, such as GCV loaded albumin NPs [6], solid lipid NPs [7], Long-circulating liposome-encapsulated GCV [8].

This study focus on development of GCV loaded dry CSNPs with an ionic gelation method. The 2^{5-2} fractional factorial design was employed to screen the process and formulation parameters. Response surface methodology with the utilization of Box–Behnken experimental design (BBD) was employed for optimization of the particle size (PS) and entrapment efficiency (% EE) of GCV loaded dry CSNPs, as they are properties of great influence on the pharmacokinetic (i.e., biodistribution) and the pharmacodynamic (i.e., therapeutic efficacy) of the drug loaded NPs [9]. The optimized formulation was investigated for physicochemical characterizations such as scanning electron microscopy (SEM), Fourier transform infrared spectroscopy (FTIR), and differential scanning calorimetry (DSC) study were employed for detection of particle morphology and any physicochemical interaction with the CS. *In vitro* release profile was investigated.

MATERIALS AND METHODS

Materials

GCV was kindly gifted by Bakul Fine Chem Research Center, Mumbai. CS (molecular weight=110 kDa, 80.0% degree of deacetylation) was gratis sample from Chitopharm S, Norway (USA). Sodium tripolyphosphate (TPP) (Cross-linking agent) was purchased from Sigma-Aldrich, Mumbai (India). The water used was pretreated with the Milli-Q plus system (Millipore, Q-5 UVS, India). All other materials of analytical grade were used.

Methods

Preparation of GCV loaded CSNPs

The GCV loaded CSNPs were prepared by ionic gelation method [10]. The possible mechanism for ionic gelation is that the ionic interaction

DEVELOPMENT AND VALIDATION OF UV SPECTROPHOTOMETRIC METHOD FOR THE ESTIMATION OF AGOMELATINE IN NANOSTRUCTURED LIPID CARRIERS

Verma S. D., Prajapati J. B.* and Patel A. A.

(Received 04 June 2016) (Accepted 01 January 2017)

ABSTRACT

The objective of work was to develop and validate a UV spectrophotometric method for determination of agomelatine (AGM) loaded in nanostructured lipid carriers (NLCs). The solvent and wavelength of detection were optimized in order to maximize sensitivity of proposed method. The method was validated for different parameters like linearity, precision, specificity, accuracy, limit of detection (LOD), limit of quantitation (LOQ) and robustness as per ICH guidelines. A wavelength maximum of AGM in methanol: chloroform (7:3V/V) mixture was found at 235nm. The method was found to be linear in the range of 1 to 6µg/mL with a correlation coefficient (r^2) of 0.997. The accuracy of the method was studied by recovery study and % recovery was found in range of 99 to 100.11%. The LOD and LOQ were found to be 0.043µg/mL and 0.141µg/mL respectively. The method is simple, accurate and requires relatively inexpensive instrument. The method was used successfully for determination of AGM loaded into NLCs.

Keywords: UV spectrophotometry, Agomelatine, Nanostructured Lipid Carriers

INTRODUCTION

Agomelatine (AGM) is a new antidepressant drug which is a potent agonist at melatonin MT1 and MT2 receptors and antagonist at the serotonin $5HT_{2C}$ receptor subtype. It is indicated for the treatment of major depressive disorder (MDD) in adults. It has a novel mechanism of action and fewer side effects as compared to older antidepressant drugs such as tricyclic antidepressants (TCAs) and selective serotonin reuptake inhibitors (SSRIs)[1]. It is well absorbed orally (>80%) but the absolute bioavailability is less than 5% due to high first pass effect. It has a plasma half life of less than 2 hours.

AGM is chemically *N*-[2-(7-methoxynaphthalen-1-yl) ethyl]acetamide. It is white to off-white powder, soluble in ethanol, methanol, chloroform, dimethyl sulfoxide (DMSO), dimethyl formamide (DMF) and practically insoluble in water. Its molecular formula is $C_{15}H_{17}NO_2$ and molecular weight is 243.0 g/mol. Its chemical structure is as shown in Fig. 1. Commercially available formulation is film coated tablet (25 mg).

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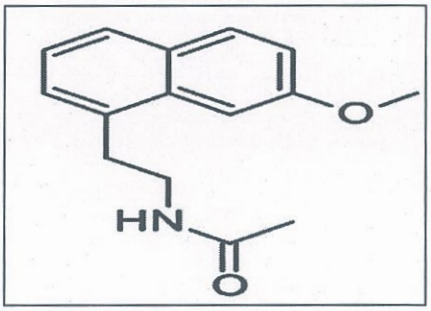

Fig. 1: Chemical structure of AGM

Literature survey revealed that HPLC[2], HPTLC[3] and LC-MS[4] methods have been reported for the estimation of AGM. The aim of the present work was to develop a simple and accurate method for the analysis of AGM loaded into nanostructured lipid carriers (NLCs).

MATERIALS AND METHODS

Equipment

UV- VIS double beam spectrophotometer (Shimadzu UV-1800, Shimadzu Corporation, Japan)

Materials

AGM was procured as a gift sample from Astron Research Ltd., Ahmedabad, Gujarat. Dynasan 118 was kindly gifted by Sasol GmbH, Germany. Labrafil M2125CS was kindly gifted by Gattefosse India Pvt. Ltd., Mumbai. Tween 80 was obtained from Suvidhinath

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Chemometric Assisted Spectrophotometric Methods for Simultaneous Determination of Paracetamol and Tolperisone Hydrochloride in Pharmaceutical Dosage Form

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ABSTRACT
Three simple Thermometric assisted UV- Visible Spectrophotometric methods, Classical Least Square (CLS), Partial Least Square (PLS) and Principal Component Regression (PCR) were developed for simultaneous estimation of PCM and TOL in pharmaceutical dosage form without any chemical separation and any graphical treatment of the overlapping spectra of two drugs. The UV absorption spectra of the drugs studied in the range of 220 – 280 nm. Beer's law was obeyed for both drugs in the concentration ranges of 5 – 25 µg/ml for Paracetamol and 1.5 – 7.5 µg/ml for Tolperisone Hydrochloride. Twenty five (25) mixed solutions were prepared for the chemo metric calibration as training set and sixteen mixed solutions were prepared as validation set. The absorbency data matrix was obtained by measuring the absorbency at twenty-one wavelength points, from 220 to 280nm with the interval of 3nm. The developed methods can be applied in simultaneous determination of the selected drugs from the pharmaceutical formulation in routine analysis.
Keywords: PCR, chemometric, paracetamol (PCM), tolperisone hydrochloride (TOL), PLS and CLS

INTRODUCTION

Paracetamol (PCM) chemically it is, 4-hydroxyacetanilide [**Figure 1(a)**] is a well-known analgesic drug. It is used for temporary relief of fever, minor aches and pains. It is official in Indian Pharmacopoeia (IP), European Pharmacopoeia (EP), Japanese Pharmacopoeia (JP), British Pharmacopoeia (BP) and United State Pharmacopoeia (USP) [1-5]. Tolperisone Hydrochloride (TOL) chemically, it is (2R, S)-2-Methyl-1-(4-methylphenyl)-3-piperidin-1-propan-1-one mono hydrochloride [**Figure 1(b)**] is a piperidine derivative. TOL is official in Japanese Pharmacopoeia (JP) [6]. It is a centrally acting muscle relaxant. The combination of PCM and TOL is used for the treatment of adult patients with acute muscle/musculoskeletal spasms. The combination of PCM and TOL is commercially available in tablet dosage form.

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Research Article

TOXICOLOGICAL EVALUATION OF AYURVEDIC FORMULATION: GOKSHURADI GUGGULU

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ABSTRACT

Objective: To evaluate toxicological studies of Ayurvedic formulation Gokshuradi Guggulu (GG) on male Wistar rats.

Methods: Acute toxicity study was conducted as per the Organisation for Economic Co-operation and Development guidelines.

Results: Results from the present study have elucidated that treatment with GS exerted no significant signs of toxicity at dose level 2000 mg/kg body wt. There was no mortality observed in all the groups. Behavioral, biochemical, and hematological parameters and histopathological studies were not significantly much altered as compared to control group.

Conclusion: LD_{50} for GS was >2000 mg/kg. Thus, it is regarded as safe or non-toxic.

Keywords: Gokshuradi Guggulu, Acute toxicity, Biochemical parameters.

 DOI: http://dx.doi.org/10.22159/ajpcr.2017.v10i9.19295

INTRODUCTION

Ayurveda is the oldest holistic management system with meticulously documented medicines and being practiced by a large population in India and abroad. The development of this traditional system of medicines with perspectives of safety, efficacy, and quality will help not only to preserve the traditional heritage but also to rationalize the use of natural products in health care [1].

Gokshuradi Guggulu (GG) is official in the Ayurvedic Formulary of India, indicated as aphrodisiac and spermatogenic. Fruits of *Tribulus terrestris* are incorporated as major ingredient in the formulation. Fruits of *T. terrestris* showed aphrodisiac and spermatogenic potential in several independent preclinical and clinical studies conducted in normal subjects or subjects with compromised reproductive ssystem functioning [2].

Toxicity is an expression of being poisonous, indicating the state of adverse effects led by the interaction between toxicants and cells. This interaction may vary depending on the chemical properties of the toxicants and the cell membrane as it may occur on the cell surface, within the cell body or in the tissues beneath as well as at the extracellular matrix. The toxic effects may take place before the binding of the toxicants to the vital organs such as liver and kidneys. Hence, evaluation of toxic properties of a substance is crucial when considering for public health protection because exposure to chemicals can be hazardous and results to adverse effects on human being. In practice, the evaluation typically includes acute, subchronic, chronic, carcinogenic, and reproductive effects [3].

The acute oral toxicity testing was carried out using male animals as per the Organisation for Economic Co-operation and Development (OECD) guidelines.

METHODS

Procurement of formulation

GG was procured from sunder pharmacy; pharmaceutical quality/ manufacturing standards certified manufacturing unit associated with J and S Ayurveda College, Nadiad (Gujarat, India). GG was manufactured by adopting procedure given in the Ayurvedic Formulary of India. The formulation was used to evolve physicochemical standard as well as to carry out biological studies without any further modifications.

Procurement animals

Healthy male Wistar rats of 12 weeks old weighing between 250 and 350 g were used in the experiments. Rats were procured from Zydus Research Centre, Ahmedabad India. All animals were housed at 22°C±3°C, with relative humidity of 70±5%, under 12 hrs light/dark cycle. A basal diet and water were provided *ad libitum*. They were allowed to acclimatize to laboratory conditions for a week before starting the experiment.

Preparation of animals

The animals are randomly selected, marked to permit individual identification, and kept in their cages for 5 days before dosing to allow for acclimatization to the laboratory conditions.

Acute toxicity studies

Acute toxicity studies were conducted as per the OECD guidelines [4]. Animals were divided into two groups, three animals per group. Animals were fasted overnight and weighed. Single dose of GG (2000 mg/kg) suspended in 1% acacia solution was administered with milk p.o. control group was received 1% acacia solution.

Animals were observed individually after dosing during the first 30 minutes, periodically during the first 24 hrs, with special attention given during the first 4 hrs, and daily thereafter, for a total of 14 days. All observations are systematically recorded with individual records being maintained for each animal. At the end of the studies, blood samples were collected from all animals through retro-orbital plexus, under light ether anesthesia. Hemoglobin content, red blood cell (RBC) count, differential white blood cell (WBC) count, and platelet count were performed from blood. Serum glutamic oxaloacetic transaminase (SGOT), serum glutamic pyruvic transaminase (SGPT), serum creatinine, serum bilirubin, and total serum protein were estimated. Vital body organs such as heart, kidney, liver, and testes were dissected out, cleansed of adhering tissues, and rinsed in normal saline. The organs were preserved in 10% formaldehyde buffer (10% formaldehyde in phosphate-buffered saline) individually, for 24 hrs. These preserved specimens were washed off and stored in 70% alcohol. The specimens were subjected to microscopic histological analysis. The data of hematological studies, biochemical studies as well as histological observation for the test animals were compared for control group animals [5].

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Review Article

COMORBIDITY OF CARDIOVASCULAR DISEASES AND RHEUMATOID ARTHRITIS

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ABSTRACT

Rheumatoid arthritis (RA) is a chronic disease related to swelling of joints which lead to restriction in movement due to pain and deformity mainly in feet, ankle, wrist, and fingers. It is an autoimmune disease, and the manifestations caused due to its occurrence are not clearly understood. In today's time, it has been observed that comorbid conditions account for most of the deaths as they influence the outcome of RA and limit therapeutic options. The most common comorbid conditions which are diagnosed in RA patients are generally cardiovascular (CV) abnormalities, several infections, certain mental disorders, and malignancies. Among which CV comorbid diseases are the most common kind relating to disorders of heart and blood vessel that eventually leads to severe conditions such as angina, myocardial infarction, stroke, rheumatic heart disease, and many more. RA affects the quality of life of patients directly or indirectly, but it mainly shows a significant increase in the prevalence of CV diseases. Hence, it is essential to diagnose and understand about the related manifestations when one is suffering from RA. These studies will aid to make better treatment and management strategies. Hence, an attempt has been made in this review article regarding the epidemiology, impact of both diseases and related risk factors. It also gives information in brief about the pathological causes of the comorbidity and summarizes measures that may be used in the prevention and treatment of these conditions.

Keywords: Cardiovascular diseases, Comorbidity, Rheumatoid arthritis, Inflammation.

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INTRODUCTION

Rheumatoid arthritis (RA) is a chronic, incurable disease characterized primarily by painful joint inflammation [66]. Comorbidity is a medical condition that co-exists along with the disease of interest for instance. RA comorbidity can be further defined in terms of a current or past condition. It represents either an active, past or transient illness. It may be linked to the rheumatic disease process itself and/or its treatment, or it may be completely independent. Due to these links, comorbidities have grown in importance to physicians and researchers because they greatly influence the patient's quality of life, the effectiveness of treatment, and the prognosis of the primary disease. A given RA patient can approximately have 1.6 comorbidities and its frequency increases with increase in age. The more comorbidities a patient is identified with, it leads to more utilization of health facilities which has an impact not only on personal costs but also escalates societal costs. Ultimately, poor quality of life leads to greater chances of hospitalization and mortality. Such complications affect patient care, making diagnosis and treatment decisions more challenging. If presence of co-morbidity is more than one is prone towards more interference in on-going drug treatment and also face problems like increased medical costs and raised risk of mortality. Hence, it is essential to recognize such illnesses and to ensure the care of every individual patient [1].

Patients with RA suffer significantly with increased cardiovascular (CV) morbidity and mortality when compared with the general population [2]. CV diseases (CVD) are the ones relating to disorders of heart and blood vessel which lead to severe conditions such as angina, myocardial infarction (MI), stroke, rheumatic heart disease, carditis, and many more [3,4].

17.5 million people die each year from CVDs, an estimated 31% of all deaths worldwide. It can be established from recent literary work that the mortality of most people suffering from RA is largely due to the presence of a cardiac suffering in the same individual. Ischemic heart disease is among the most common CVDs significantly in individuals with RA [3,4]. Improper adherence to medications is also major patients' problem remains one of the main issues in the treatment of CVD problem like hypertension [65].

As per described previously the other comorbid disorders with RA are as follows:

Infections

Tuberculosis (TB) is the most common infection which is prone to occur in RA patients. Mortality rate associated due to this infection is about 25% in RA patients. Cause of this disease arousal is still not known whether it is due to immune dysfunction of RA patient or due to drugs used in treating individual infection or both diseases [57,60].

Mental disorders

Anxiety and depression are the most common mental diseases as such reason behind is generally increased disease condition in RA patients [61,64].

Malignancies

Leukemia and several myelomas have greater chances to arise in RA patient, but the reason behind this malignancy is still unknown [60].

STUDY EVIDENCE

The latest population-based study carried out compares RA and non-RA subjects and suggests that those with RA show a 3.17-fold higher risk for having hospital MI and an almost 6-fold increased risk of having a silent MI. Thus, the data expresses a progressive incidence of silent MI and of sudden death after its occurrence [5].

EPIDEMIOLOGY OF COMORBIDITY OF CVDS AND RA

As per the survey report of community-based cohort study which was carried out form the period of 1985-1989, among 183 patients with

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Research Article

DRUG UTILIZATION PATTERN AND PHARMACOECONOMIC ANALYSIS OF ANTIHYPERTENSIVE DRUGS PRESCRIBED IN SECONDARY CARE HOSPITAL IN GUJARAT, INDIA

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ABSTRACT

Objective: Hypertension is the most common condition seen in primary care and leads to myocardial infarction, stroke, renal failure, and death if not detected early and treated appropriately. A large number of antihypertensive drugs alone or in various combinations are available, and physicians need to choose most appropriate drug for a particular patient. Pharmacoeconomic and drug utilization studies at regular intervals help physicians to prescribed rational drugs with high efficacy along with minimal cost.

Methods: The prospective observational study was conducted at Seth H. J. Mahagujarat Hospital from July to December 2013. 250 hypertensive patients, attending medicine outpatient department were included for drug utilization study and 100 hypertensive patients, attending in patients department were included for pharmacoeconomics analysis during the study period.

Result: The most frequently prescribed antihypertensive drug as monotherapy, as combination therapy and in fixed dose combinations was calcium channel blocker (Amlodipine). Generic drugs showed same efficacy as brand drug, but both drugs were significantly differed in the prize. Among 100 inpatients admitted for the hypertensive condition in general ward total of direct medical cost was 65.19% and total of indirect medical cost was 34.81%. β-blocker and diuretics were the most effective therapy which is followed by the clonidine, envas (Enalapril), and then, amlodipine.

Conclusion: We concluded from this study that use of β-blockers and diuretics were most cost-effective for the hypertensive patients in this study.

Keywords: Antihypertensive drugs, Drug utilization study, Pharmacoeconomics analysis.

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INTRODUCTION

Hypertension (HTN) is considered as silent killer. It is one of the most significant risk factors for cardiovascular (CV) morbidity and mortality resulting from target organ damage to blood vessels of the heart, brain, kidney, and eyes [1]. Worldwide, raised blood pressure is estimated to cause 7.5 million deaths, about 12.8% of the total of all deaths. This accounts for 57 million disability adjusted life years (DALYS) or 3.7% of total DALYS [2]. Globally CV disease accounts for approximately 17 million deaths a year, nearly one-third of the total [3], of these complications of HTN account for 9.4 million deaths worldwide every year [4]. Premature death, disability, personal and family disruption, loss of income, and health-care expenditure due to HTN, take a toll on families, communities, and national finances. In low- and middle-income countries many people do not seek treatment for HTN because it is prohibitively expensive [5]. Over the period 2011-2025, the cumulative lost output in low- and middle-income countries associated with noncommunicable diseases is projected to be US$ 7.28 trillion [6]. The annual loss of approximately US$ 500 billion due to major noncommunicable diseases amounts to approximately 4% of gross domestic product for low- and middle-income countries. CV disease including HTN accounts for nearly half of the cost [7]. Blood pressure drugs work in several ways, such as removing excess salt and fluid from the body, slowing the heartbeat or relaxing and widening the blood vessels. A wide range of antihypertensive drugs belonging to different pharmacological classes is available. Choice of drugs for a particular patient changes because of factors such as efficacy, side effects, cost, and development of newer drugs. Hence, it is necessary to survey prescription patterns as a component of medical audit for monitoring, evaluation, and necessary modifications in prescribing practices to achieve rational and cost-effective medical care.

The World Health Organization addressed drug utilization as the marketing, distribution, prescription and use of drugs in society, considering its consequences, either medical, social, and economic. The main goal of drug utilization research is to assist the rationale use of drugs in populations. With the knowledge on how drugs are being prescribed and used, a discussion on rational drugs use and suggestions on measures to improve prescribing habits should be more efficiently. Descriptive studies are part of drug utilization research and their main target is to describe variations and trends in the extend, costs, and quality of drug use among individuals and populations [8]. Drug utilization research not only can profile the discrepancy that exists between true need and therapeutic practice but also a tool to correct it. If it is unquestionable the importance of promoting compliance on prescribed medicines, it is not of less importance, to avoid overuse of drugs, which may be responsible for an increase in adverse events, iatrogenic diseases, and unnecessary costs. Since drug utilization studies are designed only to provide the existing distribution of variables, without any regard for causality, external validity of such studies is limited [9].

Joint National Committee guidelines recommend diuretics as the first choice in hypertensive patients with no comorbidities [10]. However, differences still exist between these guidelines and the initial drug of choice in clinical practice [11]. It is estimated that nearly $60 billion is spent on managing HTN and its complications annually in the United States, yet only 34% of the patients treated with antihypertensive medications reach desired blood pressure goals [10,12]. Recent studies have stated that much of this increase in cost is attributable to the introduction of new and generally more costly brand name drugs that replace older and less expensive medications [13].

Original Research Paper

Simultaneous Quantification of Related Substances of Ezetimibe and Simvastatin in Combined Dosage Form Using a Novel Stability-Indicating Liquid Chromatographic Method

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A novel, simple, robust, and rapid reversed-phased high-performance liquid chromatographic method has been developed for the separation and quantitative determination of the related substances of ezetimibe and simvastatin in combined dosage forms. Successful separation of the drug from the process-related impurities and degradation products formed under stress conditions was achieved on Inertsil ODS-3V (150 × 4.6 mm, 5.0 µm) column. The gradient liquid chromatography (LC) method employs solution A and solution B as mobile phase. The solution A contains 0.1% orthophosphoric acid solution in water, and solution B contains 0.1% orthophosphoric acid solution in acetonitrile. Flow rate was monitored at 2.0 mL/min, and the ultraviolet (UV) detection, at 238 nm. In forced degradation studies, the effect of acid, base, oxidation, UV light, and temperature was investigated, showing that good resolution between the peaks corresponds to process-related impurities and degradation products from both analyte. The performance of the method was validated according to the present International Conference on Harmonization (ICH) guidelines for specificity, limit of detection, limit of quantification, linearity, accuracy, precision, ruggedness, and robustness. To the best of our knowledge, a rapid LC method, which separates all the impurities of ezetimibe and simvastatin in combined dosage forms, disclosed in this investigation was not published elsewhere.

Keywords: Ezetimibe, simvastatin, high-performance liquid chromatography, impurity, method validation

Introduction

Simvastatin, chemically (1*S*,3*R*,7*S*,8*S*,8a*R*)-1,2,3,7,8,8a-hexahydro-3,7-dimethyl-8-{2-[(2*R*,4*R*)-tetrahydro-4-hydroxy-6-oxo-2*H*-pyran-2-yl]ethyl}-1-naphthyl-2,2-dimethyl butyrate (Table 1), is obtained from the fermentation of *Aspergillus terreus*. After oral ingestion, simvastatin, which is an inactive lactone, is hydrolyzed to corresponding β-hydroxy acid, leading to the inhibition of 3-hydroxy-3-methylglutaryl-coenzyme A (HMG-CoA) reductase, responsible for catalyzing the conversion of HMG-CoA to mevalonate, which is an early and rate limiting step in cholesterol biosynthesis [1–3]. Administration of the highest approved statin dose offers only limited additional lowering of low-density lipoprotein (LDL) cholesterol at the expense of an increased incidence of side effects [4, 5]. Therefore, novel compounds that further reduce LDL cholesterol levels when added to statin therapy are of interest. Ezetimibe, (3*R*,4*S*)-1-(4-fluorophenyl)-3-[(3*S*)-(4-fluorophenyl)-3-hydroxypropyl]-4-4-hydroxyphenyl)-2-azetidi-none (Table 2), is a selective cholesterol absorption inhibitor, which potently inhibits the absorption of biliary and dietary cholesterol from the small intestine without affecting the absorption of fat soluble vitamins, triglyceride, or bile acids. Ezetimibe inhibits cholesterol absorption by binding to the Niemann–Pick C1-like 1 (NPC1L1) protein. The latter is located at the brush-border membrane of the enterocyte, where it contributes substantially to the intestinal uptake and cellular transport of cholesterols and non-cholesterol sterols. Combined therapy of ezetimibe with a statin provides an incremental reduction in LDL cholesterol levels of 12–19%. Also, co-administration of ezetimibe with statins could significantly reduce the risk of coronary heart disease (CHD) events in patients with hypercholesterolemia [6–9].

Monograph for ezetimibe and simvastatin is available in United States Pharmacopoeia (USP). In the literature, a number of analytical methods described for the determination of simvastatin in aqueous samples and human plasma including liquid chromatography (LC) [10–12], liquid chromatography–tandem mass spectrometry (LC–MS/MS) [13–16], gas chromatography–mass spectrometry (GC–MS) [17], micellar electrokinetic chromatography [18], cerimetric reaction based on redox and complex formation [19], and ultraviolet (UV) spectrophotometry [20]. Methods have also been reported for determination of ezetimibe in pharmaceutical formulations and biological fluids including LC [21,22], LC–electrospray ionization (ESI)–MS [23–25], in human plasma by LC–MS/MS, and a reversed-phase high-performance liquid chromatography (RP-HPLC) method for determination of the pharmaceutical form of the drug [26]. Related substances method for ezetimibe and simvastatin are reported individually. Literature survey reveals that there is no method reported for analysis of related substances simultaneously in ezetimibe and simvastatin tablets. Based on the facts, the study aimed to develop and validate a simple, economic, and rapid analytical method which can be easily applied in routine analysis for the determination of related substances in ezetimibe and simvastatin in combined dosage forms (i.e. tablets).

Materials and Methods

Chemicals and Reagents. Ezetimibe, simvastatin, and related impurities were obtained from Zydus Cadila Healthcare Limited,

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Document details - Classifying druggability on potential binding sites of glycogen synthase kinase-3β: An in-silico assessment

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Classifying druggability on potential binding sites of glycogen synthase kinase-3β: An in-silico assessment(Article)(Open Access)

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Abstract

Putative binding sites of glycogen synthase kinase-3β (GSK-3β) have been identified by various computational methods; however, the druggability of these pockets is still unknown. Herein, we assessed a dataset of 24 Protein Data Bank (PDB) crystal structures of GSK-3β using SiteMap to compute the druggability of each identified site. The binding sites were assessed with two site-scoring functions known as the Druggability score (Dscore) and SiteScore

Document details - Formulation development and evaluation of Natamycin niosomal in-situ gel for ophthalmic drug delivery

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Formulation development and evaluation of Natamycin niosomal in-situ gel for ophthalmic drug delivery(Article)

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Abstract

[No abstract available]

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Topic: Ophthalmic Administration | Eye Irritation Tests | Bioadhesives

Document details - Development of carbon tetrachloride-induced chronic hepatotoxicity model in rats and its application in evaluation of hepatoprotective activity of silymarin

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Development of carbon tetrachloride-induced chronic hepatotoxicity model in rats and its application in evaluation of hepatoprotective activity of silymarin(Article)(Open Access)

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Document details - Evaluation of prescribing pattern of fixed dose combinations of antihypertensives and antidiabetic agents

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Evaluation of prescribing pattern of fixed dose combinations of antihypertensives and antidiabetic agents(Article)(Open Access)

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Abstract

Objective: The objective of this research was to evaluate prescribing pattern of fixed dose combinations (FDCs) of antihypertensives and antidiabetic agents among patients of private hospitals. Methods: An observational study was carried out in the outpatient department of two hospitals. Data of patients being diagnosed with the symptoms of

Document details - Design, synthesis and molecular docking of 1-cyclopropyl-6-fluoro-4-Oxo-7-{4-[2-(4-Substituted-Phenyl)-2-(Substituted)-Ethyl]-1-Piperazinyl}-1,4-dihydroquinoline-3-carboxylic acid as an antimicrobial Agents

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Design, synthesis and molecular docking of 1-cyclopropyl-6-fluoro-4-Oxo-7-{4-[2-(4-Substituted-Phenyl)-2-(Substituted)-Ethyl]-1-Piperazinyl}-1,4-dihydroquinoline-3-carboxylic acid as an antimicrobial Agents(Article)

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Mobile Applications Testing Challenges and related solutions

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Abstract:. Mobile is becoming the dominant digital driver in the world due to fast growing mobile applications and their usage among people. Mobile applications are used in almost all domains and that kept far behind the desktop in usage. Due to intense usage of mobile applications, efficiency of them matters. Efficiency of mobile applications is checked using appropriate testing techniques. Testing techniques used to check mobile applications are totally different than traditional software applications. This paper will mainly focus on challenges of mobile application testing strategies. After discussion of the challenges of testing strategies, the paper will give probable solutions to them.

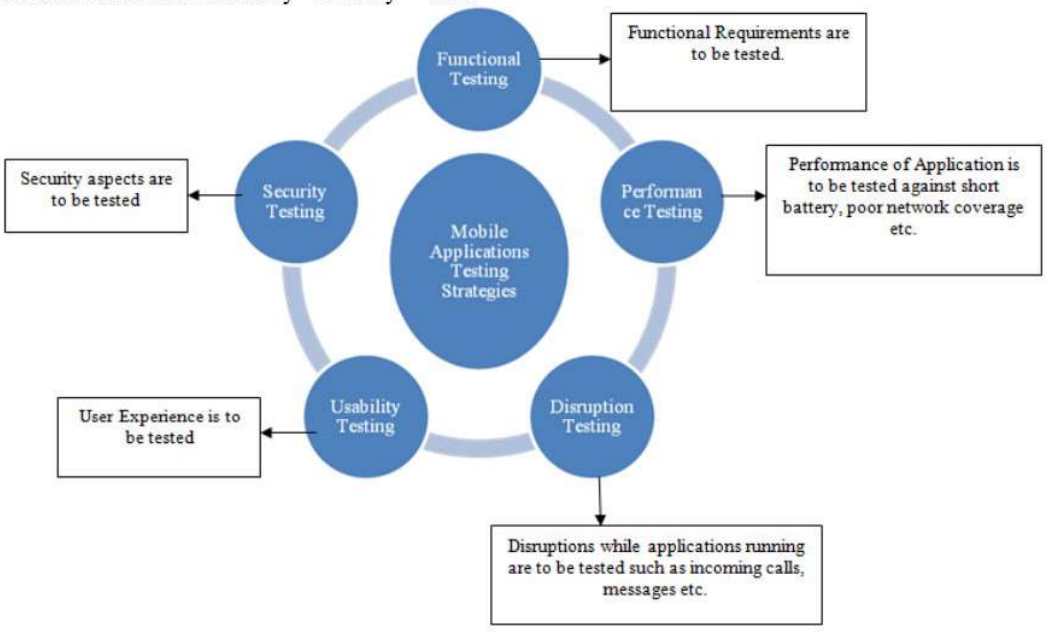
Keywords: Mobile Application, Performance Testing, Automated Testing, Functional Testing, Test Metrics

I. INTRODUCTION

Mobile application usage in India has grown up at very hasty way and in future this rate will boost more than this tempo. For the successful implementation and usage of any mobile application, performance and error free execution is very vital and that is achieved by applying appropriate testing on an application. Mobile Application testing can be done either manually or by using software tools. Manual testing has several limitations such as: entail more time and resources; performance testing is quite impossible, question of accuracy, etc. Properly planned software based automated testing greatly reduce time; omit human errors and helps in business values by increasing testing efficiency, effectiveness, accuracy, speed and coverage.

The mobile Application development environment is totally different than traditional software development environment [1, 2, 3]. Mobile application development environment, there is an intricacy in identifying precise requirements and related stakeholders from whom requirements are to be collected. Generally delivery time of mobile applications is very short and frequent expectations and requirements of customers changing so there is a huge chance to get erroneous applications and in such circumstances testing of functional requirements of applications become crucial. Functionalities of mobile applications affect in several other conditions also such as short battery, poor network coverage, and concurrent access by multiple users. Mobile Applications also get disturbed by many disrupts such as incoming and outgoing calls and messages, media power on/off, etc. User experience is very important towards any mobile application so usability testing can play a vital role while testing mobile applications. Several mobile applications transmit sensitive data over insecure internet in that case testing of security aspects of mobile applications is very important.Figure-1 describes different testing strategies for Mobile Applications Testing.

Section-II of the paper will describe the challenges associated with all testing strategies. Section-III will cover the related solutions for them.



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Crop Prediction Framework Using Rough Set Theory

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Abstract—**The agriculture sector contains the vast amount of data which require the development of specialized framework to store, clean, and analysis of the stored data to convert it into the knowledge such that hidden pattern can be identified from the data. Here, the basic concept of Rough Set Theory which is applied to the agriculture data set to make the decision. The Rough Set Theory (RS) offers a feasible approach for extraction of decision rules from data sets. These rules can be used for doing forecasting of crop-yield in the agriculture sector. In this paper, the RS framework ispresentedto generate the classification rules from 640 sets of agriculture data for crop forecasting.In proposed framework, the collected data are preprocess and then information table is generated. After this, decision table is generated. The reduction method is employed for finding out the reduct of the data set which holdsthe minimal subset of attributes accompanying with a class label. By applying the LEM2 algorithm, the rules are generated from the reduct. The study shows that the theory of rough sets is the one of the best technique for rule generation and decision making.**

Keyword- decision making, knowledge discovery, Rough Set Theory, crop-yield forecasting, rule generation and reduction, rule classification

I. INTRODUCTION

Now a day, the RST is applied in various domains, such asmachine learning [1], knowledge acquisition and knowledge discovery from database[2], decision analysis [3], expert systems[4], inductive reasoning and pattern recognition[5], data mining[6], and many more.The rough set methodology is applied to many applications like legal reasoning for drawing conclusion from the fact data, churn modeling in telecommunications and analysis of medical, finance and military dataset[7].

The central objective of the analysis using RST is to induce of (learning) approximations of concepts [8]. It gives mathematical tools to discover the hidden patterns in data. It can be used for data reduction[9], feature selection[10], feature and pattern extraction [11], decision rule generation [12]. Moreover, it can be employed to recognize partial or total dependencies in data,dynamic data,removes redundant data, missing data, give approach to null values , [13] and others.

The best of our knowledge, a very little work is done by employing rough set in agriculture sector. Therefore, we motivated to develop a framework by applying rough set in this domain. Advantages of employing this technique are explained as follows [14][15]:

- There is no prior or additional information about the data set is required
- It provides a valuable analysis
- It provides the interpretation in form of quantitative and qualitative data.

The main objectives of this study is to build an appropriate framework to access the performance of rough set classifiers, to do the forecasting of crop in the agriculture domain and to produce understandable decision rules to be applied on crop.

Use of Rough Set in Various Domains:

The RST has many properties which makes the one and only option for solving the various real problems like pattern recognition in which it is used for improvement in the classification ability of a hybrid pattern recognition system [16]. The designand development ofa mobile support system to triage abdominal pain in the emergency room of a hospital was done by the use of rough sets [17]. The rough sets concept is also applied to generalize the rules that explain the association between acoustical parameters ofconcert halls and sound processing algorithms [18]. The RST is employed to do the extractionof facts and rules for the power system operation [19].The hierarchical learning method based on RST is applied to the problem of sunspot classification from satellite images [20]. The author Shen and Jensen have identified the other area where rough

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Designing four-Channel High Rate TDM Passive Optical Network with NRZ Scheme for Wired Environment

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Abstract

It is advantageous to think about the innovations accessible for presenting time division multiplexing (TDM) in PONs, This strategy is utilized to get the coveted points of interest of PON. Examination is made between past innovations to choose which gives better execution under certain given criteria like power, data transmission, no of clients, cost, adaptability and unwavering quality. The capability of PONs to convey high data transmissions to clients in get to systems and their favourable circumstances over current access innovations have been generally perceived. PONs have gained solid ground as far as institutionalization and sending in the course of recent years. This paper basically covers fundamental design of TDM-PON network with multiple inputs or channels. Chanel can use different coding scheme at input side. Data can be transferred using wired environment which used nonlinear fiber.

Keywords: Optical network, WDM, TDM, PON, Nonlinear fiber.

INTRODUCTION

In the TDM PON, the CO devotes schedule opening to the numerous endorser (ONU) associated with the PON. Each ONU would then be able to utilize the full upstream data transfer capacity of the optical connection for the span of it's doled out schedule vacancy. Since the TDM PON can commonly benefit N = at least 32 supporters, the normal devoted transfer speed to each ONU is typically just a couple of percent of the channel limit. To interface the different ONUs to a solitary feeder fiber. This couples N:1 of the power from every endorser into the feeder fiber for transmission back to the OLT at the CO.

There are three institutionalized forms of the TDM-PON: Ethernet PON (EPON), broadband PON (BPON), and Gigabit PON (GPON). They all utilization one wavelength for downstream transmission and another wavelength for upstream transmission as represented in figure 1. One essential qualification between the three sorts of TDM-PON is operational speed. BPON is moderately low speed with 155 Mbps upstream/622 Mbps downstream operation. The EPON bolsters 1.0 Gbps symmetrical operation. The GPON guarantees 2.5/1.25 Gbps topsy-turvy operation. Two Types of Time Division Multiplexing Techniques are utilized (a) Fixed Time Division Multiplexing (b) Statistical Time Division Multiplexing. In Fixed time division multiplexing technique a settled measure of time moving or delay is presented between two OLTs while in Statistical time division multiplexing the moving time is chosen by activity at input side and measure of information to be sent from OLTs.

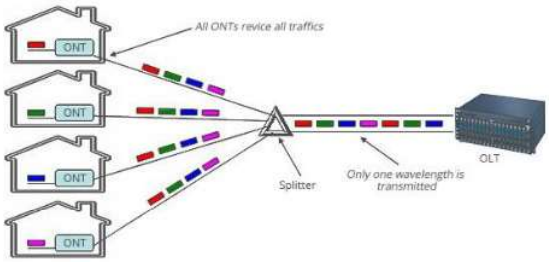

Figure 1: TDM-PON Diagram

The OLT is situated in a local office and controls the bidirectional stream of data over the Optical Distribution Network (ODN). In the down connection bearing the limit of an OLT is to take in voice, data, and video gushing activity from a long separation or metro system and communicate it to all the ONT framework segment on the ODN. A product is to be presented at splitter stage. ONT is found specifically at the client's premises. There its motivation is to give an optical association with the PON on the upstream side and to interface electrically to the client gear on the opposite side [21]. A more assortment of ONT helpful plans and frame outlines are open to suit the necessities of various bases of prerequisite. The traverse of an ONT can extend from an

A Fuzzy-LP Approach in Time Series Forecasting

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Abstract. In this study, a novel model is presented to forecast the time series data set based on the *fuzzy time series (FTS)* concept. To remove various drawbacks associated with the FTS modeling approach, this study incorporates significant changes in the existing FTS models. These changes are: (a) to apply the linear programming (LP) model in the FTS modeling approach for the selection of appropriate length of intervals, (b) to fuzzify the historical time series value (TSV) based on its involvement in the universe of discourse, (c) to use the high-order fuzzy logical relations (FLRs) in the decision making, and (d) to use the degree of membership (DM) along with the corresponding mid-value of the interval in the defuzzification operation. All these implications signify the effective results in time series forecasting, which are verified and validated with real-world time series data set.

1 Introduction

In time series data analysis and forecasting, it includes the problems associated with prediction of daily temperature, short-range as well as long-range rainfall amount, daily stock index price, economic growth of a country, etc. The fuzzy logic has the capability to deal with uncertainties involved in time series events. Using the concept of fuzzy logic, Song and Chissom [1] introduced the first model in 1991 to deal with the uncertainty and imprecise knowledge contained in time series data. In their modeling approach, each of the TSVs is represented by the fuzzy linguistic variables, and modeled and simulated them together to obtain the predicted value. They referred their model as "fuzzy time series (FTS)". Recently, various modifications are suggested by the researchers [2–5] to improve the predictive skill of one-factor time series data set.

In the FTS modeling approach, there are four significant factors, which predominantly impact on the performance of the FTS model [5], as: (a) selection of the effective length of intervals, (b) determination of the DM of each historical TSV, (c) inclusion of the high-order FLRs, and (d) defuzzification operation. Hence, the contribution of this work is fourfold, as: (a) **First**, for the selection of

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Efficacy of Blended English Language Learning versus Traditional English Language Learning: An Experimental Study carried out on the Students of B Tech Program

Dr. Bhaskar Pandya

ABSTRACT

Almost all problems of the world have their roots in human actions and remedies in Education. Hence, frontiers of new knowledge and new ways and means of acquiring knowledge are opened up every day. Further, over the years, various definitions and meanings of education have come down to us. They change with years and places; so do change the ways and means of imparting education. The practice today is or what the focus of attention of the English Language Teachers and Practitioners is Blended Learning. The paper aims at making an in-depth study of English Language Teaching juxtaposing Blending Learning versus Traditional ways of Teaching and Learning. Observations have been made along with a comparative study of teaching the same students through both the modes of teaching and the results. It, finally, proves that Blended Learning is far more effective than Traditional Ways of Teaching. However, the Research is based on data and observations from only one Institute, it needs to be taken further by investigating the other Engineering Institutes of the State and Nation.

Key Words : English Language Teaching, Traditional Teaching, Teaching Methods, Blended Learning

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"Teaching is a system of actions, intends to induce learning through interpersonal relationships."
- B O Smith

If one juxtaposes both – Human Problems and Education, one would definitely find that almost all of them have their roots in the human acts and solution in Education. Rabindranath Tagore opines that the highest education is that which does not merely give us Information but makes our life in harmony with all existence. Hence, education has been perceived as a tool for Holistic Development. It is a philosophy of education based on the premise that every one finds identity, meaning, and purpose in life through connections to the community, to the natural world, and to humanitarian values such as compassion and peace.

Over the years, various definitions and meanings of education have come down to us. They change with years and places. They bear a kaleidoscopic meaning in various countries and periods. Greece and Athens designated the meaning of education in the form of developing seven liberal arts. At the same time, in the Vedic Age education meant self-control, development of character, and generation of social awareness.

Today, education means a range of institutions where education is imparted. Among all, a university is credited the most for educating the generations and, ultimately, a nation. It is believed that a university converts eyes into sight and vision; information into knowledge and wisdom; and demography into citizens and harmonious living. Thus, a University inculcates leadership and restlessness into a generation. Its primary goal is to create, sustain and continue the national identity through responsible citizens.

This is why Education is considered to be one of the most critical elements of the national development. In particular, it is the Higher Education (HE) that leads to national development. HE has been considered to be a powerful tool to build knowledge-based society of the century. Hence, Nations have dedicated their efforts to improve and expand education. It also strives to eliminate disparities in access with great emphasis on improvement in quality and

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A STUDY TO IDENTIFY PERSONALITY PROFILES OF ACADEMICS ACROSS VARIOUS DISCIPLINES USING MYERS-BRIGGS TYPE INDICATOR (MBTI) TEST

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ABSTRACT

Purpose - *To categorize the personality types and preferences of academics in a State Private University[1] in middle Gujarat, India. It explores personality profiles, differences in personality preferences with special reference to the academics' gender, designation, religion, and marital status.*

Design - *The research was carried out through a questionnaire (in line with Myers-Briggs Type Indicator) of a total of 257 academics. The descriptive statistical analysis of the data comprises the frequency and percentage of the respondents was carried out.*

Finding - *The study revels leading part of personality types are by ESTJ and ISTJ. In the personality preference scale of E-I, a reasonably high proportion of Extraverts were found. The high percentage of Sensing in the S-I Scale, Thinking in T-F, and Judging in J-P Scale were found.*

Practical Implications – *The culture in the academic is course oriented and it concentrates on well-orderedness and conscientiousness.*

Key Words: ***Personality Assessment, Myers Briggs Type Indicator***

Introduction

Academics are proficient intellectuals and communicators. They are researchers, narrators, innovators, instructors, and leaders. Academics contribute significantly to the attainment of

[1] As per Ministry of Human Resource Development (MHRD), a State Private University is established under a State/Central Act by a sponsoring body viz. A Society registered under the Societies Registration Act 1860, or any other corresponding law for the time being in force in a State or a Public Trust or a Company registered under Section 25 of the Companies Act, 1956.

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ORIGINAL PAPER

Influence of Pb^{+2}-Thiourea complex concentration on the structural, optical, thermal and electrical properties of PbS/PVP-PVA nanocomposite films

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Abstract
Deposition of nanocomposite films of lead sulphide (PbS) nanoparticles in blend (1:1) of polyvinyl pyrrolidone (PVP) and Polyvinyl alcohol (PVA) by dip-coating from a precursor aqua-methanolic solution containing of Pb^{+2}-TU complex (LTUC) is reported. To obtain nanocomposite films, solid precursor films are heated at about 110 °C in air for 10 mins to convert the LTUC in to PbS nanoparticles in PVP-PVA by in-situ thermolysis. PbS/PVP-PVA films with different loading of PbS was prepared by varying the concentration of LTUC in precursor solutions. The effect of LTUC on the microstructural, optical, thermal and electrical properties of the films was investigated. The X-ray diffraction of films confirms the presence of PbS nanoparticles in PVP-PVA matrix. The band gaps of PbS/PVP-PVA films varied from 1.8 to 0.8 eV as the concentration of LTUC varied from 0.0125 to 0.1 M due to formation of PbS nanoparticles. Transmission electron microscopy (TEM) shows that PbS nanoparticles are spherical with maximum diameter of 18 to 22 nm. The Fourier transformed infrared (FTIR) spectroscopy and X-Ray photoelectron spectroscopy (XPS) indicate the formation of hydrogen bond between –O–H group of PVA and –C = O group of PVP. However, PbS nanoparticles does not interact with either of the polymers. Thermogravimetric analysis (TGA) reveals that there was an improvement in thermal stability of PbS/PVP-PVA nanocomposites as compared to PVP-PVA blend. The dc conductivities of PVP-PVA and PbS/PVP-PVA(0.1 M) NC were found to be 3.2×10^{-6} S cm^{-1} and 14.2×10^{-6} S cm^{-1}, respectively.

Keywords Polymer blend · Nanocomposites · PbS nanoparticles · Band gap

Introduction

In recent years, synthesis and characterization of polymer based nanocomposites (NC) have drawn considerable attention because of their extensive applications in optical and photonic devices. For the optical and photonic devices point of view, the inorganic nanoparticles (NPs) must be incorporated in solid polymer matrix. For the available matrixes, the blend of two polymer is also suitable for preparing metal/polymer and inorganic nanocrystals/polymer NC films. The preparation of polymer blends is readily dependent on the hydrogen bonding between two polymers and their miscibility. Sometimes the blend shows pronounced effect on the optical properties, mechanical properties and thermal stability of the polymers which can't be accomplished by utilizing single polymer [1].

The incorporation of inorganic NPs or metal sulphide nano crystals into a polymer matrix permits the properties of inorganic NPs and polymers to be shared. NC containing nanostructured transition metal sulphide such as CdS, ZnS, PbS, HgS, CuS, etc. exhibit very unusual physical and chemical properties compared with their bulk. Out of the different semiconductors, PbS is unique and exceptional. Bulk PbS has a narrow direct band gap of 0.41 eV with large excitonic Bohr radius of 18 nm. Consequently PbS NC has significant size-dependent band gaps from 0.4 to 3.5 eV. Thus, the synthesis and processing of PbS/polymer NC pay much attention due to their different applications, such as, bulk heterojunction solar

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RESEARCH PAPER

A Comparison of Magnetic Fluid Flow Models on the Behavior of a Ferrofluid Squeeze Film in Curved Rough Porous Circular Plates Considering Slip Velocity

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Abstract
This study aims to present a comparison of all the three magnetic fluid flow models (Neuringer–Rosensweig model, Shliomis model, Jenkins model) regarding the behaviour of a ferrofluid based curved rough porous circular squeeze film with slip velocity. The Beaver's and Joseph's slip model has been adopted to evaluate the effect of slip velocity. Further, the stochastic model of Christensen and Tonder has been used to study the effect of surface roughness. The concerned stochastically averaged Reynolds type equation is solved with appropriate boundary conditions to get the pressure distribution lead thus leading to the calculation of load carrying capacity. The graphical representations ensure that Shliomis model may be preferred for designing the bearing system with enhanced life period. However, for lower to moderate values of slip even Neuringer–Rosensweig model may be adopted. In addition, when the slip is at minimum the Jenkin's model may be deployed when the roughness is at lower level.

Keywords Circular bearing · Magnetic fluid · Roughness · Flow models

1 Introduction

The squeeze film, which has its own importance from a long time, is used in clutch plates, automobile transmissions and domestic appliances. Due to this, many investigators (Prakash and Vij 1973; Bhat 1978; Bhat and Deheri 1995; Deheri et al. 2005; Deheri and Patel 2011) investigated the problem of squeeze film bearing.

Ferrofluids, which are prepared by dispersing the magnetic particles in the liquid carrier, are a kind of multi functional materials. Because of the dispersing particles, the magnetic fluids could be simply divided into magneto rheological fluid and ferrofluid. Due to their some important properties the ferrofluids have been attractive in different types of applications, such as vacuum sealing, magnetic resonance, imaging, intelligent sensors, buffer solution in chips and drug delivery.

In 1964, Neuringer and Rosensweig proposed a simple flow model to study the steady flow of ferrofluids in the existence of slowly changing external magnetic fields. Quite a good number of papers are available in the literature dealing with the discussion of different types of bearing using Neuringer and Rosensweig flow model, for example, Tipei (1982) in short bearing, Agrawal (1986), Shah and Bhat (2003) and Deheri and Patel (2011) in slider bearing, journal bearing by Nada and Osman (2007) and Patel et al. (2012) and circular plates by Shah and Bhat (2000) and Deheri and Abhangi (2011). Jenkins (1972) modified the flow model of Neuringer and Rosensweig (1964) using Maugin's modification. It was observed that Neuringer–Rosensweig model modified pressure while Jenkins flow model modified both the pressure and the velocity of the ferrofluid. The steady-state performance of bearings with Jenkins model based magnetic fluids was analyzed by Agrawal (1986), Ram and Verma (1999), Shah

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ORIGINAL ARTICLE

Ionic liquid promoted facile and green synthesis of 1,8-dioxo-octahydroxanthene derivatives under microwave irradiation

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KEYWORDS

Homogeneous catalysis;
Microwave assisted synthesis;
Green chemistry;
Ionic liquid

Abstract An efficient and environmentally benign procedure for the synthesis of 1,8-dioxo-octahydroxanthene by condensation reaction between 5,5-dimethyl-1,3-cyclohexanedione (dimedone) and structurally diverse aldehydes using carboxy functionalized ionic liquid under microwave irradiation is described. The methodology provides synergy of ionic liquid and microwave irradiation which offers several advantages such as high yields in shorter reaction time, convenient operation, reusability of catalyst and easy work-up.

1. Introduction

Xanthene core and its derivatives serve as an important class of compounds, as it is present in natural products with broad biological activities [4,29,34,35]. Most notably among them, xanthenedione constitutes structural unit in a number of natural products, and having a wide range of therapeutic and pharmacological properties [18,7,47]. Several functionalized 1,8-dioxo-octahydroxanthene derivatives possess the significant synthetic interest as they exhibit anticancer [28], antiplasmodial [53], antiviral [45,40], antibacterial [24,40] and anti-inflammatory [37,40] activities. Besides, these heterocyclic molecules have been widely used as luminescent dyes [15,40], sensitizers in photodynamic therapy [43,21,41,30], in laser technology [3,1] as well as pH sensitive fluorescent materials [6,26]. There are several methods reported for the synthesis of xanthenedione derivatives over various catalysts such as sulfuric acid or hydrochloric acid [19], $InCl_3$/ionic liquid [13], $SmCl_3$ [20], Fe^{+3} montmorillonite [44], amberlyst-15 [11], $FeCl_3$/[bmim][BF_4] [14], p-dodecylbenzenesulfonic acid [38], sulfamic acid [39], $HClO_4$·SiO_2 [50], trimethylsilyl chloride (TMSCl) [22]. However, most of the reported methods require expensive reagents, hazardous organic solvents, longer reaction time and tedious workup. Hence, the further innovation toward contemporary reaction with easy isolation of product, reusability of catalyst, perhaps with minimal or no waste is highly attractive.

The development of sustainable, environmentally benign processes for the synthesis of heterocyclic compounds is one of

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Dip-coated PbS/PVP nanocomposite films with tunable band gap

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PbS/polyvinylpyrrolidone (PVP) nanocomposite films with tunable band gap are synthesized by solid state *in situ* thermolysis. Precursor films are dip-coated on glass substrates from a methanolic solution of Pb^{2+}–thiourea complex and PVP and then heated in air at 110 °C for 10 minutes to obtain shiny brown clear films of PbS/PVP. The formation of PbS nanoparticles in PVP matrix is confirmed by X-ray diffraction studies. The size of PbS nanoparticles varied from 2 to 8 nm depending of the weight fraction of the Pb^{2+}–thiourea complex in the PVP. Transmission electron microscopy shows that the nanoparticles are spherical. The transmission spectra of the PbS/PVP films in the wavelength range of 300 to 2600 nm showed absorption edges near 900 nm and below due to the presence of PbS nanoparticles. The band gaps of PbS/PVP films, as determined from Tauc plots, varied from 0.8 to 1.92 eV as the weight fraction of the complex decreased from 82 to 36%. Fourier transformed infrared (FTIR) spectroscopy, X-ray photoelectron spectroscopy (XPS) and ^{13}C Nuclear Magnetic Resonance (NMR) studies reveal that there is strong interaction between PbS and PVP which limits the growth of the nanoparticles.

1. Introduction

Organic–inorganic nanocomposites (NCs) consisting of PbS nanoparticles (NPs) or quantum dots (QDs) implanted in polymers have received considerable attention due to the significant quantum size effect of PbS itself.[1] Semiconducting conjugated or insulating polymers have been used as the host in PbS/polymer nanocomposites. Conjugated polymer hosts include poly[2-methoxy-5-(2′-ethylhexyloxy-*p*-phenylenevinylene)] (MEH-PPV),[2–8] poly(2-(6-cyano-6′-methyl heptyloxy)-1,4-phenylene) (CN-PPP),[2] poly(3-hexylthiophene-2,5-diyl) (P3HT),[4,9–12] polypyrrole (PPy),[13] and poly[2-methoxy-5-(3′,7′-dimethyloctyloxy)-1,4-phenylenevinylene] (MDMO-PPV).[14] Insulating polymers, such as, polyacryl amide (PAM),[15,16] poly-*p*-xylylene (PPX),[17] polyacrylonitrile (PAN),[18] poly(methyl methacrylate) (PMMA),[19] polystyrene (PSt),[7,20,21] poly thiourethane (PTU),[22] polyvinyl alcohol (PVA),[23–28] poly(vinyl acetate) (PVAc),[29] poly(vinyl pyrrolidone) (PVP),[30,31] polyvinylidene fluoride (PVDF),[32] and poly(ethylene oxide) (PEO)[33] have been employed as hosts. Films of PbS/conjugated polymer NCs have been basically investigated as a photoactive component of bulk heterojunction solar cells,[6,10,12,14,32,34] and photo detectors. Application of PbS/insulated polymer NC films as photo-detectors,[3,20,27] high refractive index material,[22] non-linear optical device,[19,23,29] have been also explored. However, studies on interaction between PbS NPs and host polymer or control of band gaps of PbS NPs by polymer matrix are very few. Further, deposition of PbS/polymer NC thin films by simple dip-coating technique from a single precursor solution have not been studied. Also there is no detailed study on PbS/PVP nanocomposite.

PbS is an earth-abundant low band gap (0.41 eV at 300 K) semiconductor with extraordinary size dependent properties at nanoscale. PbS has a large excitonic Bohr radius of 18 nm because of high dielectric constant 17.2 and low effective mass of electrons ($\approx 0.1m_e$). Hence, it exhibits a strong quantum size effect for larger NPs/QDs (<18 nm) as compared to CdS or CdSe (<4 nm). Thus, the band gap of PbS NPs can be easily tuned from 0.41 (bulk) to 4 eV by selecting appropriate size.

To synthesize nanocomposites (NCs), two different schemes are generally employed depending on where the nanoparticles (NPs) are processed *ex situ* or *in situ*. In the *ex situ* method, NPs are made separately and then blended either with a monomer before the polymerization or directly with the polymer. The *in situ* method of NCs consists of the synthesis of inorganic NPs either in monomers or in polymers. Both the routes are generally liquid based and solid NCs are obtained by co-precipitation or solvent evaporation. Although both *ex situ* and *in situ* solution-based routes have been utilized for obtaining PbS–polymer nanocomposites, the latter has been favoured the most. Nanocomposites were synthesized from a solution of polymer and lead salt by introducing sulphur ions from different sources. Sulphur ions was added in form of H_2S gas,[15,22,24,25,33] elemental

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frontiers in Plant Science

ORIGINAL RESEARCH
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Transgenic Peanut (*Arachis hypogaea* L.) Overexpressing *mtlD* Gene Showed Improved Photosynthetic, Physio-Biochemical, and Yield-Parameters under Soil-Moisture Deficit Stress in Lysimeter System

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Peanut, an important oilseed crop, frequently encounters drought stress (DS) during its life cycle. In this study, four previously developed *mtlD* transgenic (T) peanut lines were used for detailed characterization under DS, at the reproductive stage using lysimeter system under controlled greenhouse conditions. In dry-down experiments, T lines maintained better photosynthetic machinery, such as, photosynthesis rate, stomatal conductance, transpiration rate, and SPAD (Soil-Plant Analyses Development) values, and had lower oxidative damage, including lipid membrane peroxidation and hydrogen peroxide and superoxide radical accumulation than WT, when exposed to 24 days of DS. WT plants had a more negative water potential (WP; up to −3.22 MPa) than T lines did (−2.56 to −2.71 MPa) at day 24 of DS treatment. During recovery, T lines recovered easily whereas 67% of WT plants failed to recover. In T lines, the rate of photosynthesis strongly and positively correlated with the transpiration rate ($r = 0.92$), RWC ($r = 0.90$), WP ($r = 0.86$), and total chlorophyll content ($r = 0.75$), suggesting its strong correlation with water retention-related parameters. Furthermore, yield parameters such as, pod weight and harvest index of T lines were up to 2.19 and 1.38 times more than those of WT plants, respectively. Thus, the significantly better performance of *mtlD* T peanut lines than of WT plants under DS could be attributed to the accumulation of mannitol, which in turn helped in maintaining the osmoregulation and ROS scavenging activity of mannitol and ultimately conferred water-economizing capacity and higher yield in T lines than in WT plants.

Keywords: drought stress, peanut, lysimeter system, physio-biochemical parameters, growth-related traits, wilting symptoms

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A NEW CLASS OF FUNCTIONS SUGGESTED BY THE GENERALIZED BASIC HYPERGEOMETRIC FUNCTION

MEERA H. CHUDASAMA AND B. I. DAVE

ABSTRACT. We introduce an extended generalized basic hypergeometric function ${}_r\phi_{s+p}$ in which p tends to infinity together with the summation index. We define the difference operators and obtain infinite order difference equation, for which these new special functions are eigen functions. We derive some properties, as the order zero of this function, differential equation involving a particular hyper-Bessel type operators of infinite order, and contiguous function relations. A transformation formula and an ℓ-analogue of the q-Maclaurin's series are also obtained.

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1. INTRODUCTION

Let $0 < q < 1$. A q-analogue of factorial function

$$(a)_n = a(a+1)(a+2)\dots(a+n-1)$$

is defined by [4, Eq.(1.2.15) and (1.2.30), p. 3,6]

$$(a;q)_n = \begin{cases} 1, & \text{if } n = 0 \\ (1-a)(1-aq)\cdots(1-aq^{n-1}), & \text{if } n \in \mathbb{Z}_{>0} \\ [(1-aq^{-1})(1-aq^{-2})\cdots(1-aq^{-n})]^{-1}, & \text{if } n \in \mathbb{Z}_{<0} \\ \frac{(a;q)_\infty}{(aq^n;q)_\infty}, & \text{if } n \in \mathbb{C}, \end{cases} \tag{1.1}$$

where $a \in \mathbb{C}$ in general, and $(a;q)_\infty = \prod_{k=0}^{\infty}(1-aq^k)$.

For $a \equiv q^a = q$,

$$(q;q)_n = (1-q)(1-q^2)\cdots(1-q^n)$$

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Regular paper

A rapid qualitative assay for detection of *Clostridium perfringens* in canned food products*

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Clostridium perfringens **(MTCC 1349) is a Gram-positive, anaerobic, endospore forming, and rod-shaped bacterium. This bacterium produces a variety of toxins under strict anaerobic environment. *C. perfringens* can grow at temperatures ranging between 20°C and 50°C. It is the major causetive agent for gas gangrene, cellulitis, septicemia, necrotic enteritis and food poisoning, which are common toxin induced conditions noted in human and animals. *C. perfringens* can produce produce four major types of toxins that are used for the classification of strains, classified under type A–E. Across the globe many countries, including the United States, are affected by *C. perfringens* food poisonings where it is ranked as one of the most common causes of food borne infections. To date, no direct one step assay for the detection of *C. perfringens* has been developed and only few methods are known for accurate detection of *C. perfringens*. Long detection and incubation time is the major consideration of these reporter assays. The prensent study proposes a rapid and reliable colorimetric assay for the detection of *C. perfringens*. In principale, this assay detects the para nitrophenyl (yellow colour end product) liberated due to the hydrolysis of paranitrophenyl phosphetidyl choline (PNPC) through phospholipase C (lecithinase). Constitutive secretion of phospholipase C is a charactristic feature of *C. perfringens*. This assay detects the presence of the extracellular lecithinse through the PNPC impragnated impregnated probe. The probe is impregnated with peranitrophenyl phosphotidyl choline ester, which is colourless substrate used by lecithinase. The designed assay is specific towards PNPC and detectes very small quantites of lecithinase under conditions used. The reaction is substrate specific, no cross reaction was observed upon incubation with other substrates. In addition, this assay gave negative results with other clostridium strains, no cross reactions were observed with other experimental strains like *C. tetani*, *C. botulinum*, *C. acetobutyricum*, *Bacillus subtilis*, and *Escherichia coli*. This assay is extramly rapid and provides reliable and reproducible results within one hour of incubation at 37°C.**

Key words: *Clostridium perfringens*; lecithinase; peranitrophenyl phosphotidyl choline ester

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Abbreviations: cm, centimetre; h, hour; RPM, revolutions per minute; CFU, colony forming unit; nm, nanometre

INTRODUCTION

Canning is generally regarded as a safe method for preserving food over prolonged periods of time, if practiced properly. In the canning process, foodstuff kept in jars or similar containers is heated above the boiling temperature of water. This process kills the microbes without compromising the quality of the foodstuff. During this heating process, the air is driven out of the jar and as it cools a vacuum seal is formed. This vacuum seal prevents the air from getting back into the product and bringing with it possible contaminating microorganisms. Canning efficiently removes microbes. Occasionally, few anaerobic microbes and spores of anaerobes that survive under this harsh killing procedure may contaminate the food products.

Clostridium perfringens is a Gram-positive anaerobic spore-forming bacterium that causes life-threatening gas gangrene and mild enterotoxaemia in humans, although it colonizes humans and animals as a normal intestinal flora. The organism is known to produce a variety of toxins and enzymes that are responsible for the severe myonecrotic lesions. Among five types (A to E), *C. perfringens* type A is known to cause two types of infectious diseases in humans. The first is gas gangrene (Clostridial myonecrosis), in which *C. perfringens* typically contaminates a skin wound as a spore from the soil and then rapidly grows and produces various histolytic toxins and enzymes that destroy the surrounding muscles and connective tissues. The second type of common disease is food poisoning caused through the few strains of Clostridia (approximately 5% of all *C. perfringens* type A isolates) of *C. perfringens* producing enterotoxin (CPE) (Ohtani *et al.*, 2013). The CPE-producing strains are responsible for nearly one million cases of *C. perfringens* food poisonings annually. It is also ranked as the second most commonly reported bacterial food-borne disease in the United States (Jihong Li *et al.*, 2013). When food products contaminated with vegetative CPE-producing *C. perfringens* cells are ingested, the microbes colonize the intestine and begin to sporulate within 24-h of incubation. During the sporulation process, a large amount of CPE is produced. CPE forms pores in the membranes of intestinal epithelial cells and causes watery diarrhoea.

Presently, the reported bioassays detect clostridia through culturing on specific microbiological media. This culturing method requires a long time for detection and it also requires an extra effort to create oxygen free environment for growth. Countries in the developing world, however, require a rapid, inexpensive and simple method to perform tests that do not require a highly sophisticated laboratory and equipment. To address

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Role of inter-particle force between micro and nano magnetic particles on the stability of magnetorheological fluid

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The concept of phase condensation of larger size particles in a poly-dispersed magnetic fluid (also known as ferrofluid) is employed as a tool to investigate the interaction of nanoparticles with micro particles in magnetorheological (MR) fluid. Two different shapes iron micron sized particles are used in MR fluid formulation: spherical and flake shaped. The magnetic fluid is used as a base carrier having three different magnetic nanoparticles volume fraction (0.2%, 0.6% and 0.8%). The study suggests that the interaction of magnetic nanoparticles with micron sized particle depends on the geometrical shape of the particle as well as surface roughness. The sedimentation ratio of flake shaped MR fluid increases with nanoparticles volume fractions while for spherical particles it remains virtually constant. The supernatant fluid analysis suggests that, larger sized particle fraction from magnetic fluid are attached to the surface of micron sized flake shape particles, which results in reduction of sliding friction between the particles and small sized fraction clouds around the flake. The atomic force microscopy results suggest that the surface roughness of flake shape particles are nearly 5 times higher than spherical shape particles. The role of these two different interactions is reflected in the sedimentation ratio of MR fluid. [http://dx.doi.org/10.1063/1.4975635]

I. INTRODUCTION

The onset of new repulsive force induced by a magnetic field is observed when Ni particles of 10 micrometer diameter are dispersed in magnetic fluid (also known as ferrofluid) containing 5% volume fraction of magnetic nanoparticles.[1] According to theoretical calculation, the origin of repulsive force is due to the field-induced condensation of largest magnetic nanoparticles in the zone situated around the poles of micro particles. The mechanism explain for this repulsive force is based on the influence of the demagnetizing field of the dense region, which pushes apart the two particles till it becomes equal to the osmotic force. The range of the repulsive force is of the order of micro particle diameter. This repulsive force becomes more substantial as the permeability of the fluid increases. Similar phase condensation of largest nanoparticle in a polydispersed magnetic fluid is theoretically predicted by Buyevich and Ivanov.[2] Bacri et al[3] have shown that, if nanoparticles in magnetic field are not well stabilized, i.e. the possibility of agglomeration due to van-der Waals and magnetic dipole-dipole interaction becomes dominant, one can even observe phase condensation of large sized nanoparticles in the absence of magnetic field. All these mechanisms depend on the inter-particle forces between particles.

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Performance of Mn-Zn ferrite magnetic fluid in a prototype distribution transformer under varying loading conditions

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ABSTRACT

The temperature distribution performance of prototype transformer has been evaluated for varying loads. A 3 KVA single phase transformer is prototyped for this purpose and thermocouples were inserted at various places for the study. A novel temperature sensitive magnetic fluid (TSMF - Mn-Zn ferrite magnetic fluid) is proposed to improve the cooling performance. Winding temperature reduces when prototype transformer is submerged in TSMF compared to the same experiment performed with transformer oil, for all loading (normal load, under load, overload). The reduction in temperature with TSMF attributes to the thermo-magnetic convection, and it is the maximum when the Curie temperature of the magnetic fluid is comparable to the hot spot temperature of the transformer. The experimental results match with numerical calculation and the existing simulation. The maximum cooling is observed with TSMF for overload condition and increases normal life expectancy nine times. In case of planned overload condition normal life expectancy doubles for all situations. Study leads to the conclusion that TSMF works as a better transformer coolant under all conditions, delivers more power than its nameplate rating without using any external accessories, and improves normal life of transformer. This will reduce the basic investment cost and maintenance of transformer.

1. Introduction

Oil immersed transformers are cooled due to the natural convection of the oil, which is relatively poor and less efficient, due to which the temperature gradient across the oil reservoir often observed to be quite large. This results into the elevated resistance within the windings, increases hysteresis losses within the core, degrades the transformer's insulation and transformer oil, evolution of gases from winding insulation and lead conductors, reduced mechanical strength, expellees the oil, development of the hot-spot, etc. The severity of these problems is minimized by increasing the flow rate of oil (this will dissipate the heat from the core to the surrounding efficiently). Additional auxiliary cooling mechanism such as fins, cooling ducts, radiators, pumping devices, fans, etc. may also solve the purpose. But they need more space and increases the overall weight of the transformer, additionally it is cumbersome, consume power and require maintenance. Hence their use is typically restricted. The alternate way to enhance the flow rate is to modify the transformer oil.

With the development of magnetic fluid technology, it is possible to enhance the flow rate of conventional oil by dispersing temperature sensitive magnetic nanoparticles in insulating oil [1–6]. Transformer's winding is a source of maximum magnetic field as well as of highest temperature; hence the magnetic fluid experiences a drag towards the winding. A typical value of maximum core saturation is of 2 T while the maximum temperature tolerance of 383 °K exhibited by a high voltage transformer. The surrounding of transformer is at ambient temperature with no magnetic field. Therefore, gradient in magnetic field ($\nabla \cdot \mathbf{H}$) is in the direction of the temperature gradient (∇T). The fluid from the surrounding feels attractive force at the core. As the fluid approaches the winding, its temperature rises due to heat generated by the device. The hot fluid losses its magnetic property along with the reduction in its density as compared to the surrounding fluid. This creates a gradient in fluid magnetization (∇M) and density gradient ($\nabla \rho$). The magnetic fluid rises as the gravitational effect of

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Temperature dependent acoustic properties of temperature sensitive magnetic fluid subjected to magnetic field

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ABSTRACT

The ultrasonic velocity of temperature sensitive magnetic fluid is investigated as a function of volume fraction, temperature and magnetic field. The ultrasonic velocity decreases with increasing volume fraction of magnetic nanoparticles. This is attributed to the particle-carrier interaction which leads to form shorter aggregates. The pre-aggregates in magnetic fluid break when temperature increases in the absence of a field. Magnetic field makes the system anisotropic to ultrasound wave propagation. The change in ultrasonic propagation velocity under the influence of magnetic field shows chain like alignment for low volume fraction of magnetic nanoparticles (1.6%) which changes to short dipolar chains at an intermediate volume fraction (6.8%). Above this volume fraction, short chains become thicker by aligning sidewise to the neighboring chains resulting in spherical drop like structures. The modified Tarapov's theory fit to change in ultrasonic propagation velocity confirms the transformation from chains to aggregates with increasing magnetic nanoparticles volume fraction. The optical microscopy study also confirms the results. Upon increasing the temperature the field dependent velocity variation shows breaking of thick chain like aggregates. The modified Tarapov's theory fit shows that this is attributed to decrease in magnetic moment with increasing temperature. The variation of magnetic moment with temperature obtained from the fitting gives the Curie temperature of fluid as 363 K. This value agrees with those obtained from other techniques.

1. Introduction

Magnetic fluid represents a technologically important material because of its wide scope of tuning the macroscopic behavior under different environment. Recent experiments and analysis show that magnetic dipole force and strong magnetic field expels nanoparticles to form chains and aggregates that can greatly affect the macroscopic properties of magnetic fluid even at low concentration [1–6]. In the absence of external magnetic field, magnetic fluid behaves like a normal suspension containing magnetic nanoparticles but the exposure of the magnetic field induces the dipole moment in particle as a result particles respond to the magnetic field either through Neel rotation or through Brownian rotation. In addition to the particle-field interaction, particles experience short-range van der Waals and magnetic dipolar attractive forces. The collective behavior of the same will produce different structures within the carrier matrix.

Ultrasonic propagation in magnetic fluid is a non-destructive method to investigate the structure formation without any prior modifications of the sample such as thin film preparation, drying or freezing of the sample, etc., and have maximum sample recovery. In addition, the study can be performed for a concentrated system too. It offers an added advantage to investigate the study under different magnetic field and temperature without changing the geometry of the experimental set-up. Moreover, it is possible to study the simultaneous effect of these parameters, i.e., particle concentration (φ), temperature (T), and magnetic field (H) using ultrasonic interferometer.

Several experimental and theoretical studies performed to investigate the properties of ultrasonic propagation in magnetic fluid prepared in polar and non-polar carrier [7–15]. The spatial ordering of magnetic nanoparticles influences the parameters of ultrasonic propagation and by analysing these; it is possible to understand the homogeneity of magnetic fluid. Experimental results of aggregation and structuring of dispersed ferromagnetic particles in magnetic fluid have been explained theoretically by Tarapov [15] using an ultrasound wavelength of the order of 10^{-4} m which is much greater than the dimension of the aggregates ($\sim 10^{-6}$ m). In such a high wavelength limit, the fluid behaves as if it is a homogeneous fluid, but the presence of aggregation can change the magnetic structure (due to dipole-dipole interactions) and the thermodynamic properties of fluid making the system anisotropic and inhomogeneous. This influences the collective behavior of magnetic particles under magnetic field.

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The effect of magnetic field induced aggregates on ultrasound propagation in aqueous magnetic fluid

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ABSTRACT

Ultrasonic wave propagation in the aqueous magnetic fluid is investigated for different particle concentrations. The sound velocity decreases while acoustic impedance increases with increasing concentrations. The velocity anisotropy is observed upon application of magnetic field. The velocity anisotropy fits with Tarapov's theory suggests the presence of aggregates in the system. We report that these aggregates are thermodynamically unstable and the length of aggregate changes continuously with increasing concentration and, or magnetic field and resulted in a decrease in effective magnetic moment. The Taketomi's theory fits well with the experimental data suggesting that the particle clusters are aligned in the direction of the magnetic field. The radius of cluster found to increase with increasing concentration, and then decreases whereas the elastic force constant increases and then becomes constant. The increase in cluster radius indicates elongation of aggregate length due to tip-to-tip interaction of aggregates whereas for higher concentration, the lateral alignment is more favorable than tip-to-tip alignment of aggregates which reduces the cluster radius making elastic force constant to raise. Optical images show that the chains are fluctuating and confirming the lateral alignment of chains at higher fields.

1. Introduction

A stable magnetic fluid is a colloidal suspension of single-domain magnetic nanoparticles in a carrier liquid medium. The properties of magnetic fluids are isotropic due to the Brownian rotation of colloidal particles and the balance between the van der Waals attractive force and a steric repulsive force due to the surfactant layer around particle surface [1]. The external magnetic field, concentration of magnetic particles, etc. gives rise to the anisotropy: the liquid undergoes restructuring by the formation of quasi-spherical and or chain-like clusters. Many applications of magnetic fluid require stability of the structure, i.e. no formation of relatively large aggregates, even in a strong magnetic field. This property is of particular importance in medical applications, micro channel flow, etc. in which a magnetic fluid is required, such that the particles do not aggregate and block their own spread.

Ultrasound propagation in magnetic fluid offers an advantage of investigating the structure formation as a function of magnetic field, particle concentration and temperature in a non-destructive way. Several reports exist mentioning the ultrasonic velocity anisotropy induced by ordering magnetic nanoparticles in a localized region due to dominating van der Waals interaction, magnetic dipolar interaction and or magnetic field induced orientational structures [2–16]. In the present paper we report the influence of an external magnetic field on the propagation of sound waves in aqueous magnetic fluid of various concentrations. The results are analyzed using the Tarapov's theory [4] and Taketomi's theory [5].

2. Experimental

A dilution stable water based magnetic fluid was prepared as per the method described by Khalafalla et al. [17] using dodecanoic acid ($CH_3(CH_2)_{10}COOH$) as a surfactant to stabilize the particles in aqueous medium. Four different volume concentrations were prepared from resultant fluid, respectively, as 5.87%, 5.23%, 3.64% and 1.72% labeled as MFW4, MFW3, MFW2 and MFW1. The crystal structure of the magnetic nanoparticles was identified using the powder X-ray diffractometer (XRD-Bruker D2 Phaser). Fig. 1a shows the XRD pattern of the particles. The well developed peaks are broad mentioning the nano size of the particles. All the peak positions indicate that particles possess single phase cubic spinel structure. The crystallite size of the particles was calculated using Scherrer formula and (311) plane which comes out as

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Nanolubricant: magnetic nanoparticle based

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Keywords: friction, lubrication, and wear, magnetic liquids, four-Ball tester, nanolubricant

Abstract

In the present study magnetic nanoparticles of Fe_3O_4 having average particle diameter, 11.7 nm were synthesized using chemical coprecipitation technique and dispersed in alpha olefin hydrocarbon synthetic lubricating oil. The solid weight fraction of magnetic nanoparticles in the lubricating oil was varied from 0 wt% to 10 wt%. The tribological properties were studied using four-ball tester. The results demonstrate that the coefficient of friction and wear scar diameter reduces by 45% and 30%, respectively at an optimal value, i.e. 4 wt% of magnetic nanoparticles concentration. The surface characterization of worn surface was carried out using a scanning electron microscope, and energy dispersive spectroscopy. These results implied that rolling mechanism is responsible to reduce coefficient of friction while magnetic nanoparticles act as the spacer between the asperities and reduces the wear scar diameter. The surface roughness of the worn surface studied using an atomic force microscope shows a reduction in surface roughness by a factor of four when magnetic nanoparticles are used as an additive. The positive response of magnetic nanoparticles in a lubricating oil, shows the potential replacement of conventional lubricating oil.

1. Introduction

Lubricating oil is widely utilized in automobile and industrial machines, as it prolongs the machine life as well as improve the efficiency. The lubricating oil available in the market is a mixture of additives, such as anti-friction (long chain fatty acid), anti-wear (zinc dialkyldithiophosphate (ZDDP), extreme pressure (sulphur and phosphate), anti- rust and anti- corrosive (Alkaline compounds, organic acids and esters) as well as a viscosity enhancer (Acrylatepolymers, olefin polymers and copolymers) to enhance the properties of base oil. These additives chemically react to the metal and form a film on the metal surface which protects the wear, friction and corrosion. On the other hand, owing to its toxicity, its uses are limited as it affects the environment [1–3].

The use of nanoparticles instead of these additives is an effective approach, as they have the positive influence on tribological properties [4] as well as eco-friendly [5]. Among various nanoparticles the magnetic nanoparticles dispersed in lubricating oil (magnetic fluid) have attracted the attention of most researchers due to several advantages over other nanoparticles [6–8]. The magnetic fluid has the wide range of applications from biology (hyperthermia, target drug delivery, etc) [8] to engineering (transformer refrigeration oil, lubricating oil, automobiles etc) [9–13]. Typical size of magnetic nanoparticle in magnetic fluid is approximately 10 nm. The stability of magnetic fluid depends on particle–particle and particle-carrier interaction. Therefore, functionalization of magnetic nanoparticles is essential. This is achieved either by steric stabilization or electrostatic stabilization [14].

Recently, Huang *et al* [13] have introduced an overview of recent developments in the area of magnetic fluid lubrication. In overall, very few experimental studies on the lubrication behavior of magnetic fluid have been reported showing that it does enhance anti-friction and anti-wear properties. Most of the base oils available in the market are having all anti-wear and anti-friction additives, therefore the compatibility of the nanoparticles with these additives remain a question. In summation, it is very difficult to understand the lubrication mechanism responsible for enhancing the performance, unless one formulates nanoparticle based lubricant in lubricating oil without holding any of this performance enhancing additives.

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Layer-engineered I-V characteristics of p-Si/WS_2 Van der Waals Heterostructure diode

Sanni Kapatel, C.K. Sumesh, Pratik Pataniya, G.K. Solanki and K.D. Patel

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Crystal growth, characterization and photo detection properties of 2H-$V_{0.75}W_{0.25}Se_2$ ternary alloy with 1T-VSe_2 secondary phase

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Salt assisted sonochemical exfoliation and synthesis of highly stable few-to-monolayer WS_2 quantum dots with tunable optical properties

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Abstract As a 2D material, few to monolayer WS_2 have seen much research interest due to its strong excitonic effects, which will affect the optical and optoelectronic properties. In this study, we report synthesis of highly stable few-to-monolayer quantum dots of tungsten disulfide (WS_2) and its analysis. A facile method in which salts such as sodium hydroxid, sodium chloride, ammonium hydroxide and lithium hydroxide assisted sonochemical exfoliation of bulk WS_2 powder has been employed in *N*-Methyl-2-pyrrolidone for 2 h. Resultant WS_2 quantum dot nanosheets were characterized by the XRD, DLS, TEM, HRTEM, Raman and UV–Visible Spectroscopy to amass structural, morphological and optical properties. Salts promoted the exfoliation processes and the prepared few-to-monolayer WS_2 quantum dot have a lateral size of 3 ± 0.5 nm and better yield in comparison to WS_2 quantum dots in *N*-Methyl-2-pyrrolidone. Further the Raman and UV–Vis. analysis reiterate the successful exfoliation mechanism which consumes less time and the WS_2 quantum dots show blue shift with an excitonic band gap of 2.7 eV.

1 Introduction

The study of two-dimensional (2D) materials in recent time has become one of the most trending research areas in nanoscience. The unprecedented material properties analogous to graphene has peaked up much interest vigorously in elementary research because of their potency in discrete fields such as electronic devices, catalysis, energy storage and conversion, sensing and biomedicine [1–7]. 2D structured materials possess ultrahigh specific surface area with confinement of electron in all three dimensions exhibits many variations in optical, chemical and electronic properties of it [8]. There has been a great momentum in the current research on transition metal dichalcogenides (TMDCs) of few-to-monolayer, nanocrystal (NCs) or quantum dots (QDs) of MoS_2, WS_2, $MoSe_2$, WSe_2, $NbSe_2$, VS_2, etc., which are conceived as best substitute of the graphene [9].

Transition metal dichalcogenides (TMDCs) are van der Waals layered materials with hexagonal lattice structure arranged in triple layer (X-M-X). The structure of layered TMDCs (i.e. chemical formula MX_2, where M is a transition element and X is a chalcogen) are similar to that of graphite and each layer has a thickness of 6–7 Å with strong in-plane covalent bonding and weak out-of-plane van der Waals interactions [8]. Investigations are in frontier with many top-down and bottom-up approaches to get high yield of monolayers and QDs of TMDCs. Micromechanical cleavage (Scotch tape method), ion intercalation, chemical vapour deposition (CVD), liquid phase exfoliation (LPE), solvothermal method are few of them [10–15]. These methods are not suitable for controlled synthesis of mono layered QDs because of the synthesis limitations [16–18].

Liquid exfoliation through cavitation to get high yield monolayers is already well studied for graphene [19]. However, this is an emerging area for TMDC where the

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Influence of particle shape on the magnetic and steady shear magnetorheological properties of nanoparticle based MR fluids

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Abstract

The effect of addition of nanoparticles in irregular flake and spherical shaped particles based MR fluids and its influence on physical, magnetic and steady shear magnetorheological properties is investigated. For this, ferrofluids constitute of different volume concentration of Fe_3O_4 nanoparticles are used as a dispersion medium and constant amount of flake shaped iron particles are added. In order to verify the particle shape influence results are compared to spherical particle based fluids. Nanoparticles smoothens the surface of the flake shaped particles by magnetically attaching to it, this results into the decrement in viscosity. The reduction in the particle–carrier friction is the proposed reason of this observed result. The saturation magnetization of the flake based MR fluid shows 15% increment in value for the highest volume concentration of nanoparticles. In the present work, we have systematically studied the interaction between the nanoparticles and flake shaped micro particles and its influence in magnetorheology.

Keywords: magnetorheological fluid, ferrofluid, flake-shaped particle, yield stress, friction

(Some figures may appear in colour only in the online journal)

1. Introduction

Magnetorheological fluids (MRFs) are the dispersed system of micrometre-range ferro- or ferrimagnetic particles in a non-magnetic liquid carrier. Under the application of external magnetic field, they experience the rapid and reversible magnetorheology by increasing viscosity and yield stress [1–7]. Depending on the volume fraction of solid constituents and the strength of the magnetic field, MRFs exhibit the yield stress up to the few hundred kilopascal. Due to these unique features they are the core components in many high-tech industrial applications like controlling vibrations of torque transfer. These distinctive properties have motivated the interest to enhance the performance of the MRFs. Similar to the other dispersed system stability and redispersibility of this fluid is the main concern due to the particle size and the higher solid concentration, a problem concern with many technologically important systems. The most common magnetic component of the MRFs is the iron microparticles acquired from the thermal decomposition of iron pentacarbonyl [5, 8, 9]. Considering the high density of the particles in correspondence with the carrier density, their stability and redispersibility are the main issues towards a generalized application of MRFs, as micron particles drag to the bottom due to gravity [10–12]. Therefore, there is a severe need of finding improved methods for facilitating their stabilization.

To find a new ways to enhance the performance and the stability of the dispersed system, the focus has been shifted on dispersion suspensions having varied shape particles rather than using conventional spherical shape particles for newer applications [13–16]. A very interesting example of improving both stability and magnetorheological properties using micron size wire shaped iron particles based fluid was reported by Bell *et al* [13]. For 6 vol% suspension having 7.6 μm wires, the increment in yield stress is more than double in comparison with MRFs employing spherical particles. Also, more sensitive control (higher yield stress) at low magnetic fields was determined for microwire based fluids.

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Immobilization on graphene oxide improves the thermal stability and bioconversion efficiency of D-psicose 3-epimerase for rare sugar production

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ABSTRACT

D-Psicose (D-ribo-2-hexulose or D-allulose), an epimer of D-fructose is considered as a rare low-calorie sugar displaying important physiological functions. Enzymatic production using ketose 3-epimerases is the feasible process for the production of D-Psicose. However, major drawbacks in application of ketose 3-epimerases are bioconversion efficiency and reusability of the enzyme. We have attempted immobilization of ketose 3-epimerases from *Agrobacterium tumefaciens (agtu)* D-psicose 3-epimerase (DPEase) on graphene oxide. Scanning electron microscopy (SEM), Fourier transform infrared spectroscopy (FTIR) and Thermo gravimetric analysis (TGA) showed that the enzyme was successfully immobilized on the graphene oxide. Graphene oxide immobilized *agtu*-DPEase (GO-*agtu*-DPEase) shows pH optima at 7.5 and 60 °C as higher working temperature. Significant improvement in thermal stability was observed which showed half-life of 720 min at 60 °C whereas *Agrobacterium tumefaciens (agtu)* DPEase displayed 3.99 min. At equilibrium, 40:60 (D-psicose: D-fructose) the bioconversion efficiency was accounted for Graphene oxide immobilized DPEase which is higher than the *agtu*-DPEase. Graphene oxide immobilized DPEase showed bioconversion efficiency up to 10 cycles of reusability.

1. Introduction

Sustainable processes have widely increased the usage of enzymes as a catalyst in the industrial process, biomedical applications and diagnosis of various diseases [1]. Enzymes increase the rate of reactions without alteration in the equilibrium [2]. However, the use of enzymes in the industrial process are associated with some limitations like long-term operational stability, sensitivity to the reaction conditions and practically, it is difficult to recover for reusability [2,3]. To overcome such problems, enzyme immobilization has been developed which improves the physical properties, recovery and reusability of enzymes [4,5]. Economically, it is the comparitavely better feasible process when enzymatic reactions are a possible route to produce the fine chemicals [6].

D-Psicose (D-ribo-2-hexulose or D-allulose) is a C3 epimer of D-fructose and considered as a rare sugar [7,8]. It is regarded as a low-calorie sweetener, an inhibitor of hepatic lipogenic enzymes, an activator of abdominal lipolysis and intestinal alpha-glycosidase enzymes [8,9] D-psicose reduces the hyperglycemia, obesity, and hyperlipidemia and decrease the blood glucose level in type-2 diabetes [10]. Considering the important physiological action without side effects, Food and Drug Administration has approved D-psicose as "generally regarded as safe" (GRAS) [11,12].

D-psicose is a rare sugar, found in small amount in nature and it is very difficult to synthesize chemically [11,13,14]. D-psicose exits in Itea plants and Wheat in very small quantity and can be produced in low amount from D-fructose during heat treatment of food products [13–15]. However, the chemical synthesis methods which are accompanied by various drawbacks, such as reaction conditions, chemical waste formation, time-consuming and formation of various byproducts [17]. Biological processes such as enzymatic reactions with various ketose epimerase, oxidoreductase and aldose isomerase as well as various microbial reactions are feasible process for the synthesis of D-psicose [14,18]. Bioproduction of D-psicose from D-fructose using D-tagatose 3-epimerase (DTEase) family enzymes have been studied in past years [8,19].

D-psicose can be produced from naturally available sugar D-fructose using 3-epimerase enzyme. D-tagatose 3-epimerase (DTEase) from *Pseudomonas cichorii* was evaluated and characterized for mass production of D-psicose from D-fructose [19]. Later, D-Psicose 3-Epimerase family has been identified based on substrate preference [18]. First, D-psicose 3-epimerase (DPEase) was identified and characterized from

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A single and two step isomerization process for D-Tagatose and L-Ribose bioproduction using L-arabinose isomerase and D-lyxose isomerase

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Highlights (For Review)

- Cloning and Expression of araA gene coding for L-arabinose Isomerase from soil isolates and identified as a *Shigella flexneri*
- Biochemical characterization of Sf-AI, its substrate specificity and kinetic efficiency
- Bioconversion of D-Galactose to D-Tagatose
- L-ribose synthesis by two step bioconversion using *Shigella flexneri* L-arabinose isomerase along with D-lyxose/ribose isomerase in sequential manner

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RESEARCH ARTICLE

Nano silver-embedded electrospun nanofiber of poly(4-chloro-3-methylphenyl methacrylate): use as water sanitizer

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Abstract Water contaminated with microorganisms causes numerous diseases and is a major concern for public health. In search of a simple material which can provide clean water free from pathogens, nanofibers of poly(4-chloro-3-methylphenyl methacrylate, abbreviated as CMPMA, and nano Ag-doped poly(CMPMA) composite nanofibers were used to decontaminate water from microorganisms such as *Escherichia coli* and *Bacillus subtilis*. Nanofibers were prepared by electrospinning. X-ray diffraction (XRD) and transmission electron microscopy (TEM) provide the diameters of the Ag nanoparticles which are in the range 18–21 and 13–18 nm. The diameter of the poly(CMPMA) and nano Ag-doped poly(CMPMA) composite nanofiber is seen to vary between 400 and 700 nm with the change of the processing parameters. Optimum parameters for uniform nanofibers have been obtained. The morphology of the fibers is derived from scanning electron microscopy (SEM). The superiority of the nano Ag-doped poly(CMPMA) composite nanofiber was established.

Keywords Nano silver · Electrospun nanofiber · Thermal analysis · Well diffusion method · Sanitizer

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Introduction

Nanofibers, because of their distinctive properties e.g. high surface area to weight ratio, low density, and pore size, have drawn much attention of researchers. The fabrication of nanofibers via different techniques (Ondarçuhu and Joachim 1998; Martin 1996; Ma and Zhang 1999; Liu et al. 1999; Deitzel et al. 2001) is well reported. Nanofibers or composite nanofibers are used as adsorbents (Ma et al. 2015; Wang et al. 2015a; Zhao et al. 2015), for water treatment (Shekh et al. 2016; Feng et al. 2013; Saud et al. 2015), in various medical applications (Unnithan et al. 2012; Xu et al. 2015; Wang et al. 2015b), and many more (Hussain and Ramkumar 2006; Zhu et al. 2011; Si et al. 2015). Electrospinning is the most compatible and cost-effective technique for fabrication of nanofiber.

Processing parameters (applied voltage, distance between needle tip and collector, and flow rate), solution parameters (concentration of solution, molecular weight of polymers, viscosity of solution, surface tension, and conductivity), and ambient parameters (temperature and humidity) determine the characteristics of nanofibers (Bhattarai et al. 2014; Shao et al. 2015; Pise et al. 2015; Chowdhury and Stylios 2010; Seok et al. 2005; Jiang et al. 2004; Lee et al. 2004; Wannatong et al. 2004; Yuan et al. 2004; Zhang et al. 2005; Zong et al. 2002; Zuo et al. 2005; Sarabi-maneji et al. 2014). The effects of processing parameters and solution parameters on the

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Enhancement in recovery of drugs with high protein binding efficiency from human plasma using magnetic nanoparticles

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ABSTRACT

In this paper, we propose an alternate method for bioanalytical extraction of drugs from human plasma samples using bare magnetic nanoparticles. The magnetic nanoparticles (MNPs) were used for deproteination of biological samples that further assist in extraction of plasma bound drugs for bioanalytical studies. The method uses basic solvents (ethanol, methanol, etc.) rather than the expensive and toxic solvents. The MNPs provide several advantages like avoiding the use of centrifuge machine, and making extraction time effective. The average time involved for the sample preparation is around 30–40 min. The developed method was examined for seven different drugs having moderate (40–70%) to high (>80%) plasma protein binding efficiency. The present study focuses on the principle of magnetic nanoparticle based extraction of drug that binds with the plasma protein. In calcitriol (protein binding efficiency >99%), it was observed that the drug extraction efficiency could be enhanced by 16% using the present method. However, we assume that still there is a scope for improving the extraction efficiency by optimizing proper solvent for the specific drug. The use of magnetic nanoparticles makes the extraction cost effective and quick with improved efficiency.

1. Introduction

Bioanalytical methods are used for the quantitative determination of small molecules like drugs and their metabolites from the biological matrix. Determination of the concentration of these drugs helps to ascertain several related parameters like bioavailability (BA), bioequivalence (BE) and its dosage requirement [1]. The process of bioanalysis comprises of (i) the sample preparation which involves extraction of drugs from the biological samples, followed by (ii) estimation of the extracted drug. Biological samples like blood are complex in nature comprising of various proteins, carbohydrates, lipids, metabolites and chemical compounds. Due to the interference of all these compounds the sample preparation becomes a critical step in bioanalysis [2,3]. Nevertheless, an efficient sample preparation method eliminates unwanted components (e.g. protein, DNA, RNA, etc.) from the sample and isolates and/or concentrates the analyte [4]. Sample preparation accounts for almost 80% of the total time required for bioanalysis [5]. The three main sample preparation techniques commonly used in bioanalysis are liquid-liquid extraction (LLE), solid phase extraction (SPE) and protein precipitation (PP) based extraction [6]. The concentration of the drug is estimated after extraction from the biological matrix. Due to their high sensitivity and accuracy (even up to picogram levels), nowadays, the drug estimation is done using liquid chromatography–mass spectrometry (LC–MS/MS) spectrometry [7].

Out of the extraction methods mentioned earlier (LLE, SPE and PP), the protein precipitation based techniques are widely used. A significant reason for such wide applicability is that most drugs reported in literature are moderate to high protein binders [8]. Precipitation eventually disrupts the protein-drug interaction and helps to release the plasma bound drug to the supernatant [9]. In general, the working of protein precipitation based methods involves addition of the precipitating agent to the plasma samples followed by vigorous vortexing for proper mixing. This step releases the drug which was earlier bound to plasma proteins in supernatant. High speed centrifugation of these samples yields a strong pellet of precipitated plasma proteins and supernatant which is separated for estimation of released drug [10].

Abbreviations: BA, bioanalytical; BE, bioequivalence; LC/MS, MS liquid chromatography–tandem mass spectrometry; SPE, solid phase extraction; LLE, liquid-liquid extraction; PP, protein precipitation; HPLC, high performance liquid chromatography; FDA, food and drug administration; SOP, standard operating procedure; AUC, area under curve; CPS, counts per second; EPA, eicosapentaenoic acid; DHA, docosahexaenoic acid; *m/z*, mass to charge ratio; MNPs, magnetic nanoparticles.

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Sonochemical synthesis of 2,3-dihydro-4(1*H*)-quinazolinones and 1-amidoalkyl-2-naphthols using magnetic nanoparticle-supported ionic liquid as a heterogeneous catalyst

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Abstract Ultrasound-promoted synthesis of 2,3-dihydro-4(1*H*)-quinazolinones and 1-amidoalkyl-2-naphthols were carried out using magnetic nanoparticle-immobilized ionic liquid (IL@MNP) as a magnetically separable catalyst. Ultrasound accelerates the reaction at ambient temperature making the protocol clean, simple and greener compared to conventional procedures. The catalyst showed high activity and stability during the reaction. The heterogeneous nature of the catalyst enabled easy recovery through an external magnet and it was reused up to six times without the loss of its activity. The synergistic effect of IL@MNP and ultrasound facilitate the reaction with excellent isolated yield in a shorter reaction time.

Keywords Ultrasound · Green chemistry · Heterogeneous catalyst · Magnetic nanoparticle

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ALCOHOLISM: CLINICAL AND EXPERIMENTAL RESEARCH

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Protective Effects of Diallyl Sulfide Against Ethanol-Induced Injury in Rat Adipose Tissue and Primary Human Adipocytes

Venkata Harini Kema, Imran Khan, Reshma Jamal, Sandeep Kumar Vishwakarma, Chandrakala Lakki Reddy, Kirti Parwani, Farhin Patel, Dhara Patel, Aleem A. Khan, and Palash Mandal

Background: Alcohol consumption is the fourth leading cause of death and disability worldwide. Several cellular pathways contribute to alcohol-mediated tissue injury. Adipose tissue apart from functioning as an endocrine organ secretes several hormones and cytokines known as adipokines that are known to play a significant role in alcohol-induced tissue damage. This study was designed to test the efficacy of diallyl sulfide (DAS) in regulating the alcohol-induced outcomes on adipose tissue.

Methods: Male Wistar rats were fed with 36% Lieber–DeCarli liquid diet containing ethanol (EtOH) for 4 weeks. Control rats were pair-fed with isocaloric diet containing maltodextrin instead of EtOH. During the last week of feeding protocol, the EtOH-fed rat group was given 200 mg/kg body weight of DAS through diet. We also studied DAS effect on isolated human primary adipocytes. Viability of human primary adipocytes on DAS treatment was assessed by MTT assay. Malondialdehyde (MDA), a marker of oxidative stress, was measured by HPLC and the thiobarbituric acid method. Expression of inflammatory genes and lipogenic genes was studied by qRT-PCR and Western blotting. Serum inflammatory gene expression was studied by ELISA.

Results: Our study results showed that DAS could alleviate EtOH-induced expression levels of proinflammatory and endoplasmic reticulum (ER) stress genes and improve adipose tissue mass and adipocyte morphology in male Wistar rats fed Lieber–DeCarli diet containing 6% EtOH. Further, we showed that DAS reduced the expression of lipogenic genes and improved lipid accumulation and adipocyte mass in human primary adipocytes treated with EtOH. Subsequently, we also showed that oxidative stress, as measured by the changes in MDA levels, was reduced in both male Wistar rats and human primary adipocytes treated with EtOH plus DAS.

Conclusions: Our study results prove that DAS is effective in ameliorating EtOH-induced damage to adipose tissue as evidenced by the reduction brought about by DAS in oxidative stress, ER stress, and proinflammatory gene expression levels. DAS treatment also regulated lipogenic gene expression levels, thereby reducing free fatty acid release. In conclusion, this study has clinical implications with respect to alcohol-induced adipose tissue injury among alcohol users.

Key Words: Adipose Tissue, Alcohol, Diallyl Sulfide, Inflammation, Lipogenic Genes, Human Primary Adipocytes.

ALCOHOL CONSUMPTION HAS multifactorial effects on tissue involving cross talk among various tissues and organs. Chronic consumption of alcohol results in oxidative stress and inflammation in a number of tissues including adipose tissue (Barnes et al., 2014; Kema et al., 2015; Lu and Cederbaum, 2008; Sebastian et al., 2011). Alcohol intake affects innate immunity and metabolic activities of adipose tissue resulting in tissue injury. Cytochrome P4502E1 (CYP2E1)-mediated metabolism of alcohol results in oxidative stress, endoplasmic reticulum (ER) stress, and subsequently adipokine dysregulation. Increased CYP2E1 expression in adipose tissue after chronic alcohol consumption is found to activate transcription factors that aggravate reactive oxygen species (ROS) production leading to inflammation. Also enhanced CYP2E1 levels trigger apoptosis in adipose tissue by activating C1q-dependent complement system thereby further enhancing inflammatory responses (Sebastian et al., 2011). Studies on the effects of alcohol consumption in both humans and

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p-DEFORMATION OF A GENERAL CLASS OF POLYNOMIALS AND ITS PROPERTIES

RAJESH V. SAVALIA AND B. I. DAVE

ABSTRACT. The work incorporates the extension of the Srivastava-Pathan's generalized polynomial by means of p-generalized gamma function: Γ_p and Pochhammer p-symbol $(x)_{n,p}$ due to Rafael Díaz and Eddy Pariguan [Divulgaciones Mathemáticas Vol.15, No. 2(2007), pp. 179-192]. We establish the inverse series relation of this extended polynomial with the aid of general inversion theorem. We also obtain the generating function relations and the differential equation. Certain p-deformed combinatorial identities are illustrated in the last section.

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1. INTRODUCTION

In this work, we consider the general polynomial:

$$S_n(l,m,\alpha,\beta:x) = \sum_{k=0}^{\lfloor n/m \rfloor} \frac{(-1)^{mk}\lambda_k}{\Gamma(1+\beta-n\alpha+lk)(n-mk)!}x^k \qquad (1.1)$$

due to Manisha Dalbhide [1] with an objective to provide extension in the light of recently proposed one parameter deformation $\Gamma_p(x)$ of the classical gamma function $\Gamma(x)$ such that $\Gamma_p(x)$ reduces to $\Gamma(x)$ when $p = 1$. This introduction is due to Rafael Díaz and Eddy Pariguan [3]. In fact, the occurrence of the product of the form $x(x+p)(x+2p)\cdots(x+(n-1)p)$ in combinatorics of creation and annihilation operators ([2], [4]) and the perturbative computation of Feynman integrals [5] led them to generalize the Gamma function in the form involving the above factors.

The p-Gamma function is given in Euler integral form as follows [3]. For

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1,2,4-Triazole and 1,3,4-oxadiazole analogues: Synthesis, MO studies, *in silico* molecular docking studies, antimalarial as DHFR inhibitor and antimicrobial activities

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ABSTRACT

1,2,4-Triazole and 1,3,4-oxadiazole analogues are of interest due to their potential activity against microbial and malarial infections. In search of suitable antimicrobial and antimalarial compounds, we report here the synthesis, characterization and biological activities of 1,2,4-triazole and 1,3,4-oxadiazole analogues (**SS 1-SS 10**). The molecules were characterized by IR, mass, ^{1}H NMR, ^{13}C NMR and elemental analysis. The *in vitro* antimicrobial activity was investigated against pathogenic strains, the results were explained with the help of DFT and PM6 molecular orbital calculations. *In vitro* cytotoxicity and genotoxicity of the molecules were studied against *S. pombe* cells. *In vitro* antimalarial activity was studied. The active compounds were further evaluated for enzyme inhibition efficacy against the receptor Pf-DHFR computationally as well as *in vitro* to prove their candidature as lead dihydrofolate reductase inhibitors.

1. Introduction

Heterocyclic chemistry has become one of the most important fields of research in pharmaceutical industry due to their many fold applications. Amongst all, heterocyclic molecules containing nitrogen and oxygen have shown most potent biological activities.[1] It follows from the literature that depending on the type of substituent, the analogues of 1,2,4-triazole have a high potential for a wide range of biological activities such as antimicrobial,[2–4] analgesic,[4] anti-tumor,[5] anti-inflammatory,[6] anti-hypertensive,[7] anti-cancer[8] and antiviral[9] activities. In a host of standard medicines 1,2,4-triazole moiety is present.[10] 1,3,4-Oxadiazole is an essential core in heterocyclic chemistry and represents a key motif in medicinal chemistry due to their potential to exhibit bioactivities such as anti-HIV,[11] analgesic,[12,13] anti-inflammatory,[12,13] anti-cancer,[14,15] antimalarial,[16] antimicrobial[16] and anti-tuberculosis.[16] Medicines having 1,3,4-oxadiazole ring are plenty.[10] Schiff bases also have gained importance in the field of medicine due to their wide spectrum of biological activities such as antimicrobial,[17–19] anti-tubercular,[20–22] anti-HIV,[22] anti-cancer,[22] anti-tumor,[23] anti-inflammatory,[24] analgesic[24] and anticonvulsant.[25,26]

Considering the significant biological and medicinal importance of Schiff bases, 1,2,4-triazole and 1,3,4-oxadiazole, Schiff bases derived from 1,2,4-triazole and 1,3,4-oxadiazole were synthesized and efficacy of these compounds as bioactive material was investigated. Different aldehydes having five members and six members (benzene) rings with various electron withdrawing and electron donating groups have been used to prepare the analogues. This was done to examine the effect of the ring size and substituent in the ring on the efficacy of the biological activities of these compounds.

Data from FTIR, NMR, mass and elemental analysis were used to characterize the compounds. The antibacterial and antifungal potency of these Schiff bases were investigated against certain standard strains. The activities of these compounds were compared with standard antibacterial and antifungal drugs. Molecular orbital calculations with DFT and PM6 have been done for the Schiff bases to correlate the antimicrobial activities with electronic parameters. The fission yeast *Schizosaccharomyces pombe* is an important model

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Benzothiazole analogues: Synthesis, characterization, MO calculations with PM6 and DFT, *in silico* studies and *in vitro* antimalarial as DHFR inhibitors and antimicrobial activities

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ABSTRACT

Benzothiazole analogues are of interest due to their potential activity against malarial and microbial infections. In search of suitable antimicrobial and antimalarial agents, we report here the synthesis, characterization and biological activities of benzothiazole analogues (**J 1-J 10**). The molecules were characterized by IR, Mass, ^{1}H NMR, ^{13}C NMR and elemental analysis. The *in vitro* antimicrobial activity was investigated against pathogenic strains; the results were explained with the help of DFT and PM6 molecular orbital calculations. *In vitro* cytotoxicity and genotoxicity of the molecules were studied against *S. pombe* cells. *In vitro* antimalarial activity was studied. The active compounds **J 1, J 2, J 3, J 5** and **J 6** were further evaluated for enzyme inhibition efficacy against the receptor Pf-DHFR, computational and *in vitro* studies were carried out to examine their candidatures as lead dihydrofolate reductase inhibitors.

1. Introduction

Malaria is one of the most disturbing infectious diseases in the world, due to their high mortality and morbidity. The protozoan parasite *Plasmodium falciparum* (*P. falciparum*) is responsible for their occurrence. It has been estimated that around 212 million people get infected in subtropical and tropical countries and 429,000 deaths occur annually by malarial infection.[1] To add to the problem, malaria parasites have acquired resistance against many drugs causing serious problem. We do observe today, a dramatic increase in serious infections due to microorganisms resistant to multiple antimicrobial agents and these have become a problem of great concern.[2,3] To overcome the threat of malarial infection, there is an imperative need for development of new drugs with divergent and unique structures and possibly with a different mechanism of action from that of the existing drugs. Also, recent studies have demonstrated that amino acid changes within *P. falciparum* dihydrofolate reductase (pf-DHFR) are associated with drug failures.[4] Hence DHFR enzyme has been shown to be reliable and the best target to design new antimalarial drugs. Thus, the need for the discovery of new lead structures and novel chemical entities which will act as antimalarial and antimicrobial agents becomes more relevant.

Heterocyclic compounds particularly those with oxygen, nitrogen and sulphur atoms have been identified to have the most comprehensive spectrum of biological activities.[5] Further, benzothiazole are highly important scaffolds in bioorganic and medicinal chemistry with application in drug discovery. This core has shown numerous biological activities such as anticancer,[6–9] antiHIV,[6] antioxidant,[10] anticonvulsant,[11] trypanocidal agent,[12] antitumor,[13–16] antimicrobial,[17] COX inhibitor,[18] hypoglycemic,[19] antidiabetic,[20] antituberculosis,[6,21] antiurease[22] and inhibitor of α-glucosidase.[23] There are also some well-known drugs such as ethoxzolamide (glaucoma, ulcers and as a diuretic), riluzole (anticonvulsant), pramipexole (Parkinson's disease), pharminox and phortress (antitumor) having benzothiazole moiety. Because of their various biological activities such as antimicrobial,[24–26] antitubercular,[27–29] antiHIV[29] anticancer,[29] antitumor,[30] antiinflammatory,[31] analgesic[31] and anticonvulsing,[32,33] compounds with Schiff base moiety are of great interest. Consequently, Schiff bases with benzothiazole moiety are expected to be good pharmaceutical agents.

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Synthesis, characterization, *in silico* molecular docking study and biological evaluation of a 5-(phenylthio) pyrazole based polyhydroquinoline core moiety†

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A multicomponent cyclocondensation reaction has been developed by incorporating 3-methyl-5-substituted phenylthio-1-phenyl-1*H*-pyrazole-4-carbaldehydes **3a–c**, various enaminones **6a–c** and different active methylene compounds **7a–c** (malononitrile 7a/ethylcaynoacetate 7b/caynoacetamide 7c) in the presence of piperidine as a basic catalyst, to afford a combinatorial library of polyhydroquinoline scaffolds, *i.e.* **8a–p**. The targeted compounds were synthesized in good to excellent yields (71–84%). All the synthesized compounds have been characterized by ^{1}H NMR, ^{13}C NMR, IR, mass spectrometric techniques and elemental analysis. All the synthesized compounds were evaluated *in vitro* for their antibacterial, antitubercular and antimalarial activities. An *in silico* molecular docking study as well as *in silico* pharmacokinetics evaluation have been carried out. Many candidates of this new class revealed noticeable activities against first line drugs.

1. Introduction

Malaria causes serious social and economic consequences. 300–500 million people are affected annually and about 3 million deaths occur due to this severe global health issue.[1,2] Amongst the four *Plasmodium* parasites, *Plasmodium falciparum* is considered responsible for ~95% of deaths.[3] Tuberculosis (TB) is caused by *Mycobacterium tuberculosis* (MTB) which is a human pathogen. Nearly one-third of the global population is infected by MTB. TB has been declared a global emergency by the World Health Organization as it is suspected that about 30 million people will suffer from TB in the next two decades.[4,5] The second most common reason for death is microbial infections after heart attack being the prime one. This is because of their resistance towards the existing antibiotic remedies.

Fluorine plays a crucial role[6–8] in improving the pharmacodynamic and pharmacokinetic properties[9,10] of drug molecules. Trifluoromethylation is the most significant strategy to modulate physical and biological properties. The high lipophilicity of the trifluoromethyl group enhances *in vitro* uptake and transport of the candidate.[11]

Fluoro-substituted pyrazole and its derivatives are a significant class of heterocycles enjoying a remarkable position in medicinal chemistry. Pyrazole derivatives exhibit a variety of pharmacological activities including antimicrobial,[12,13] anti-inflammatory,[14,15] cytotoxic,[16] antitumor,[17–19] antiviral,[20] anticancer,[21] analgesic[22–24] and anti-parkinson[25] activities.

A multicomponent condensation reaction, MCR,[26,27] is one of the leading methods to synthesize small molecules. Several condensation reagents react in a single step through simultaneous reactions to yield the desired products. Alteration in the reaction components of MCRs can easily lead to the molecular diversity in combinatorial libraries.

Since the discovery of drug molecules, their exposure to the various disease causative agents has resulted in drug-resistance. To overcome this problem, there is an immense need to design a fluoro-pyrazole combined polyhydroquinoline nucleus that combats such pathogens in an effective manner. In this perspective, the current communication describes the design and synthesis of polyhydroquinoline core molecules from the 5-substituted phenylthio-1-phenyl-1*H*-pyrazole-4-carbaldehydes, and various active methylenes and enaminones under conventional conditions. The synthesized compounds were also tested for their diversified

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Notes

Novel acrylate polymer nanocomposites with nano CdS

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Homopolymer of 4-chloro-3,5-dimethylphenylacrylate (CDMPA) and *p*-chlorophenylmethacrylate (PCPMA) and their copolymers with different compositions are synthesized by free radical polymerization technique using 2,2-azo-bis-isobutyronitrile as initiator in N,N-dimethylformamide as solvent at 70 °C. Their polymeric nanocomposites with nano CdS have then been synthesized by in-situ technique. Characterisation of the monomers, polymers and their polymeric nanocomposites with nano CdS have been done by spectroscopic methods. X-ray diffraction studies show cubic structured nanocrystalline CdS with 2.41-3.16 nm diameter. Compositions of the copolymers are determined by ^{1}H-NMR. Linear methods, namely, Finemann-Ross, inverted Finemann-Ross, Kelen-Tudos and extended Kelen-Tudos have been used for the determination of reactivity ratio of the monomers. Thermal analyses of the virgin polymers and their polymeric nanocomposites with nano CdS have been carried out by thermogravimetric studies. The kinetic parameters of virgin polymers and polymeric nanocomposites with nano CdS are determined by Broido method and Coats-Redfern method. Antimicrobial screening of homo and copolymers and one of the polymer nanocomposite with nano CdS has been studied against different microorganisms.

Keywords: Polymer nanocomposites, Acrylate polymer nanocomposites, Nanocomposites, Cadmium sulphide, Thermal analysis

Acrylate and methacrylate polymers are made from the acrylate monomers which are usually esters containing vinyl groups. Acrylates and methacrylates have been polymerized or copolymerized with an variety of different monomers[1-3]. Acrylate and methacrylate polymers have a wide range of applications such as biomedical, adhesive, coating, textile, paper industries and solar cells[4-10]. Nanocomposite is a multiphase compound in which at least one of the phases shows dimensions in the range below 100 nm. Polymers have lower mechanical, thermal and electrical properties than inorganic materials, hence, dispersion of nanoparticles in a polymer matrix would provide excellent possibilities of functional materials with exceptional properties for catalytic, electrical, photodetector, light emitting diodes, laser communication and sensing applications[11-17]. Nanocomposites have improved UV stability, and thermal, mechanical, and other physical properties and offer the combine advantages of organic polymers and inorganic nanomaterials[18, 19].

Presently much attention has been given to studying polymer nanocomposites with nano cadmium sulphide (CdS) due to their applications in areas such as photocatalysis, optoelectronics, photoluminescence, light emitting diodes, thin film transistors, solar cells etc.[20-26] Thermal stability of CdS polymer nanocomposite plays an important role from the application point of view. Thermal stability of polymers and polymer nanocomposites is investigated from thermogravimetric analysis and these data have been employed to investigate the kinetic parameters and thermodynamics of polymer degradation like enthalpy change, entropy change and free energy change. Kinetic study may successfully assist in probing degradation mechanisms as well as predicting the thermal stability of polymers. The effects of metal nanoparticle on polymer molecules at higher temperature has been studied in detail and it was concluded that the concentration of nanoparticles in polymer nanocomposite and its strong/ weak interactions affect the degradation of polymer molecule at higher temperatures[27, 28].

Herein we present the synthesis of monomers 4-chloro-3,5-dimethylphenylacrylate (CDMPA) and *p*-chlorophenylmethacrylate (PCPMA) and their homo and copolymers via free radical polymerization process. The preparation of polymeric composites with nano CdS by an in-situ technique is also discussed. The monomers, homopolymers, copolymers and polymeric nanocomposites with nano CdS are characterized with spectroscopic data. The main focus of this investigation is the thermal stability and kinetic and thermodynamic parameters of the synthesized homo and copolymers and their polymeric nanocomposite with nano CdS. The effect of CdS nanoparticles on polymer degradation at higher temperature has been discussed. The antimicrobial screening of these polymers and polymer nanocomposite containing nano CdS against different microorganism is also reported.

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Original article

Phytol induces ROS mediated apoptosis by induction of caspase 9 and 3 through activation of TRAIL, FAS and TNF receptors and inhibits tumor progression factor Glucose 6 phosphate dehydrogenase in lung carcinoma cell line (A549)

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ABSTRACT

A number of drugs as well as lead molecules are isolated from natural sources. Phytol is one of such lead molecule belongs to terpenes group distributed widely in medicinal plants. In the present work, we investigated the cytotoxic behavior of phytol on human lung carcinoma cells (A549). Phytol was found to cause characteristic apoptotic morphological changes and generation of ROS in A549 cells. The mechanism of phytol involved the activation of TRAIL, FAS and TNF-α receptors along with caspase 9 and 3. *In silico* molecular docking studies revealed that phytol has a good binding affinity with glucose-6-phosphate dehydrogenase (G6PD), which is known to promote tumor proliferation. The ability of phytol to become potential drug candidate has been revealed from the pharmacokinetic study performed in the present study.

1. Introduction

Apoptosis or programmed cell death (PCD) is an essential, integrative part of the normal physiological development, which maintains a homeostatic balance between cell proliferation and cell death. Apoptosis eliminates the damaged, aged cells through intrinsic and extrinsic pathways. Intrinsic pathway is usually mediated through mitochondria and extrinsic pathway is mediated through a receptor. Malfunction, imbalances or alterations in apoptosis can lead to various diseases like cancer, AIDS, Parkinson's and diabetes [1,2].

At onset, myriad of deaths worldwide have been caused by cancer. Various treatments like surgery, chemotherapy have been known to reduce cancer-related death by only 5%. Moreover, such treatments resulted in several side effects. In cancer, defective apoptosis plays a vital role in tumor mass expansion, cell proliferation, angiogenesis and tumor progression [3]. Thus, lots of researchers worldwide making their best effort in searching for better drug lead molecule from naturally occurring compounds.

A number of anticancer drugs in the market are derived from natural resources or synthesized by chemical means. Betulinic acid, Gambogic acid, Ursolic acid, Triciribine, Perillic acid, Camptothecin, Garcinol, Maslinic acid are the examples of such compounds [4–12]. Phytol is present as a constituent of the side chain of chlorophyll and widely distributed in nature [13]. Chlorophyll is abundantly found in leaves of the plant. Phytol was reported from various medicinal plants like *Abutilon indicum* (L.) Sweet, *Rumex hastatus* D. Don, *Isodon rugosus* Wall. ex Benth, *Hippuris vulgaris* L. and from seaweed [14–18].

Phytol is a precursor for the synthesis of vitamin K1 and E [19]. Phytol is an acyclic monounsaturated diterpene alcohol used as an aromatic ingredient in many fragrant compounds and also found in some cosmetic and non-cosmetic products [20]. Phytol is also known for its anti-inflammatory [21], antinociceptive and antioxidant [22], antitumor [23], immunostimulatory [24], antimicrobial [25] and cytotoxic effects [26]. The majority of the studies are limited to reporting of cytotoxicity. Although, phytol was reported for its anticancer and apoptosis inducing ability in

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RESEARCH ARTICLE

Evaluating the effect of diallyl sulfide on regulation of inflammatory mRNA expression in 3T3L1 adipocytes and RAW 264.7 macrophages during ethanol treatment

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ABSTRACT

Diallyl sulfide (DAS) has been studied extensively for its alleged role as an anticancer and protective agent. Alcohol influences and effects on human health have been extensively studied. However, investigations toward developing and testing therapeutic agents that can reduce the tissue injury caused by ethanol are scarce. In this backdrop, this study was designed to explore the potential effect of DAS in reducing alcohol induced damage of 3T3L1 adipocytes and RAW 264.7 macrophages. MTT [3-(4,5-dimethylthiazol-2-yl)-2,5-diphenyltetrazolium bromide] assay was performed to determine the DAS effect on cell viability. Reactive oxygen species (ROS) production was assessed by flow cytometer. Expression of inflammatory genes was studied by the qRT-PCR method. Our study results showed that DAS at concentrations less than 200 μM was not toxic to the cells and the viability of ethanol-exposed 3T3L1 adipocyte cells was found to be significantly increased when ethanol-exposed cells were treated with DAS. Further, treatment of ethanol-exposed 3T3L1 cells with 100 μM DAS for 24 h was found to reduce ethanol induced ROS production, expression of pro-inflammatory cytokines, and enhance anti-inflammatory cytokine production in the cells. Also, 100 μM DAS was found to increase the expression of M2 phenotype-specific genes in ethanol-exposed RAW 264.7 macrophage cells. Further, 100 μM DAS also improved the levels of lipid accumulation in 3T3L1 adipocytes that was down-regulated by ethanol exposure. Taken together, our study results imply that DAS may be effective in reducing ethanol induced injury of cells thereby suggesting its potential to be used in drug formulations.

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3T3L1 adipocytes; RAW 264.7 macrophages; alcohol; diallyl sulfide; inflammation; reactive oxygen species; macrophage polarization; lipid accumulation

Introduction

Use of garlic in folk medicine has been in existence since ancient times and it has been studied to have anticancer, anti-microbial, anti-diabetic, and several other beneficial effects (Block 1985, Thomson and Ali 2003, Rao *et al.* 2015). The chief constituent of garlic is the organosulfur compound besides it also has several minerals, enzymes, and amino acids (Amagase *et al.* 2001, Omar and Al-Wabel 2010). Metabolism of allicin present in garlic produces diallyl sulfide (DAS), the principle oil soluble organosulfur compound (Iciek *et al.* 2009). DAS is a selective inhibitor of cytochrome P450 2E1 (CYP2E1) enzyme that metabolizes alcohol and several analgesic drugs (Matsumoto *et al.* 1996, Morimoto *et al.* 1995a).

Alcohol, a principal etiological agent, causes most common health problems associated with disability adjusted life years (DALYs) and mortality (Room *et al.* 2005). Low doses of ethanol are metabolized by alcohol dehydrogenase, acetaldehyde dehydrogenase, CYP2E1, and catalase enzymes. When ethanol is consumed at higher doses or in chronic alcohol consumers, ethanol is primarily metabolized via the CYP2E1 pathway (Lieber 1997, Rao *et al.* 2015). Cellular toxicity is caused by ethanol induced oxidative stress, endoplasmic reticulum stress and inflammation that results in modifications at transcriptional, translational, and post-translational levels (Rao *et al.* 2015, Novak and Woodcroft 2000). Several investigations on the pathologies induced by alcohol metabolism have shown that CYP2E1 dependent ethanol breakdown results in oxidative stress that manipulates regulation of several genes at the transcriptional level leading to tissue injury (Rao *et al.* 2015).

Metabolism of alcohol via the CYP2E1 pathway generates excessive reactive oxygen species (ROS) production that results in oxidative stress and inflammation leading to alcohol induced cellular damage (Zima and Kalousova 2005). Recent studies have shown that adipose tissue function dysregulation has a role to play in the manifestation of alcoholic liver disease (ALD). Metabolism of alcohol via the CYP2E1 pathway in adipose tissue results in adipose tissue inflammation, hyper-lipolysis and apoptosis (Kang and Nagy 2006, Chen *et al.* 2007, Sebastian *et al.* 2011, Kema *et al.* 2015). Further, recent investigations have also suggested that macrophages play a central role in ALD progression (Karakucuk *et al.* 1989, Luna-Casado *et al.* 1997, Afford *et al.* 1998, Tapia-Abellan *et al.* 2012, Ju and Mandrekar 2015). Macrophages also

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Potential Molecular Mechanism of Probiotics in Alcoholic Liver Disease

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Abstract

Alcohol consumption and its abuse are significant prevalent cause for liver diseases and death worldwide. Increased bacterial endotoxin in the portal circulation, the plasma ratio of liver enzymes like alanine aminotransferase (ALT), aspartate aminotransferase (AST) and triglyceride implies the symbiotic relation between the gut and liver plays a key function in alcoholic liver disease (ALD). Consumption of alcohol leads to gut dysbiosis and informalities of the intestinal barrier, hyper gut permeability, oxidative stress, inflammation and adversely affect adipose tissue metabolism, and those are mainly recognized as major factors for progression of alcoholic liver disease. Alteration of gut microbiota is referred to as bacterial overgrowth which leads to the release of bacterial products to change in commercial/pathogenic microbiota equilibrium. Lipopolysaccharide (LPS) derived inflammatory signal renders inflammation in alcoholic liver disease. Increase in concentration of lipopolysaccharide leads to activation of toll-like receptor 4 (TLR4) and alteration in micro RNA (miRNA) expression at the transcription level. Activation of myeloid differentiation factor 88 (MyD88) pathways eventually produces pro inflammatory cytokine activation that is an important mediator of alcoholic liver disease. However, there is no effectual Food and Drug Administration (FDA) approved treatment for any stage of alcoholic liver disease. Thus, the potential therapeutic approach for alcoholic liver disease is restoration and alteration of gut microbiota. With the increasing importance of gut microbiota in the onset and occurrence of a variety of diseases, the potential use of probiotics in ALD is receiving more exploration and clinical attention. Probiotic administration is nontoxic, inexpensive and non-invasive strategy with minimal side effects compared to antibiotic therapy and surgery. Yet, there is no substantial evidence on the efficient molecular mechanism regarding mode of action of probiotics on ALD as therapeutics. This review summarizes the research done on gut liver-axis and potential mechanism of probiotic in alcoholic liver disease.

Keywords: Alcoholic liver disease; Gut liver axis; Toll like receptors; Probiotics

Abbreviations:

ALD: Alcohol Liver Disease; ALT: Alanine Aminotransferase; AP-1: Activating Protein-1; AST: Aspartate Aminotransferase; CD-14: Cluster of Differentiation 14; CFU: Colony Forming Unit; CYP2E1: Cytochrome P450 2E1; FoxO4: Forkhead Box O3; GGT: Gamma Glutamyl Transferase; HO-1: Heme Oxygenase-1; iNOS: Inducible Nitric Oxide Synthase; IL: Interleukin; IFN-β: Inducing Interferon-β; LBP: LPS-Binding Protein; LDH: Lactate Dehydrogenase; LGG: Lactobacillus Rhamnosusgorbach-Goldin; LPS: Lipopolysaccharide, MAPKs: Mitogen-Activated Protein Kinases; MCP-1: Monocyte Chemoattarctant Proetin 1; MDA: Malondialdehyde; MyD88: Myeloid Differentiation Factor 88; NF-κB: Nuclear Factor-Kb; PAMPs: Pathogen Associate Molecular Patterns; Reg3b: Regenerating Islet-Derived Protein 3-Beta; TLR: Toll Like Receptor; TNF-α: Tumor Necrosis Factor-α; s-TNF-R1/R2: Soluble Tumor Necrosis Factor Receptor ½; TG: Triglyceride; TGF-β: Tumor-Growth Factor-β; WAT: White Adipose Tissue; 4-HNE: 4-hydroxynonenal

Gut Liver Axis and Alcoholic Liver Disease

Alcoholic liver disease encompasses of fatty liver, hepatic steatosis, alcoholic steatohepatitis, alcoholic hepatitis, fibrosis, cirrhosis, and hepatocellular carcinoma. On the persistent use of alcohol, fatty liver can result into cirrhosis, which leads to the development into hypertension in portal vein or liver malfunction [1] (Figure 1). Gut microbiota should be accepted an "externalized" organ placed within the body, as it provides fundamental physiological functions [2].

Alcoholic Liver Disease and Enteric Dysbiosis

Presently recognized pathogenic factor connecting enteric dysbiosis and ALD appears to be pathological bacterial translocation [3]. The factors behind the pathogenesis of the increased intestinal permeability are shown in (Figure 2) [4]. The intestinal permeability of Caco2 cell monolayers seems to be increased due to exposure of ethanol and acetaldehyde, which causes tight junction disruption [5]. Intestinal CYP2E1 plays a key role in alcohol-induced intestinal permeability and oxidative stress [6].

Recent evidences provide information about the control of host inheritance and metabolism on the composition of the intestinal microbiota [7]. The correlation between alcoholic liver injury and imbalance of certain bacteria phylum are largely unidentified. Increased gut permeability along with consumption of alcohol also altered activity and composition of the gut microbiota such as Clostridiales Family XIV *Incertae Sedis*, *Ruminococcaceae* and *Bifidobacterium* spp.

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Review Article Open Access

Association of Advanced Glycation End Products (AGEs) with Diabetic Nephropathy and Alcohol Consumption

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Abstract

The occurrence of diabetes is accelerating worldwide, with consequent increase in the secondary complication like diabetic nephropathy (DN). Diabetic nephropathy refers to a set of structural and functional abnormalities of kidney in patients with diabetes. Detrimental changes like glomerular hypertrophy, glomerulosclerosis, hyperfiltration, proteinuria, etc. occur in DN. One of the major pathways suggested for the pathogenesis is formation of Advanced Glycation End Products (AGEs) via non enzymatic glycation (NEG). NEG is the process in which reducing sugars irreversibly modify free amino groups of proteins, by various events leading to the formation of a Schiff base resulting in Amadori products, culminating into AGEs. AGEs activate several cascades of intracellular signaling via interaction with Receptor for AGEs (RAGE) that results in responses like release of pro-inflammatory cytokines resulting in inflammation, autophagy and programmed cell death. AGEs can also come into circulation from baked food and processed food items. AGEs can also be formed through various oxidative reactions, including the chronic use of alcohol. Alcohol in excess could result in accumulation of acetaldehyde that would lead to insulin resistance. Many risk factors like race, genetic susceptibility, hypertension, hyperglycemia, hyper filtration, smoking, advanced age, male sex, and high-protein diet account for development of DN. Therapeutic interventions include glycemic control, control of blood pressure. This review focuses on the formation of AGEs via non enzymatic glycation, its implications in pathogenesis of DN and therapies designed to break AGEs so as to prevent the development of DN.

Keywords: Non-enzymatic glycation; Alcohol; Insulin resistance; AGEs; AA-AGEs; RAGE; Diabetic nephropathy

Introduction

Diabetes Mellitus is a metabolic disorder characterized by hyperglycemia owing to either lack of insulin release, lack of insulin action termed as insulin resistance or a in few instances, both. Non-Insulin Dependent Diabetes Mellitus (NIDDM) also called as Type 2 Diabetes Mellitus (T2DM) results due to acquisition of insulin resistance by the endothelial cells, resulting in failure to respond to insulin being produced by beta cells of the pancreas.

Secondary complications in diabetes

Insulin resistance and impaired beta cell mass and function are the hallmarks of T2DM, resulting in a compromised glucose regulation. The persistent hyperglycemia is one of the major factors leading to the development of secondary complications in diabetes; macrovascular and microvascular. Oxidative stress resulted due to hyperglycemia is incriminated as a factor for diabetes associated tissue complications. Macrovascular complications include atherosclerosis that affects arteries supplying blood to the heart, brain and lower extremities imparting a higher risk of developing myocardial infarction, stroke and limb amputation in diabetic patients. Microvascular complications damage the blood capillaries leading to complications like neuropathy, retinopathy and nephropathy associated with peripheral nerves, retina and renal glomerulus respectively. Many researchers have shown positive correlation between glycaemia and microvascular complications in both type 1 and type 2 diabetes [1,2].

There are four major hypotheses about hyperglycemia induced diabetes complications which are (i) accelerated glucose flux through polyol pathway [3]; (ii) activation of protein kinase C (PKC) isoforms through *de novo* synthesis of the lipid second messenger diacylglycerol induced by hyperglycemia [4]; (iii) formation of Advanced Glycation End Products (AGEs) [5] and (iv) increased oxidative stress [6].

Diabetes Nephropathy

Diabetes nephropathy (DN) broadly can be termed as a disease caused due to damage in the capillaries that supply blood to the kidneys. It is also a leading cause of End Stage Renal Disease (ESRD) in the world. It can be characterized by glomerular hypertrophy, thickening of basement membrane, mesangial expansion, tubular atrophy, interstitial fibrosis and arteriolar thickening [7,8]. Also, there occurs the accumulation of extracellular matrix (ECM) protein in the glomeruli, which results in an imbalance in the synthesis and degradation of the ECM components. Studies done over the last few years to facilitate differentiation of stages of renal modification (Figure 1).

Advanced glycation end products

Non-enzymatic glycation (NEG) is the process in which amino groups in the protein are irreversibly modified by reducing sugars by various events like Schiff's base formation resulting into formation of Amadori products, which yields AGEs. This process of reaction between free amino acids and reducing sugar is called as Maillard reaction. AGEs are yellowish brown, mostly fluorescent and insoluble adducts that modify a protein to lose its physiological functions [9]. AGEs and Advanced lipoxidation end products (ALEs) are complex,

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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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Influence of multi-components in a magnetic fluid on tribological properties

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Abstract
A tribological property of magnetic nanoparticles as an additive in gear oil has been reported in the present paper. Moreover, an influence of secondary surfactant and anti-friction additive (AFA) on tribological properties of magnetic fluid has been studied. These properties were measured using TE – 800 FBT four ball tester using ASTM D4172. The worn surfaces were observed using scanning electron microscope (SEM) and atomic force microscopy (AFM). MF-3 (Magnetic nanoparticle dispersed in gear oil having additive) exhibit reduction in coefficient of friction and wear scar diameter by almost 50 % and ≥ 20 %, respectively. The results were explained on the basis of the interaction between various components viz., magnetic nanoparticles, oleic acid, secondary surfactant, AFA and gear oil. The synergetic effect of coating on magnetic nanoparticles and anti-friction additive resulted into improved anti-friction and anti-wear properties of a magnetic fluid.

Introduction

Lubricating oils are widely used to reduce friction and wear between moving parts in mechanical components. These oils show improved tribological properties upon formulation with several additives such as anti-friction, anti-wear, anti-corrosion, anti-oxidant, etc, under boundary lubrication condition. However, it is reported that combination of one or more additives shows enhanced performance over that of individual additive [1-3]. Guanqiu at al [2] studied the synergistic effect of borate ester with heterocyclic compound evaluated using four ball tester, implies the positive influence of synergism on tribological properties. The combined effects of anti-oxidants and an anti-wear additive were examined in rape seed oil, shows improved tribological performance by combinations of compound [3]. With the soaring for better lubrication, the researcher has developed solid lubricants, nanoparticles, showed improved anti-wear and anti-friction properties compared to oil soluble additives [4, 5].

Among various nanoparticles, magnetic nanoparticles have attracted the interest of researchers due to its fascinating properties like fluid flow under a magnetic field, which can be held at the desired site, do not allow spitting of oil, etc [5]. The magnetic fluid consists of a stable colloidal suspension of magnetic nanoparticles having the size ~10 nm. The stable colloidal suspension created by coating magnetic nanoparticles with a surfactant. The secondary surfactant is used to increase the stability of magnetic fluid. The literature showed DDP coated ZnS improved the tribological performance [6]. Hence, it will be interesting to study the influence of an oil-soluble additive in magnetic fluid prepared in lubricating oil.

Till today, there is a scare of literature on the synergetic effect of magnetic nanoparticles with oil additives in the lubricating oil. In the present paper, oleic acid coated Fe_3O_4 magnetic nanoparticles (12 nm) are dispersed in gear oil and a secondary surfactant (PIBSA) is added to increase its stability. A synergetic influence of multi-component magnetic fluid and anti-friction additive: complex ester has been evaluated using Fourball tester. A synergistic effect shows positive results.

Experimental

Gear oil (Alpha olefin-based synthetic oil) and an oil-soluble anti-friction additive (AFA) a complex ester (procured from Lubgraf Syn oil Pvt. Ltd, Ahmedabad, India). A magnetic fluid (Fe_3O_4 nanoparticles, 10 wt %) was synthesized by using chemical co-precipitation technique in a gear oil as a base carrier. The stability of the magnetic fluid was obtained by adding 10 wt % of secondary surfactant (PIBSA) with respect to particle weight fraction. A magnetic fluid was also prepared in gear oil having anti-friction additive. The synthesized fluid, with its composition and physical properties, are mentioned in Table 1. A crystallite size of magnetic nanoparticles calculated using Scherrer's formula from a most intense peak of (311) plane of X-ray diffraction pattern (X-ray diffractometer, D2 Phaser) is found to be 12 nm. Transmission electron microscopy (JEOL 2100) analysis shows that magnetic nanoparticles are spherical in shape. The rheological properties of all fluids were evaluated utilizing a controlled-rate magneto-rheometer (MCR 301, Anton-Paar, Austria). Tribological properties, a namely coefficient of friction and wear of nano-lubricants were evaluated with four ball test machine (TE-800-FBT, MAGNUM engineering, Bangalore, India) according to ASTM D4172 (1200 ± 20 rpm, 392 N, 348K). The test balls used are made up of chrome alloy steel, according to AISI E- 52100, with a diameter of 12.7 mm (EP 25 and 60-65 HRC). Each measurement was carried out thrice for all samples. The wear scar

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RESEARCH ARTICLE

Column Chromatography Free Purification of Recombinant α-Amylase from *Bacillus licheniformis* by Tagging with Hydrophobic Elastin Like Polypeptide

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Abstract Thermal sensitive and highly hydrophobic elastin like polypeptide (ELP) tends to undergo inverse transition cycling (ITC) which can be used for non chromatographic purification. The present study reports non-chromatographic purification of industrially important α-amylase tagged with ELP and compared with IMAC (Immobilized metal affinity chromatography) purified α-amylase. *amyL*-Gene encoding α-amylase from *Bacillus licheniformis* was cloned and expressed in *E. coli* BL21. The expressed protein with His-tag was purified through IMAC using Ni–NTA matrix. Three ELP genes encoding repeats of pentapeptide $(Val\text{-}Pro\text{-}Gly\text{-}Val\text{-}Gly)_n$ with variable length (V = 20, 21, 22) were synthesized through PCR using overlapping primers. To generate ELP tagged α-amylase, *amyL* was placed at N-terminal of ELPs and transformed to *E. coli* BL21 for expression. After ITC, ELP_{22} at 30 °C showed maximum yield. α-Amylase purification through ITC and IMAC showed 2.9 and 1.72-fold purification, respectively. Furthermore, physical parameters of ELP tagged α-amylase have shown improvement with working temperature and thermal stability in comparison to His-tag α-amylase. The k_{cat}/K_m for ELP tag and His-tag α-amylase was found to be 61.4 and 23.7 mg^{-1} min^{-1}, respectively, which shows that ELP-tag increased the enzyme efficiency. In conclusion, the ELP-tag purification strategy can be applied to industrially relevant enzyme for purification by the non-chromatography method.

Keywords α-Amylase · Elastin like polypeptide · Inverse transition cycling · Transition temperature · Hydrophobic peptide

Introduction

Catalytic efficiency of enzymes has already been promoted for its use in industries and α-amylase is effectively applied in the starch, textile, food, brewing and paper industries [1, 2]. Microbial sources for α-amylase production are very economical as it is easy to cultivate for bulk production. Properties such as being active and stable in harsh conditions, like solubility at high temperature and extreme pH are necessary for industrial applications. α-Amylase produced by the *Bacillus licheniformis* is thermophilic and stable in nature due to lowering the rate constant of monomolecular conformational scrambling by the deamination of Asn/Gln residues [3]. Multiple techniques like affinity, ammonium sulphate fractionation, and size exclusion chromatography have been developed, however they are time consuming and economically not feasible [2]. To meet the bulk volume demand crude extract being supplied to make the process economical and viable. Such process requires high volume of water and subsequently it requires extensive effluent treatment.

Purification from bulk volume of the media containing α-amylase through conventional chromatography is adding up to the end product cost which directly affects the cost of essential commodities such as glucose from starch. To produce the purified proteins, a trend should be followed towards a decrease in the protein purification steps and an increase in purification yield. Recombinant enzymes with

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Thickness and biopolymer coat standardization for culture of MCF7 cells on polydimethylsiloxane (PDMS) surface and off-chip retrieval of methacrylated gelatin gel from PDMS

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Poly(dimethylsiloxane) (PDMS) platforms can be molded into desirable shapes and patterns, thereby increasing their usefulness in developing architecturally well-defined tissue constructs. PDMS surface, being hydrophobic, needs a further coating of a biocompatible polymer to facilitate cell culture. In this study, we have reported a novel approach for coating capillary walls with PDMS. Further, we have compared the growth of cells on collagen and gelatin coated PDMS surfaces of varying thicknesses and PDMS coated capillaries. Therapeutic relevance of the cells cultured in defined patterns on PDMS platforms can be increased if they could be detached from the PDMS surface keeping the patterns intact. We tested the ability of a biocompatible methacrylated gelatin gel (GelMA) to be detached from PDMS surface. We have also demonstrated that GelMA can be pushed out of a PDMS coated glass capillary as intact cylindrical threads. This study is a breakthrough in extending the usability of PDMS platforms by exploiting the architectural flexibility of PDMS and the property of GelMA to get detached from PDMS.

Keywords: GelMA, Detachment, Collagen coat, Gelatin coat

Poly(dimethylsiloxane) (PDMS) has gained popularity in the microfluidics sector and on-chip cell culture. Henares *et al.*[1] demonstrated a comparison of silicon, glass and various polymers for fabrication of microfluidic devices on the parameters of cost, time, labour and optical transparency. PDMS ranked first among all these polymers on account of its low cost, ease of fabrication into desired shapes and patterns up to dimensions as low as microns, oxygen permeability for devices intended to be used for cell culture and optical transparency to facilitate visualization of cells in culture[2].

The procedure followed for fabrication of PDMS channel involves forming three sides of a channel on a silicon mold, detaching the open channels from the mold and adhering the open channel to a flat PDMS surface spin coated on a glass slide using oxygen plasma treatment[3]. Hence, spin coated PDMS forms the base of the channel on which the cells are cultured. Therefore, it is necessary to standardize the thickness of the base PDMS coat for optimum cell culture. The thickness of PDMS is inversely proportional to the spin coater speed[4], and this thickness further determines the physical properties of PDMS[5]. This study was undertaken to assess the effect of different thicknesses of PDMS on the culture of MCF7 cells.

Major limitation in using PDMS surface for adherent cell culture is its high hydrophobicity[5]. In order to overcome this limitation, it is necessary to modify the surface of PDMS. This can be achieved by coating PDMS surface with biocompatible polymers such as collagen, gelatin, tropoelastin, fibronectin, polydopamine, etc.[6-12]. For comparison of the MCF7 cell culture on collagen and gelatin coats, PDMS surfaces were coated with collagen and gelatin. In the present study, we determined the best combination of PDMS base thickness and biopolymer coat for the culture of MCF7 cells.

Glass capillary, a simplest microfluidic channel was also used in this study. Glass capillary is cheapest, easily available pre-formed channel with well-defined dimensions. Applications of capillaries have been extended for cell culture[13-16]. In order to make capillary more comparable to PDMS microfluidic channel, the inner lining of capillary was coated with thin layer of PDMS. Few approaches have been proposed to coat inner walls of capillaries with different substrates for various applications[17-21].

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Quick Response Code:

Impact of embryo co-culture with cumulus cells on pregnancy & implantation rate in patients undergoing *in vitro* fertilization using donor oocyte

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***Background & objectives*: Cumulus cell co-culture of embryo had been found to be beneficial for achieving better pregnancy and implantation rate (IR). The present study was aimed to evaluate efficiency of cumulus co-culture technique over simple culture of embryo in terms of pregnancy rate (PR) and IR in patients undergoing treatment for infertility using donor oocytes fertilized by intracytoplasmic sperm injection.**

***Methods*: This was a quasi-experimental study between control and study groups. The primary endpoint was achievement of pregnancy. Control group included 508 women who underwent embryo development without cumulus cell co-culture and study group included 394 women who underwent embryo development with cumulus cell co-culture using donor's cumulus cells.**

***Results*: The present study demonstrated a significant increase in the IR (37.2 vs 24.2%, $P<0.001$) and in PR (45.7 vs 37.8%, $P<0.05$) in study group than in control group. The PR and IR were found to be higher in study group, among all groups of women, grouped on the basis of different indications for use of donor oocytes.**

***Interpretation & conclusions*: Cumulus cell co-culture technique was found to be more effective than simple culture technique for embryo development in women undergoing treatment for infertility using donor oocytes fertilized by intracytoplasmic sperm injection.**

Key words Cumulus cell co-culture - donor oocytes - intracytoplasmic sperm injection - *in vitro* fertilization - premature ovarian failure

After successful live birth using donor oocyte in 1984[1], demand for donated oocytes has increased across the globe, as many infertile couples willing to use this as common treatment option to overcome their infertility[2]. Women facing any of problems such as gonadal dysgenesis, premature ovarian failure, iatrogenic ovarian failure due to ovarian surgery or radiation or chemical castration, who have resistant

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Prevalence of Specific *Helicobacter Pylori cagA, vacA, iceA, ureC* Genotypes and its Clinical Relevance in the Patients with Acid-Peptic Diseases

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ABSTRACT

Introduction: Virulent markers of *H. pylori*, the vacuolating cytotoxin (*vacA*), cytotoxin-associated gene A (*cagA*), induced by contact with epithelium factor antigen (*iceA* gene) and the urease C gene (*ureC*) may plays a major role in determining the clinical outcome of *Helicobacter* infections.

Aim: To detect the prevalence of the *cagA, vacA, ureC* and *iceA* genotypes of *H. pylori* from antral biopsy specimens of patients and to associate its role in specific disease.

Materials and Methods: The study was conducted at Department of Microbiology of Shree P.M. Patel College of Paramedical Sciences, Anand, Gujarat, India. Seventy one antral biopsies of symptomatic patients referred for endoscopy from October 2012 to September 2013 were subjected to Multiplex PCR. DNA isolation from 71 biopsy samples was done by using "QIAamp DNA mini kit" from QIAGEN (GmbH, Hilden, Germany). Data was analysed using Chi square (χ^2) test and p-value<0.05 was considered significant.

Results: Out of the 71 biopsies screened, 22(31%) samples were positive for *H. pylori* by PCR, with high proportion of *cagA* positive (17/22 specimen; 77.27%), followed by *ureC* positive (4/22 specimen; 18.18%) and *vacA* positive (1/22 specimen; 4.54%) strains. Significant association was found between *cagA* and female gender (p-value=0.042). Out of 17 *cagA* positive strains, 9(52.94%) were found in patients with gastritis, 5(29.41%) in reflux oesophagitis and 3(17.64%) in patients with diodenal ulcer. We found 0% prevalence of *iceA* gene; conversely we had three peptic ulcer patients with only *cagA* positivity.

Conclusion: The *cagA* positive strain mainly affects the patients with gastritis specifically of female gender and *iceA* genotype is not a useful marker associated with peptic ulcer disease. Patients should be screened for *cagA* genotype when reported to be a case of gastritis for early treatment to prevent further complications such as cancer.

Keywords: Cytotoxin associated gene A, Gastritis, Genotyping, *Helicobacter pylori*

INTRODUCTION

Ever since its discovery in 1982 by Warren JR and Marshall B [1], the organism has generated tremendous interest among the medical fraternity. *H. pylori* are major etiological agent for the development of chronic gastritis, gastroduodenal ulcers and gastric adenocarcinoma [2]. Genotyping is very useful in molecular epidemiological studies and identification of predominant strains as *H. pylori* isolates tend to be diverse genetically with heterogeneous distribution [3]. The *cag* and *vac* markers tend to play a major role in determining clinical outcome [4]. The above virulence factors are found in a subset of clinical isolates such as *cagA, vacA*, *iceA*, *ureC* [4]. The *cagA* is frequently associated with cytotoxin production and the induction of cytokines like Interleukin 8 (IL8) by gastric epithelial cells [5]. Studies have suggested that *cagA* is a useful marker for the most virulent strains that are associated with peptic ulcer, atrophic gastritis and adenocarcinoma and presenting about 60% to 70% of *H. pylori* strains [5,6]. The *vacA* is also one of the major virulence factors, which is encoded by the *vacA* gene and this 87 kDa protein induces both vacuole formation and apoptosis in gastric epithelium [7,8]. The heterogenecity exist at the middle (m) and the signal (s) region of *vacA*, due to which there is a considerable variation in the vacuolating activity in strains [8]. The *iceA* gene (a gene induced by contact with gastric epithelium) produces high levels of cytokine IL-8 in gastric mucosa and hold higher rates of peptic ulcer disease [9]. Molecular methods like polymerase chain reaction have the potential to accurately determine both the presence of infection and the genotype of bacteria; and looks very permissive as well as sensitive and specific test for the detection of *H. pylori* genotypes [9].

To predict the clinical outcomes of the infection and also for better understanding the distribution of microorganism and its evolutionary origins, it is very important to study the diversities of *H. pylori* genes. In the present study, we tried to explore the distribution of various genotypes of *H. pylori* isolates from biopsy specimens and also to establish the potential association with the clinical outcome.

MATERIALS AND METHODS

This prospective cross-sectional study was conducted at the Department of Microbiology, Shree P.M. Patel college of Paramedical Science and Technology, Anand, Gujarat, for a period of one year from October 2012 to September 2013.

Design of the Study

Seventy one consecutive (46 males and 25 females, age; 10-90 years), symptomatic patients attending the endoscopic unit of "deep surgical hospital" were included in this study. Based on endoscopic findings, out of 71 patients, 34 patients were suffering from gastritis, 26 with reflux oesophagitis, nine with duodenal ulcer and two with duodenitis. Patients taking aspirin or Non-Steroidal Anti-Inflammatory Drugs (NSAIDS) in the past four week or those on Proton Pump Inhibitors (PPI) or patients with previous therapy to eradicate *H. pylori*, or if the inform consent was not obtained were excluded from the study.

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ARTICLE

Edifying the strategy for the finest extraction of succinoglycan from *Rhizobium radiobacter* strain CAS

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Abstract Succinoglycan is an industrially important exopolysaccharide (EPS) that is produced by certain bacteria. There are several procedures to extract this EPS, though the efficiency of all the available procedures is questionable and any improvement in the extraction efficient can greatly benefit the industry. Here we emphasize on optimization and development of new modus operandi to efficiently extract succinoglycan from liquid bacterial culture. Also, we studied the effect of different extraction methods on production, rheological and structural properties of succinoglycan. Eighteen different chemical and physical methods were tested for succinoglycan extraction from *Rhizobium radiobacter* CAS isolates with the principle of extracting EPS by precipitating it, where only eleven methods could precipitate the succinoglycan. Comparing the extraction yield of all methods, biopolymer extracted by acetone (3014 mg/L) was maximum followed by cetyl-trimethyl-ammonium-bromide (CTAB 2939 mg/L) and vacuum evaporation (2804 mg/L) methods. Upon comparison of rheological property of recovered succinoglycan, it was found that at shear rate 50 s^{-1} EPS recovered using acetone and CTAB methods tends to make the solution highly viscous with a viscosity of 150 and 146 mPa s, respectively. In agreement with these results, power law equation showed that EPS extracted by acetone and CTAB had high consistency index (k) and low flow behavior index (η). The current results showed that the physicochemical methods for EPS extraction significantly affect the structural composition of, though succinoglycan extracted using acetone and CTAB showed minimum structural abrasion.

Keywords Exopolysaccharide · Extraction · Power law · *Rhizobium* · Succinoglycan

Introduction

Exopolysaccharide (EPS) is high molecular weight compounds formed by polymerization of homo- and heteromonomeric sugar residues with diverse commercial applications in industries owing to their virtues and physical properties such as pseudoplasticity, thixotropy, viscosity, gelling and emulsifying activity [1, 2]. EPS is referred source of "green" chemistry and synthesis for its valuable properties in view of potential applications in food, cosmetics and pharmaceutical industries [3, 4]. To list few, alginate, chitosan, curdlan, dextran, levan, pullulan, succinoglycan xanthan, etc. are some commercially important microbially derived EPSs.

Succinoglycan is an economically important high molecular weight EPS produced extracellularly by *Sinorhizobium*, *Rhizobium*, *Agrobacterium*, *Alcaligenes* and *Pseudomonas* [5–13]. It is commercially used in cosmetics and home care products, fertilizer formulations, pharmaceuticals, food industries, for enhanced oil recovery as an emulsifying agent, gelling agent, stabilizing agent,

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Bioproduction of L-Aspartic Acid and Cinnamic Acid by L-Aspartate Ammonia Lyase from *Pseudomonas aeruginosa* PAO1

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Abstract Aspartase (L-aspartate ammonia lyase, EC 4.3.1.1) catalyses the reversible amination and deamination of L-aspartic acid to fumaric acid which can be used to produce important biochemical. In this study, we have explored the characteristics of aspartase from *Pseudomonas aeruginosa* PAO1 (PA-AspA). To overproduce PA-AspA, the 1425-bp gene was introduced in *Escherichia coli* BL21 and purified. A 51.0-kDa protein was observed as a homogenous purified protein on SDS-PAGE. The enzyme was optimally active at pH 8.0 and 35 °C. PA-AspA has retained 56% activity after 7 days of incubation at 35 °C, which displays the hyperthermostablility characteristics of the enzyme. PA-AspA is activated in the presence of metal ions and Mg2+ is found to be most effective. Among the substrates tested for specificity of PA-AspA, L-phenylalanine (38.35 ± 2.68) showed the highest specific activity followed by L-aspartic acid (31.21 ± 3.31) and fumarate (5.42 ± 2.94). K_m values for L-phenylalanine, L-aspartic acid and fumarate were 1.71 mM, 0.346 μM and 2 M, respectively. The catalytic efficiency (k_{cat}/K_m) for L-aspartic acid (14.18 s^{-1} mM^{-1}) was higher than that for L-phenylalanine (4.65 s^{-1} mM^{-1}). For bioconversion, from an initial concentration of 1000 mM of fumarate and 30 mM of L-phenylalanine, PA-AspA was found to convert 395.31 μM L-aspartic acid and 3.47 mM cinnamic acid, respectively.

Keywords L-Aspartate ammonia lyase · L-Aspartic acid · Cinnamic acid · *Pseudomonas aeruginosa*

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Size Dependent Mechanical and Magnetic Properties of Zn Substituted Cobalt Ferrite Below A-Site Percolation Threshold

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Abstract. Nanomagnetic particles of $Co_{0.3}Zn_{0.7}Fe_2O_4$ were synthesized using chemicalcoprecipitation technique followed by hydrothermal treatment and by controlling the preparative parameters pH and digestion time (t_d). Polydispersed nature and clear grain boundaries of the particles have been observed from the typical SEM image. EDX results confirmed the stoichiometric composition of the samples. XRD analysis shows the formation of a single phase spinel structure.Particle size ranging 5.5nm-9.0nm, calculated using Scherrer's formula, observed to be a function of pH and t_d. Cation distribution $(Zn_{0.7}Fe_{0.3})^A[Co_{0.3}Fe_{1.7}]^B$ is obtained from Rietveld analysis of XRD patterns. Lattice parameters and oxygen parameters are observed almost same showing the present synthesis technique is found to be effective to prepare particles of different size without changing the cation distribution and structural parameters. FTIR analysis and magnetic measurements reveals size dependent mechanical and magnetic properties of Zn substituted cobalt ferrite below A-site percolation threshold..

INTRODUCTION

The study of physics of magnetic nanometer sized particles is of great interest for research [1-4]. If disorder is introduced in the spinel oxide structure through dilution by nonmagnetic ions; such type of the mixed ferrite with a precisely controlled composition are expected to be very promising [5]. In the present work, size dependent mechanical and magnetic properties of the Zn substituted cobalt ferrite below A-site percolation threshold, $Co_{0.3}Zn_{0.7}Fe_2O_4$, is studied for the synthesis of magnetic nanoparticles with tailored properties.

EXPERIMENTAL

Nanomagneticferrite particles of $Co_{0.3}Zn_{0.7}Fe_2O_4$ were synthesized using chemical coprecipitation technique followed by hydrothermal treatment and controlling preparative parameters pH (10.5 and 11.6) and digestion time (t_d=30min., 60min. and 120 min.) (see Table1). In this study such six different size of the particle powder samples (code PA10 to PA12 and PA13 to PA15) were prepared. The morphology and chemical compositions of the particles were analyzed using Hitachi S-3000N Scanning Electron Microscopy (SEM) and OXFORD D7021 Energy Dispersive X-ray (EDX) spectrometer at Tmfy-MSE, Sweden. The XRD patterns, at room temperature, were obtained by BrukerD8 Advanced Model Powder X-Ray Diffractometer. Perkin-Elmer Thermonicolete IR 200 spectrometer used to receive the spectra recorded at room temperature in the range of $1x10^5$ m^{-1} – $4x10^4$ m^{-1} in KBr matrix. Room temperature magnetic hysteresis measurements of the powder samples were carried out over the field range -0.5T to +0.5T using EG & G Model 155 Vibrating Sample Magnetometer (VSM). Zero Field Cooled (ZFC) and Field Cooled (FC) magnetic measurements carried out using Quantum Design $MPMS_2$ SQUID magnetometerat Tmfy-MSE, Sweden.

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Characterization of Exopolysaccharide Produced by *Ganoderma* sp TV1 and Its Potential as Antioxidant and Anticancer Agent

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Abstract: Medicinal mushrooms are known for their bioactive molecules that have potential to fight cancer cell and have an immune-modulatory effect. Mainly these are either polysaccharide or terpenoidal molecules. In present study mushroom samples were explored for their exopolysaccharide (EPS) production as bioactive molecules. The potential EPS producer was identified as *Ganoderma* sp TV1 (GenBank accession no. KC590320). Conditions optimized for pH and temperature for higher EPS production suggest that 6.5 pH and 23°C were optimum. Antioxidant activity examined in the temporal sequence of event revealed that it shows higher on 7th day of incubation. Antioxidant activity from fruiting body and mycellial growth was examined and showed higher activity in fruiting body. Chemical characterization of EPS was done by TLC, FTIR, HPLC and XRD revealed glucose and galactose as monomer. EPS showed 50 % inhibition of ABTS in antioxidant assay and 61.8 % inhibition of A549 lung cancer cell line in MTT assay for anticancer assay. Thus, EPS by *Ganoderma* sp. TV1 can be effectively used as antioxidant and anticancer agent.

Key words: Antioxidant, Anticancer, Exopolysaccharide, *Ganoderma*, Mushroom.

Introduction

Today our society is combating with many diseases that are not curable and cancer is one of such a disease. According to WHO cancer figures among the leading causes of death worldwide, accounting for 8.2 million deaths in 2012 [5]. However, there are certain natural resources which have promising value to battle with cancer. Mushrooms are such natural resources which produce bioactive compounds such as polysaccharides and triterpenoids having nutritional and medicinal values. Fungal-derived polysaccharides especially from edible and medicinal species belonging to *Basidiomycetes*, possesses potential immuno-modulatory, antitumor, hypoglycemic, antibacterial, antiviral, antiparastic effects, and can also be used as insecticidal and nematocidal agents. *Ganoderma* spp. belongs to *Basidiomycota*, commonly known as *Ling-Zhi* in Chinese and *Reishi* in Japanese has been widely used in East Asia as a remedy for minor health disorders and to promote vitality and longevity [9].

Polysaccharides are the main immunomodulatory and anticancer components in *Ganoderma* [15]. Polysaccharides extracted from *G. lucidum* have been reported to have several physiological and health effects, such as anti-tumor [12,27], immunomodulatory [20, 32], antioxidant [28,30], and hypoglycaemic [26, 31] activities. *In vitro* and *in vivo* anticancer activity of many *Ganoderma* species,

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Characterization and rheological behaviour analysis of the succinoglycan produced by *Rhizobium radiobacter* strain CAS from curd sample

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Breast milk cell components and its beneficial effects on neonates: need for breast milk cell banking

P. Kaingade, I. Somasundaram, +3 authors J. Patel • Published 2017 • Medicine •
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Universal breastfeeding has been a stated policy of the American Academy of Pediatrics, the World Health Organization as well as UNICEF. Human milk is considered as the gold standard for infants owing to its colossal nutritional values. However, the presence of various cellular components of breast milk have been gaining more attention in recent years since the first discovery of mammary stem cells in 2007, thereby providing a ray of hope not only for growth and immunity of the neonate but also an insight into its regenerative applicability. In this relation, this article summarizes the cell components of breast milk that have been identified to date. It highlights the beneficial effects of these cells for term and preterm delivered infants along with the need for breast milk and its cell banking. Collapse

Figures, Tables, and Topics from this paper

- Milk, Human
- Cellular Structures
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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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ORIGINAL PAPER

Utilization of Corn Cob Waste for Cellulase-Free Xylanase Production by *Aspergillus niger* DX-23: Medium Optimization and Strain Improvement

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Abstract *Aspergillus niger* DX-23 produces a cellulase-free xylanase which showed efficient deinking of old newspaper pulp for recycled paper production. Towards economical production of the above xylanase when various agro-waste biomass were evaluated as substrates, under shake flask conditions, *A. niger* DX-23 produced highest amount of xylanase (59.5 ± 5.0 U/mL) using corn cob powder as substrate. A central composite design was used to optimize concentration of corn cob powder, $NaNO_3$ and KH_2PO_4 in the medium for maximum xylanase production. The optimum concentration of the above nutrients were determined to be 37.0 g/L corn cob powder, 2.5 g/L of $NaNO_3$ and 1.0 g/L of KH_2PO_4 at which level xylanase yield of 110.4 U/mL was obtained, which was 82.9 % more than the yield obtained in unoptimized medium. Moreover, under shake flask conditions, 5.0 % (v/v) of inoculum, pH of 5.0 and incubation time of 84 h was found to be suitable for maximum xylanase production. At laboratory fermentor level, *A. niger* DX-23 produced 79.4 U/mL (after 96 h) and 117.9 U/mL (after 72 h) xylanase using untreated corncob powder and alkali treated corn cob powder, respectively. In order to obtain higher xylanase procuring strains, *A. niger* DX-23 was mutagenized using UV rays. In optimized medium mutant strain of *A. niger* produced 150.9 ± 3.4 U/mL of xylanase which was 118.0 % higher than the xylanase yield obtained for parent type in unoptimized medium (60.2 ± 2.6 U/mL). The above results suggested effectiveness of the combined strategy of medium optimization and mutation towards enhanced production of xylanase by *A. niger*.

Keywords Xylanase · *Aspergillus niger* DX-23 · Corn cob waste · Optimization · Strain improvement · Response surface methodology

Introduction

Xylanases (E.C.2.8.1.8) produced by bacteria, fungi and yeasts hydrolyse β-1,4 xylans present in lignocellulosic materials [1]. Xylanases have wider industrial application such as hydrolysis of agro-industrial wastes, nutritional improvement of lignocellulosic feed stuff, clarification of juices and wines, deinking of pulps for recycling and biobleaching of kraft pulp in paper industry [2]. Compared to bacteria and yeast, filamentous fungi produce xylanases in high concentrations and also extracellularly [2, 3]. Species of *Aspergillus*, *Penicillium*, and *Trichoderma* are well-known xylanase producers [4–7]. In our previous study, we reported efficient deinking of old newspaper pulp by a cellulase-free xylanase preparation of *Aspergillus niger* DX-23 for recycled paper production [8]. To be used at industrial scale, the above xylanase should be produced economically and in large quantities. Growth medium contributes up to 40 % of the production cost of industrial enzymes [9]. Xylan-rich agrowastes offer promise as cheaper substrates for xylanase production. India being an agricultural country generates large quantities of hemicellulose-rich (30–40 % dry weight basis) agrowastes such as wheat bran, sugar cane bagasse, corn cobs, rice bran etc. which can be explored as inexpensive substrates for production of xylanases [10]. In past, the use of lignocellulosic wastes for production of cellulase has been intensely

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Feasibility study for the measurement of πN transition distribution amplitudes at $\bar{\mathrm{P}}$ANDA in $\bar{p}p \to J/\psi\pi^0$

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The exclusive charmonium production process in $\bar{p}p$ annihilation with an associated π^0 meson $\bar{p}p \to J/\psi\pi^0$ is studied in the framework of QCD collinear factorization. The feasibility of measuring this reaction through the $J/\psi \to e^+e^-$ decay channel with the AntiProton ANnihilation at DArmstadt ($\bar{\mathrm{P}}$ANDA) experiment is investigated. Simulations on signal reconstruction efficiency as well as the background rejection from various sources including the $\bar{p}p \to \pi^+\pi^-\pi^0$ and $\bar{p}p \to J/\psi\pi^0\pi^0$ reactions are performed with PandaRoot, the simulation and analysis software framework of the $\bar{\mathrm{P}}$ANDA experiment. It is shown that the measurement can be done at $\bar{\mathrm{P}}$ANDA with significant constraining power under the assumption of an integrated luminosity attainable in four to five months of data taking at the maximum design luminosity.

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I. INTRODUCTION

Understanding the hadronic structure in terms of the fundamental degrees of freedom of QCD is one of the fascinating questions of present day physics. Lepton beam initiated reactions, allowing one to resolve individual quarks and gluons inside hadrons, proved to be a handy tool for this issue. The factorization property established for several classes of hard (semi-)inclusive and exclusive processes allows one to separate the short distance dominated stage of interaction and the universal nonperturbative hadronic matrix elements. Some of the matrix elements which have been the subject of significant interest include the parton distribution functions (PDFs) [1], generalized parton distributions (GPDs) [2,3], transverse momentum dependent parton distribution functions (TMD PDFs) [4], (generalized) distribution amplitudes [(G)DAs] [5], and transition distribution amplitudes (TDAs) [6,7] encoding valuable information on the hadron constituents.

Alongside the study of lepton beam induced reactions, one can get access to the same nonperturbative functions in a complementary way by considering the cross conjugated channels of the corresponding reactions. For example, proton-antiproton annihilation into a lepton pair and a photon (or a meson) can be seen as the cross conjugated counterpart of the leptoproduction of photons (or mesons) off protons, and provides access to nucleon GPDs and/or nucleon-to-photon (nucleon-to-meson) TDAs.

Such investigations have been hindered up to now by the limitations of antiproton beam luminosities. However, very significant results on the electromagnetic form factors in the timelike region using the $p\bar{p} \to e^+e^-$ reaction were obtained by the E835 experiment at Fermilab National Accelerator Laboratory (FNAL) [8]. But inclusive lepton pair production and hard exclusive channels still remain unexplored.

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Polyethyleneimine-Polyoxometalate-Based Supramolecular Self-assembled pH-Responsive Hydrogels: Formulation and in vitro Evaluation

Azizullah,[a] Ali Haider,[b, c] Ulrich Kortz,[b] Sachin A. Joshi,[d] and Jamshed Iqbal*[a]

In the present study electrostatically-driven pH responsive supramolecular, self-assembled hydrogels of the trilacunary Wells-Dawson-type 15-tungsto-2-phosphate polyanion $[P_2W_{15}O_{56}]^{12-}$ ($\mathbf{P_2W_{15}}$) and polyethyleneimine were prepared. Cross-linking was achieved through electrostatic interactions between cationic polyethyleneimine and $\mathbf{P_2W_{15}}$. The pH responsiveness was induced by acrylic acid. Benzoyl peroxide was used as an initiator, for initiating the polymerization reaction, anchoring polyacrylic acid on the polyethyleneimine skeleton. The prepared sea-green color hydrogels were characterized by FT-IR, SEM, XRD and thermal analysis (TGA-DSC). The swelling index, $\mathbf{P_2W_{15}}$ release studies and pH responsive properties of the developed supramolecular hydrogels were evaluated at pH 1.2 and 7.4, showing maximum swellability and release characteristics at pH 7.4. For determining the $\mathbf{P_2W_{15}}$ release mechanism different mathematical models such as zero order, first order, Higuchi model and Krosmeyer-Peppas models were applied and the results showed that embedded $\mathbf{P_2W_{15}}$ release follows zero-order kinetics. The cytotoxicity results showed that naked and embedded $\mathbf{P_2W_{15}}$ exhibited dose-dependent cytotoxicity against cancer cell lines (MCF-7; Hela) with minimal effects on normal cells (Vero). The hydrogels developed through electrostatic interactions exhibited desirable qualities of a drug delivery system that can be used for the delivery of the embedded polyanion.

Introduction

Hydrogels are three dimensional, polymeric, hydrophilic networks having the ability to absorb large amounts of biological fluids or water.[1] Hydrogels are in more close resemblance to the living tissues than any other synthetic biomaterials class because of their exceptional soft consistency, porosity, high water affinity, mechanical and thermal stability,[2] therefore they are used as well-matched materials for numerous applications like tissue engineering scaffolds, contact lenses, artificial heart linings, artificial skin materials, biosensors and controlling the drug release patterns inside body.[2b,3] Hydrogels preserve their three dimensional structure and do not dissolve because of chemical or physical linkages formed between polymer chains.[4] Hydrogels are made of various polymers which could be either cationic or anionic. Polyethyleneimine is one of the most widely used cationic polymer bearing primary, secondary and tertiary amino groups, existing in both linear and branched forms having different molecular weights.[5] Branched polyethyleneimine is viscous liquid while linear polyethyleneimine is solid at room temperature. Linear polyethyleneimine is obtained as a result of 2-ethyl-2-oxazoline ring opening polymerization followed by hydrolysis while branched polyethyleneimine is obtained through aziridine acid catalyzed polymerization.[6] In the polyethyleneimine skeleton chemically reactive cationic amino groups are present, forming polyelectrolyte complexes (PECs) by reaction with negatively charged molecules such as anionic drugs or nucleic acid molecules.[7] Poly(acrylic acid) (PAA) is well recognized for its polyanionic nature and has been extensively used in designing pH-responsive macromolecular architectures for targeted drug delivery.[8] The pKa value of poly(acrylic acid) is between 4.5 and 5.0, and PAA hydrogels swell significantly at the physiological pH 7.4 due to ionization of the carboxylic acid groups.[9]

Three dimensional network structures in hydrogels are not only formed as a result of covalent bonding but also by non-covalent interactions including electrostatic interactions and hydrogen bonding resulting in the assembling of smaller building blocks into rigid supramolecular networks. These so-called supramolecular gels have recently received intense attention, mainly because of the tunability of building blocks,

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Novel pH responsive supramolecular hydrogels of chitosan hydrochloride and polyoxometalate: *In-vitro*, *in-vivo* and preliminary safety evaluation

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ABSTRACT

In the current study, electrostatically-driven pH responsive, supramolecular hydrogels of the trilacunary Wells-Dawson-type 15-tungsto-2-phosphate polyanion (P_2W_{15}) and chitosan hydrochloride (ChCl) were prepared, using methacrylic acid as pH responsive agent using benzoyl peroxide (BPO) as initiator. The prepared hydrogels were characterized by FT-IR, SEM, XRD and thermal analyses (TGA-DSC). The swelling and pH based P_2W_{15} release profile of the hydrogels showed maximum swellability and release at pH 7.4. Different mathematical models were applied, showing that P_2W_{15} release followed supercase transport-II mechanism and zero-order kinetics. The cytotoxicity results showed that free and embedded P_2W_{15} exhibited dose-dependent cytotoxicity against cancer cell lines (MCF-7; HeLa) with minimal effects on normal cells (Vero). The developed hydrogels were administered to the rabbits for determining the pharmacokinetic behavior of the polyanion. Moreover, the developed hydrogel system as well as polyanion concentration used were also checked for its oral tolerability and safety evaluation in rabbits. The histopathological studies, serum chemistry (except blood glucose level) and hematological investigations exhibited that administered hydrogel suspension at maximal tolerable dose (4000 mg/kg body weight) and polyanion concentration used (20 mg) were safe from *in-vivo* point of view. The developed hydrogels exhibited desirable qualities of a drug delivery system that can be used for the delivery of the embedded polyanion.

1. Introduction

Polyoxometalates (POMs) represents class of inorganic molecules having well-defined shape, size, configurable charge, and ability to interact with organic moieties. In the past two decades it has been proved that physico-chemical properties of POMs are suitable enough for various biological applications and are found to exhibit strong antiviral (Rhule et al., 1998), antibacterial (Daima et al., 2014; Yamase, 2005),anticancer (Menon et al., 2011) and anti-Alzheimer (Müller et al., 2006) potential. As a potential inorganic drug prototypes (Arefian et al., 2017), POMs have the capability to be tuned with respect to the biological target, such as their shape, size, composition, charge, solubility, and redox properties (Fu et al., 2015). To the best of our knowledge, no POM has reached any clinical trial after the initial development phase, probably due to their less selectivity in target cells. The full potential of POMs can be optimized either by enhancing the cell's specificity to increase cellular uptake or targeted delivery, *i.e.*, through organic functionalization in biocompatible polymeric networks such as nanoparticles and hydrogels (Geisberger et al., 2011a; Kortz et al., 2002; Pandya et al., 2015).

Hydrogels are three dimensional, polymeric, hydrophilic networks having the ability to absorb large amounts of biological fluids or water (Caló and Khutoryanskiy, 2015). Hydrogels are in more close resemblance to the living tissues than any other synthetic biomaterials class because of their exceptional soft consistency, porosity, high water affinity, mechanical and thermal stability (Peppas et al., 2000). Network structures in hydrogels are not only formed as a result of covalent bonding but also by non-covalent interactions including electrostatic interactions and hydrogen bonding resulting in the assembling of smaller building blocks into rigid supramolecular networks. These so-called supramolecular gels have recently received immense attention, mainly because of the tunability of molecular structures of building blocks, making possible the adoptability of gels for high-tech applications (Hirst et al., 2008) like nanoscale electronics (Puigmartí-Luis

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Cellular Components, Including Stem-Like Cells, of Preterm Mother's Mature Milk as Compared with Those in Her Colostrum: A Pilot Study

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Abstract

Purpose and Study Objective: Whether the preterm mothers' mature milk retains the same cellular components as those in colostrum including stem-like cell, cell adhesion molecules, and immune cells.
Participants: A total of five preterm mothers were recruited for the study having an average age of 30.2 years and gestational age of 29.8 weeks from the Pristine Women's Hospital, Kolhapur. Colostrum milk was collected within 2–5 days and matured milk was collected 20–30 days after delivery from the same mothers.
Methodology: Integral cellular components of 22 markers including stem cells, immune cells, and cell adhesion molecules were measured using flowcytometry.
Outcome: Preterm mature milk was found to possess higher expressions of hematopoietic stem cells, mesenchymal stem-like cells, immune cells, few cell adhesion molecules, and side population cells than colostrum.
Conclusion: The increased level of these different cell components in mature milk may be important in the long-term preterm baby's health growth. Further similar research in a larger population of various gestational ages and lactation stages of preterm mothers is warranted to support these pilot findings.

Keywords: colostrum, mature milk, preterm baby, stem-like cells, cellular components, marker characterization

Introduction

Human breast milk is a dynamic fluid composed of macro- and micronutrients and other bioactive factors specially suited to meet the needs of the newborn for its growth and development.[1,2] Besides these components, breast milk possesses several cellular components including colostral corpuscles, polymorphonuclear leukocytes, mononuclear phagocytes, lymphocytes, and the stem cells.[3–5] These components of breast milk form complex mixtures that contribute to the beneficial effects of breastfeeding. The particular benefits for preterm infants include protection from neonatal sepsis and necrotizing enterocolitis, lower rates of retinopathy in prematurity, and improved developmental outcomes.[6,7] Breastfeeding particularly of colostrum is, therefore, beneficial for the health of preterm infants.[8,9] This pilot study aimed to compare the quantity of various integral cellular components (hematopoietic, mesenchymal stem-like cells, cell adhesion molecules, epithelial cells, immune cells, and so on) of mature milk with those of colostrum, so as to examine whether these cell components are retained over time in mature milk.

Materials and Methods

Colostrum and mature milk were collected from five preterm mothers. The preterm delivered mothers with an average age of 30.2 years and gestational age 29.8 weeks were recruited from the Pristine Women's Hospital, Kolhapur, Maharashtra, India, for the study. Clinical correlations pertaining to this study population are mentioned (Table 1).

Preterm colostrum and mature milk samples ($n = 5$) were collected manually in an aseptic manner. The preterm colostrum was collected within 2–5 days of delivery and the

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Study of morphokinetics in day 3 embryo with implantation potential and effect of sperm cryopreservation on embryogenesis(Article)

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Abstract

Aim: In recent past, many studies had come up with the combination of time-lapse (TL) imaging of embryo morphokinetics as a noninvasive means for improving embryo selection and in vitro fertilization (IVF) success. The primary objective of the study was to find out if there is significant variation in morphokinetics of embryos with different implantation potential and also to study the effect of sperm freezing on time points of embryogenesis events in embryos with implantation potential. Materials and methods: Kinetic data and cycle outcomes were analyzed retrospectively in 142 patients who had undergone IVF/intracytoplasmic sperm injection (ICSI) cycles using semen with normal parameters and embryo transfer (ET) on day 3. For the surety of specificity of morphokinetics, only cases with single ET cycles were included in the study. Timing of specific events, from the point of ICSI, was determined using TL imaging. Kinetic markers like time to syngamy (t-pnf), t2, time to two cells (c), 3c (t3), 4c (t4), 5c (t5), 8c (t8), tMor, CC2, CC3, t5-t2, t5-t4, s1, s2, and s3 were calculated. The cleavage synchronicity from the 2-8 cell stage (CS2-8), from 4 to 8 cell stage (CS4-8), and from 2 to 4 cell stage (CS2-4) were calculated as defined elsewhere. Deoxyribonucleic acid replication time ratio (DR) was also included in the comparison. Analysis of variance test was used for comparison of the mean timing of cell division and cell cycle intervals. Results: Morphokinetics t-pnf, t2, t8, CC2, S2, S3, CS2-8, CS4-8, and CS2-4 differed significantly between embryos with and without implantation potential, when embryos were developed using fresh semen, while t3, t4, t5, CC2, S2, t5-t2, CS2-4, and DR differed significantly between the embryos with and without implantation potential when frozen semen was used. No significant difference was found in mean value of any of the above-stated parameters when comparison was done between implanted embryos fertilized by either fresh or cryopreserved sperm. Conclusion: Many morphokinetics parameters of embryogenesis vary significantly between embryos with different ability to implant; therefore, the criteria developed in our IVF lab can be useful for selection of suitable embryo even at day 3 of development with more chances of implantation. Clinical significance: Study indicates necessity of development of individualized selection model based on morphokinetics for every IVF lab and also confirms freezing as an important tool for fertility preservation of males as it does not affect events of embryogenesis.

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CASE REPORT

First Case of Successful Implantation and Live Birth after Double Trophectoderm Biopsy before and after Vitrification on the Same Cohort of Blastocyst

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ABSTRACT

Introduction: To report the first case of live birth after double trophectoderm biopsy before and after vitrification on the same cohort of blastocyst in our knowledge.

Design: Case report.

Patient: A 36-year-old female with a history of 13 years of active married life for treatment of infertility.

Main outcome measure: Live birth after double trophectoderm biopsy.

Results: Double biopsy pre- and postvitrification and its positive outcome.

Conclusion: Preimplantation genetic screening and diagnosis (PGS/PGD), though an invasive procedure on the embryos, when done meticulously would not dampen the implantation potential of the embryo and second biopsy could be a feasible option to salvage embryos with inconclusive or suspected false-positive PGS/PGD reports.

Keywords: Blastocyst, Double trophectoderm biopsy, *In vitro* fertilization/intracytoplasmic sperm injection, Preimplantation genetic screening and diagnosis, Vitrification.

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INTRODUCTION

Preimplantation genetic diagnosis and screening for monogenic diseases and/or numerical/structural chromosomal abnormalities is a tool for embryo testing aimed at identifying euploid embryo in cohort produced during *in vitro* fertilization (IVF) cycle.[1] The aim of PGS/PGD is to define whether an embryo is affected by monogenic disease and/or chromosomal impairment, thus preventing implantation of an abnormal fetus limiting the risks underlying the transfer of a chromosomally abnormal embryo. In recent years, PGD/PGS has gained a lot of momentum; various studies supporting and an equally good number opposing its role in IVF outcomes have been published. Preimplantation genetic screening and diagnosis in recent times has also come under a lot of criticism due to lot of ethical as well as scientific reason, but there is no doubt that PGD/PGS has been one of the most talked about important breakthrough in IVF. A critical aspect of this technology is the possibility that the biopsy itself can adversely affect the quality of embryo. Different approaches to biopsy have been proposed. Cleavage stage biopsy of the blastomere was the mostly commonly accepted approach. Polar body biopsy, cleavage stage biopsy, and trophectoderm biopsy all have been probed in detail for its advantages and disadvantages. Polar body biopsy either sequential or simultaneously was encouraged as an alternative to blastomere biopsy due to two significant reasons. First is the ethical and legal reason where in some countries where embryo biopsy is not allowed, it remains the obvious choice and only option, and second is due to the fact that polar body biopsy is comparatively less invasive than cleavage or trophectoderm biopsy. Cleavage stage biopsy is normally performed on day 3 on embryos with at least six blastomeres. Kirkegaard et al[2] compared the blastocyst development of biopsied day 3 embryo with that of nonbiopsied embryo and showed that biopsied embryo showed delayed compaction process and hatched in nonphysiological fashion, resulting in small blastocyst

Mechanical properties of polyphenylene oxide/talc composites with and without coupling agent

Ajay Vasudeo Rane[1]*, Krishnan Kanny[1], Abitha Vayyaprontavida Kaliyathan[2], Sachin Joshi[3] and Sabu Thomas[2,4]

Polyphenylene oxide (PPO) is an engineering polymer with high amorphous and good dimension stability commonly used in the automotive and electrical industry. Application of PPO is restricted because of its high price as compared to other thermoplastic polymer. Talc is inorganic natural filler and is widely used as filler material in polymer composite, as it is a cheap filler and easily available and save the final cost of the composite. Improvement in mechanical properties and thermal stability of the composite is achieved by loading optimum quantity of talc in polymer composite. In the present research work, PPO composite filled with 5, 10, 15, 20 and 25% untreated talc and surface-treated talc with silane coupling agent are fabricated and their mechanical properties are studied. Talc filled PPO composites with silane coupling agent and without silane coupling agent was compounded in twin-screw counter-rotating having L/D ratio 25:1 and 16 mm diameter extruder for various compositions, and test specimens were prepared from the compression moulded sheet. These specimens were tested for mechanical test by universal testing machine and izod impact equipment. The results shows improvement in the mechanical properties of composites are seen when talc is treated with 3-aminopropyl triethoxy silane as compared to untreated talc-filled PPO composites.

Keywords: Polyphenylene oxide, Talc, Composites, Twin-screw extruder, Inorganic filler

Introduction

Polyphenylene oxide is a high-temperature thermoplastic polymer and is an excellent insulator even at high frequencies, exhibits very good hydrolytic and dimension stability. The rigid structure of the polymer molecule leads to a material with high glass transition temperature (T_g), i.e. 208 °C. There is also a secondary transition at −116 °C and the small molecular motions at room temperature give the polymer a reasonable degree of toughness. One unique feature of PPO is its exceptional dimension stability amongst the engineering plastic. It has a low coefficient of thermal expansion, low moulding shrinkages and water absorption. Talc is usually lamellar (platy) structure, but the aspect ratio can vary considerably. Its high aspect ratio is the most important property for its use as an additive in thermoplastics. It is used in thermoplastics, mainly polypropylene, polyethylene and polyamide and PPO. Talc is used as an additive in thermoplastics for automotive parts, household appliances and engineering plastics products. The main objective of this research is to get improvement in mechanical properties of polyphenylene oxide, used in automotive industry. Talc is a very cheap filler material, thus it saves the final cost of the composite material. Talc provides perfect cleavage, flexibility, elasticity, infusibility, low thermal and electrical conductivity at dielectric strength; hence, it is widely used as filler in thermoplastics. The utilisation of talc as filler in polymer composite is considered important from both economic and commercial point of view. N-phenyl triethoxysilane as a coupling agent for fly ash filled polyphenylene oxide composites with filler concentration ranging from 5 to 25%, showed improvement in flexural strength and flexural modulus, whereas tensile strength, melt flow index and impact strength decreased with increase in concentration of fly ash treated and untreated filled composites.[1] Similar study was carried out using titanate as a coupling agent for talc-filled polypropylene composites. Increase in melt flow index, impact strength and elongation property, while flexural strength and yield stress decreased. Uniform distribution of talc was observed on addition of titanate.[2] Likewise, blends of thermoplastic polyurethanes and polypropylene were filled with talc treated with 3-glycidoxyoxypropyl-methoxy silane as a coupling agent. Thermal properties of blends were improved after addition of treated talc. Melting temperature, degree of crystallinity, enthalpy of treated talc composite, glass transition temperature, storage modulus increase with the addition of treated talc.[3] Improvement in toughness and thermal resistance properties of recycled polyethylene terephthalate by incorporating polyethylene glycidyl methacrylate, talc,

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Research Article

FABRICATION OF NOVEL ANTICANCER POLYOXOMETALATE $[COW_{11}O_{39}(CPTI)]^{7-}$-CHITOSAN NANOCOMPOSITE, ITS TOXICITY REDUCTION, AND SUSTAINED RELEASE

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ABSTRACT

Objectives: Polyoxometalates (POMs) are proved to be important for applications in medicine and in material science. Here, we represent nanocomposite formation of tungsten-containing potent anticancer polyanion, K_6H $[CoW_{11}O_{39}$ (CpTi)].$13H_2O$ (CoW_{11}CpTi) with biocompatible ChitosanYC-100 (CSYC100) with the goal to reduce its heavy metal toxicity.

Methods: Synthesis of "POM-CSYC100 nanocomposite" was attained without the aid of any cross-linker through electrostatic interaction technique. Nanocomposites were characterized using Fourier transform infrared spectroscopy, dynamic light scattering, transmission electron microscopy, and thermogravimetric analysis. The release profile recorded was slow and sustained at physiological pH. *In vitro* cytotoxicity assays which show an attribute to reduce the toxicity of these POM were performed on C2C12 (mouse myoblast cell line) and A-549 (lung cancer cell line), which proved the reduced toxicity of nanocomposites as compared to the bare drugs.

Results: Sustained release studies showed there was a slow and steady release of CoW_{11}CpTi for 11 hrs, with the 98% of collective release at the end. From *in vitro* cytotoxic assay, it was deduced that CoW_{11}CpTi -CSYC100 nanocomposite at the concentrations of 1.25 mM, and lower did not exhibit toxic effect on C2C12 cells as 95% total C2C12 cell mass remained viable. While in the case of A549 cells highest 5 mM concentration of bare CoW_{11}CpTi is toxic to the cancer cells and after encapsulation cell viability increases from 10% to 55%.

Conclusion: Thus, this study has designated the probability of using POM-chitosan nanocomposite for less toxic and effective biomedicinal applications.

Keywords: Anticancer, Chitosan, Nanocomposite, *In vitro* cytotoxicity, Drug release.

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INTRODUCTION

Polyoxometalates (POMs) can be defined as "early transition metal oxygen clusters." POMs have gained tremendous attention because of their mutable uses in the areas of novel drug development, material sciences, and in industrial catalyst [1]. The use of POMs in latent applications for human medicine is growing exponentially and are recently published in the literatures [2,3]. The toxicity due to the presence of metal ions is the major drawback of these precious medicinal molecules. To lower down the toxicity, it needs to be conjugate/encapsulate in some biopolymeric delivery vehicle.

Chitosan and its derivatives linger to attract noteworthy attention as a potent drug transporter with remarkable biocompatibility along with appreciable cellular uptake rates [4-6]. Chitosan is a carbohydrate heteropolymer composed of glucosamine and N-acetyl glucosamine linked by β 1-4 glucosidic bonds as a repeating unit. Chitosan is developed from chitin by its N-deacetylation. Chitin a structural polysaccharide found in the exoskeleton of shrimps and shells of crabs and the second most abundant polysaccharide found in nature after cellulose [7]. This versatile feature has been used in this study to beat the significant biomedical potential of POMs by their encapsulation in chitosan YC-100 (CSYC100) matrix. The chosen title anion $K_6H[CoW_{11}O_{39}(CpTi)].13H_2O$, hereafter denoted as ($CoW_{11}$CpTi) is reported to be the most potent anticancer POM among the family of CpTi substituted POMs studied so far. It is reported that polyoxotungstate CoW_{11}CpTi curiously decreased tumor weight of the rats bearing HLC (colon cancer cell), HL-60 (leukemia), and SSMC-7721 (liver cancer cell) where the experimental results were procured using the animal tumor implantation method. The *in vivo* anticancer efficacy of CoW_{11}CpTi is at par with the clinical anticancer drugs 5-fluorouracil and CP (abbreviation of cyclophosphamide), but the cytotoxicity of CoW_{11}CpTi is reported to be less than them [8].

The research described in this report is focused to prepare the nanocomposite of low molecular weight carbohydrate polymer CSYC100 and an anticancer POM CoW_{11}CpTi. The primary agenda of this research is to portray reduction in the metallic toxicity of POMs by its involvement in the formation of nanocomposite with CSYC100. To support this hypothesis, CoW_{11}CpTi-CSYC100 nanocomposites were prepared and its toxicity was assessed *in vitro* on cell line C2C12 (normal myoblast cell line) and A-549 (adenocarcinomic human alveolar basal epithelial cells-lung cancer cell line). To the best of our knowledge, this the first report showing the toxicity reduction of $[CoW_{11}O_{39}(CpTi)]^{7-}$ by forming their nanocomposite with CSYC100.

METHODS

Materials

CSYC100 is a low molecular weight chitosan (~10000 g/mol) and highly water soluble and purchased from Sigma-Aldrich, Steinheim, Germany. Other chemicals required for synthesis of POMs, and other studies were bought commercially from Sigma-Aldrich.

Preparation of POMs

Polyoxotungstate CoW_{11}CpTi was synthesized according to the procedure described by Wang *et al*. in 2003 [8].

Synthesis of CSYC100/CoW_{11}CpTi complexes

To synthesize CoW_{11}CpTi-CSYC100 nanocomposites, 50 mg CSYC100 was dissolved in 70 ml double distilled water. The mixture was stirred

Certain Image Formulae and Fractional Kinetic Equations Involving Extended Hypergeometric Functions

Krunal B. Kachhia, Praveen Agarwal and Jyotindra C. Prajapati

Abstract In this chapter, our aim is to establish certain new image formulae of generalized hypergeometric functions by using the operators of fractional calculus. Some new image formulae are obtained by applying specific integral transforms on resulting image formulae. We also acquired generalization of fractional kinetic equations involving extended hypergeometric functions.

Keywords Generalized Gauss hypergeometric function · Fractional derivative operators · Integral transforms · Fractional kinetic equation · Mittag–Leffler function

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1 Introduction

Fractional calculus is one of the generalizations of classical calculus, and it has been used successfully in various fields of science and technology. Many applications of fractional calculus can be found in other diverse fields, etc. (See [15, 17, 19–22, 35]).

Integral transforms and fractional integral formulae involving well-known special functions are interesting in themselves and play significant roles in their diverse

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RAPID COMMUNICATION

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A report on identification of sequence polymorphism in barcode region of six commercially important *Cymbopogon* species

Ashok Kumar Bishoyi[1,2] · Aarti Kavane[2] · Anjali Sharma[2] · K. A. Geetha[2]

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Abstract
Cymbopogon is an important member of grass family Poaceae, cultivated for essential oils which have greater medicinal and industrial value. Taxonomic identification of *Cymbopogon* species is determined mainly by morphological markers, odour of essential oils and concentration of bioactive compounds present in the oil matrices which are highly influenced by environment. Authenticated molecular marker based taxonomical identification is also lacking in the genus; hence effort was made to evaluate potential DNA barcode loci in six commercially important *Cymbopogon* species for their individual discrimination and authentication at the species level. Four widely used DNA barcoding regions *viz*., ITS 1 & ITS 2 spacers, *matK, psbA-trnH* and *rbcL* were taken for the study. Gene sequences of the same or related genera of the concerned loci were mined from NCBI domain and primers were designed and validated for barcode loci amplification. Out of the four loci studied, sequences from *matK* and ITS spacer loci revealed 0.46% and 5.64% nucleotide sequence diversity, respectively whereas the other two loci i.e., psbA-trnH and *rbcL* showed 100% sequence homology. The newly developed primers can be used for barcode loci amplification in the genus *Cymbopogon*. The identified Single Nucleotide Polymorphisms from the studied sequences may be used as barcodes for the six *Cymbopogon* species. The information generated can also be utilized for barcode development of the genus by including more number of *Cymbopgon* species in future.

Keywords Chloroplast genome · *Cymbopogon* species · DNA barcode · ITS spacer · *MatK*

Introduction

DNA barcoding is an increasingly more attractive as well as efficient molecular tool for species identification [1–4]. The primary goal of DNA barcoding is species recognition of unknown specimens and support to complex taxonomies for the advantage of science and society [5, 6]. Also, the barcoding techniques combined with high resolution melting method is very much useful for discrimination of closely related medicinal plant species [7]. In plants it was recommended that four gene regions *viz*., ITS 1 & ITS 2 spacers, *matK, psbA-trnH* and *rbcL* can be efficiently utilized as primary DNA barcoding markers for species identification [4, 8–10]. *Cymbopogon*, commonly known as lemongrass is one of the most important essential oil yielding genera of the family Poaceae [11]. Although 45 species of the genus occur in India, only few of them *viz. C. flexuosus* (East Indian lemon grass), *C. citratus* (West Indian lemongrass), *C. pendulus* (North Indian lemongrass), *C. winterianus* (Java citronella), *C. nardus* (Ceylon citronella) and *C. martinii* (Palmarosa) are commercially cultivated for essential oil production [12]. Many cultivars of these species and their hybrids produce different types of essential oils, *viz*., lemongrass oil, ginger grass oil, citronella oil, palmarosa oil, etc. which are used in perfumes, soaps, cosmetics, pesticides, fungicides, bactericides, preservatives,

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ORIGINAL ARTICLE

IJPHY

CORRELATION BETWEEN ACADEMIC PERFORMANCE AND OBESITY IN SCHOOL-CHILDREN FROM ANAND DISTRICT

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ABSTRACT

Background: Growing childhood obesity epidemic is concerning the health of future generation in any country. Today's competitive world is increasing the never ending pressure on children to excel in academic performance to ensure bright future. Hence, it is the need of the hour to understand the correlation between obesity and academic performance for implementation of the policies related to obesity prevention and treatment.

Methods: 1034 school children were taken randomly according to inclusion and exclusion criteria, and they were divided into two groups: a) 5-11 years and b) 12-18 years. BMI (BMI), Waist Circumference (WC), the Waist-Height ratio (WHtR) and SSFT (Sum of Skinfold thickness) were taken to measure obesity, and the class teacher evaluated academic performance.

Results: The prevalence of obesity when assessed by WC revealed highest values as compared to Waist-Height ratio, IOTF-BMI and SSFT. Spearman correlation between obesity (WC) and academic performance revealed that there was a significant negative moderate correlation in urban boys ($r = -0.4$, $p<0.05$) and girls ($r = -0.3$, $p<0.05$) of 5 -11 years' age-group. There was no significant (r ranging from -0.02 to -0.7, $p>0.05$) correlation between obesity and academic performance in boys and girls of 12-18 years' age-group.

Conclusions: It is also concluded from the present study that obesity and academic performance of school children were negatively correlated in boys and girls of 5 -11 years of age but it was not found in 12-18 years of age. Influence of various confounding factors could not be isolated which could have also impacted the academic performance of the child.

Keywords: obesity, academic performance, school-children, body mass index, waist circumference, waist-height ratio.

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Reliability and validity study of the Gujarati version of the Oswestry Disability Index 2.1a

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Abstract.
BACKGROUND: Among all musculoskeletal disorders back pain is the most common reason for functional limitation in working age. It is due to low back pain (LBP) that the ODI has become one of the principal outcome measures for evaluation of disability and has been widely used in research as well as in clinical practice. So far, validated Gujarati version of the ODI 2.1a has not been reported.
OBJECTIVE: To accomplish the translation and validation of the Oswestry Disability Index (ODI) version 2.1a into the Gujarati language.
STUDY DESIGN: Cross-sectional study.
METHODS: The validation of the ODI-Gujarati was tested in 120 patients diagnosed with non-specific LBP, who were receiving physiotherapy at a clinic in Gujarat, India. Data was collected at on initial visit and after 48 hours. During both visits, patients completed the Oswestry Disability Index-Gujarati (ODI-G), Roland-Morris Disability Questionnaire-Gujarati (RMDQ-G), and Visual Analogue Scale-Pain (VAS-P).
RESULTS: Internal consistency was measured by Cronbach's alpha. The Gujarati version indicated high internal consistency ($\alpha = 0.96$). Test-retest reliability was measured by intra-class correlation coefficient and it revealed very high correlation (ICC = 0.92). Construct validity was confirmed by strong correlation with RMDQ-G ($r = 0.76$), and concurrent validity indicated moderate correlation with VAS-P ($r = 0.50$). Factor analysis explained that the ODI was loaded on 1 factor.
CONCLUSION: The Oswestry disability index version 2.1a was successfully translated into Gujarati language, showing excellent psychometric properties. Therefore, it can be used in evaluating the disability amongst Gujarati population with LBP for both clinical and research purposes.

Keywords: ODI-Gujarati version 2.1a, low back pain, reliability, validity

1. Introduction

Musculoskeletal disorders a major health problem across the globe and are few of the most frequent causes of disability [1,2]. Among these disorders low back pain (LBP) is the fifth most common reason resulting into physician visits that are present with many possible etiologies and affect erratically [1–3]. In western countries, it has become a growing concern about disability associated with back pain. In United States, an estimated 6.5 million population are bed-ridden due to back pain [1,2].

Nearly, 60–65% of Indian population also suffers from back pain in their lifetime [4]. The lifetime prevalence rate of LBP is reported to be as high as 84% and the prevalence of chronic low back pain is about 23%. Twelve percent of the population is already disabled by low back pain; it can lead to early retirement and common reason for short and long-term work sick-leave. Economically, LBP is a huge burden on health care system and on socio-economic status [1–3].

Almost 85% of patients are affected by nonspecific LBP, and are defined as any type of back pain in the

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Healthcare Access and Quality Index based on mortality from causes amenable to personal health care in 195 countries and territories, 1990–2015: a novel analysis from the Global Burden of Disease Study 2015

*GBD 2015 Healthcare Access and Quality Collaborators**

Summary

Background National levels of personal health-care access and quality can be approximated by measuring mortality rates from causes that should not be fatal in the presence of effective medical care (ie, amenable mortality). Previous analyses of mortality amenable to health care only focused on high-income countries and faced several methodological challenges. In the present analysis, we use the highly standardised cause of death and risk factor estimates generated through the Global Burden of Diseases, Injuries, and Risk Factors Study (GBD) to improve and expand the quantification of personal health-care access and quality for 195 countries and territories from 1990 to 2015.

Methods We mapped the most widely used list of causes amenable to personal health care developed by Nolte and McKee to 32 GBD causes. We accounted for variations in cause of death certification and misclassifications through the extensive data standardisation processes and redistribution algorithms developed for GBD. To isolate the effects of personal health-care access and quality, we risk-standardised cause-specific mortality rates for each geography-year by removing the joint effects of local environmental and behavioural risks, and adding back the global levels of risk exposure as estimated for GBD 2015. We employed principal component analysis to create a single, interpretable summary measure–the Healthcare Quality and Access (HAQ) Index–on a scale of 0 to 100. The HAQ Index showed strong convergence validity as compared with other health-system indicators, including health expenditure per capita (r=0·88), an index of 11 universal health coverage interventions (r=0·83), and human resources for health per 1000 (r=0·77). We used free disposal hull analysis with bootstrapping to produce a frontier based on the relationship between the HAQ Index and the Socio-demographic Index (SDI), a measure of overall development consisting of income per capita, average years of education, and total fertility rates. This frontier allowed us to better quantify the maximum levels of personal health-care access and quality achieved across the development spectrum, and pinpoint geographies where gaps between observed and potential levels have narrowed or widened over time.

Findings Between 1990 and 2015, nearly all countries and territories saw their HAQ Index values improve; nonetheless, the difference between the highest and lowest observed HAQ Index was larger in 2015 than in 1990, ranging from 28·6 to 94·6. Of 195 geographies, 167 had statistically significant increases in HAQ Index levels since 1990, with South Korea, Turkey, Peru, China, and the Maldives recording among the largest gains by 2015. Performance on the HAQ Index and individual causes showed distinct patterns by region and level of development, yet substantial heterogeneities emerged for several causes, including cancers in highest-SDI countries; chronic kidney disease, diabetes, diarrhoeal diseases, and lower respiratory infections among middle-SDI countries; and measles and tetanus among lowest-SDI countries. While the global HAQ Index average rose from 40·7 (95% uncertainty interval, 39·0–42·8) in 1990 to 53·7 (52·2–55·4) in 2015, far less progress occurred in narrowing the gap between observed HAQ Index values and maximum levels achieved; at the global level, the difference between the observed and frontier HAQ Index only decreased from 21·2 in 1990 to 20·1 in 2015. If every country and territory had achieved the highest observed HAQ Index by their corresponding level of SDI, the global average would have been 73·8 in 2015. Several countries, particularly in eastern and western sub-Saharan Africa, reached HAQ Index values similar to or beyond their development levels, whereas others, namely in southern sub-Saharan Africa, the Middle East, and south Asia, lagged behind what geographies of similar development attained between 1990 and 2015.

Interpretation This novel extension of the GBD Study shows the untapped potential for personal health-care access and quality improvement across the development spectrum. Amid substantive advances in personal health care at the national level, heterogeneous patterns for individual causes in given countries or territories suggest that few places have consistently achieved optimal health-care access and quality across health-system functions and therapeutic areas. This is especially evident in middle-SDI countries, many of which have recently undergone or are currently experiencing epidemiological transitions. The HAQ Index, if paired with other measures of health-system

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ORIGINAL RESEARCH

Description of interventions is under-reported in physical therapy clinical trials

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CONSORT;
Control group;
Description of interventions

Abstract
Background: Amongst several barriers to the application of quality clinical evidence and clinical guidelines into routine daily practice, poor description of interventions reported in clinical trials has received less attention. Although some studies have investigated the completeness of descriptions of non-pharmacological interventions in randomized trials, studies that exclusively analyzed physical therapy interventions reported in published trials are scarce.
Objectives: To evaluate the quality of descriptions of interventions in both experimental and control groups in randomized controlled trials published in four core physical therapy journals.
Methods: We included all randomized controlled trials published from the *Physical Therapy Journal, Journal of Physiotherapy, Clinical Rehabilitation, and Archives of Physical Medicine and Rehabilitation* between June 2012 and December 2013. Each randomized controlled trial (RCT) was analyzed and coded for description of interventions using the checklist developed by Schroter et al.
Results: Out of 100 RCTs selected, only 35 RCTs (35%) fully described the interventions in both the intervention and control groups. Control group interventions were poorly described in the remaining RCTs (65%).
Conclusions: Interventions, especially in the control group, are poorly described in the clinical trials published in leading physical therapy journals. A complete description of the intervention in a published report is crucial for physical therapists to be able to use the intervention in clinical practice.

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Higher Levels of Caregiver Strain Perceived by Indian Mothers of Children and Young Adults with Cerebral Palsy Who have Limited Self-Mobility

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ABSTRACT. *Aim*: Describe and compare the caregiver strain experienced among Indian mothers of children and young adults with cerebral palsy (CP) living in low resource settings. *Methods*: 62 consecutive children and young adults with spastic CP (mean age 6.0 ± 4.5, range 2–21) and their parents were recruited from an outpatient physiotherapy department for this cross-sectional study. Ability to walk was classified using the Gross Motor Function Classification System and mother's caregiver strain was measured using caregiver strain index (CSI). *Results*: Mothers of children and young adults who have limited self-mobility perceived higher caregiver strain (mean CSI score 12.0 ± 1.3, $p < 0.05$) than mothers of children who can walk (mean CSI score 4.5 ± 3.0, $p < 0.05$). All 46 mothers of children and youth in GMFCS levels IV and V reported high levels of caregiver stress compared with only three of 16 mothers of children and youth who walk (levels I and II). *Conclusions*: Physiotherapists and occupational therapists serving children and youth with CP are encouraged to partner with families to identify goals for ease of caregiving, activity, and participation at home and in the community.

KEYWORDS. GMFCS, low resource setting, mothers

Caregiving can be challenging and stressful for parents of the children with cerebral palsy (CP; Raina et al., 2005). The World Health Organization's (WHO) International Classification of Functioning, Disability and Health (ICF) acknowledges caregiver strain as a third-party disability (WHO, 2001). The WHO describes third-party disability as the disability experienced by significant others as a consequence of their family members' health condition (WHO, 2001). One of the main challenges for parents of children with CP is to manage their children's physical limitations and needs for self-care and mobility. In addition, families have the responsibil-

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