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International Journal of Scientific Research and Reviews

Hepatotoxic effects of Sodium Fluoride on *Channapunctatus*(Blotch.)

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ABSTRACT

Fishes are major diverse group of vertebrates exposed to environmental contaminants essentially of aquatic origin that accumulate in their body via dietary sources and aquatic ambient sources. Analogous to other animals', fish liver is essentially a producer of bile, aids in fat digestion, red cell turnover, a detoxifier and a potent gut immune defender. By virtue of extensive blood circulation and a potent bioaccumulation, liver is a vital organ for toxicological studies. Fluoride is one such ecotoxicological element that is becoming endemic for hydrofluorosis in certain geographical regions of the world including India. Hence hepatotoxicity of fluoride in fish is considered in this study

KEY WORDS: Bio accumulator, detoxifier, fishes, Fluoride, liver,

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INTRODUCTION

International Journal of Scientific Research and Reviews

Forbidden Foods for Healthy Pregnancy

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ABSTRACT

Food is important for continuing life. During pregnancy, dietary requirements of a woman increase as the growing embryo draws nutrition from the mother's body. Hence during the days of pregnancy, would be mother needs to consume foods rich in vitamins, minerals and also should be sufficient enough to meet her calorie requirements and support the growing embryo. Not only the quantity but also the quality of the food should be considered.

KEY WORDS: Embryo, food, fetus, health benefits, pregnancy

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Eigencentality-based Analysis of Optimal Connectivity in Heterogeneous IoT Network

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Eigencentality based measures have been proposed for the optimal positioning of the multi-interface nodes in the framework of Internet of Things (IoT). The robustness of IoT network and its resilience to any kind of attack depends on the amount of heterogeneity present in the network. Jaccard dissimilarity based measurement of centrality is used as a parameter in the Modified Minimum-Vertex-Cover Algorithm to determine the maximum heterogeneity around a node. The algorithm is tested in two extremely opposite topological environments like a perfect square grid and a completely random network and is found to work well in both the cases indicating its resilience towards network variation, network dimension and amount of heterogeneity present in the network. This suggests its effectiveness to be used in IoT framework.

Keywords: Internet of Things, Heterogeneous network, Centrality, Jaccard dissimilarity, Minimum-Vertex-Cover

1. INTRODUCTION

Internet of Things (IoT) is a collection of solution specific nodes with heterogeneous connection interfaces. The successful deployment of such network depends on real-time event-driven exchange of data among the source and sink node. The nodes need to interact with cloud based services and hence

Application of Strong Arcs in m -Polar Fuzzy Graphs

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Abstract

Recently, m -polar fuzzy graph (m PF graph) becomes a growing research topic as the generalization of fuzzy graph. In this paper, at first m PF path, m PF cycle in an m PF graph are defined. The strength of connectedness of m PF path is introduced. Next, strongest and strong m PF path, m PF bridges, m PF cut nodes, m PF tree and m PF forests in an m PF graph are considered. Also, it is proved that an arc of m PF tree is strong m PF arc if and only if it is an m PF bridge. Finally, m PF end nodes in an m PF graph is defined and investigated some properties of it. An application of strongest path problem in 3-polar fuzzy graph is also given at the end.

Keywords m PF graphs · Strongest and strong m PF path · m PF bridges · m PF cut nodes · m PF trees · m PF forests

1 Introduction

Now a days, a large number of people working on graph theory due to its wide applications. In a fuzzy graph, the membership value of arc may represent distance, time, communication cost, etc. Many problems of resource networking, database design, traveling salesman, etc can be solved with the help of circuits, walks and paths. The idea of bipolar fuzzy set (BF set) was first introduced by Zhang [1,2] in 1994. Then Chen et al. [3] defined m -polar fuzzy sets (m PF sets) as a generalization of BF sets in 2014. Next Kafmann [4] introduced the definition of fuzzy graph using the concept of fuzzy relations [5–7] in 1993. Fuzzy vertex and fuzzy edges and several fuzzy analogs of graphs were defined later by Rosenfeld [8] in different way. Bhutani [9] introduced the idea of isomorphism, co-weak isomorphism and

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Different Types of Arcs in m -polar Fuzzy Graphs with Application

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Accepted: December 9, 2018.

Recently, m -polar fuzzy graph (mPFG) becomes a growing research topic as it is the generalization of fuzzy graph. In this paper, at first α -strong mPF arc, β -strong mPF arc, δ -strong mPF arc and δ^* -strong mPF arc in an mPFG are defined. An application of decision making using strong path is also given at the end.

Keywords: mPFGs, strongest and strong mPF path, mPF bridges, mPF cut nodes, mPF trees and mPF forests

1 INTRODUCTION

Now a days a large number of people working on graph theory due to its wide applications. In a fuzzy graph, the membership value of arc may represent distance, time, communication cost, etc. Many problems of resource networking, database design, traveling salesman, etc. can be solved with the help of circuits, walks and paths. The idea of bipolar fuzzy set (BF set) was first introduced by Zhang [41, 42] in 1994. Then Chen *et al.* [23] defined m -polar fuzzy sets (mPF sets) as a generalization of BF sets in 2014. Next Kafmann [2] introduced the definition of fuzzy graph using the concept of fuzzy relations [25–27] in 1993. Fuzzy edges and fuzzy vertex and several

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Genus value of m -polar fuzzy graphs

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Abstract. In this paper, the embedding of m -polar fuzzy graphs which constructed on the surface of spheres is introduced. The m -polar fuzzy genus graphs with its genus value, strong and weak m -polar fuzzy genus graph are defined. Also isomorphism properties on m -polar fuzzy genus graph are discussed. The relation between planarity value and genus value of m -polar fuzzy graph is established. Euler polyhedral equation is established in terms of genus value of the m -polar fuzzy genus graph. Finally, an application of m -polar fuzzy genus graph is given in topological surface.

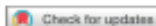
Keywords: m -polar fuzzy graphs, graph embedding, genus value, strong and weak m -polar genus value

1. Introduction

Graph theory is a very important tool to represent many real world problems. Applications of fuzzy graph include data mining, image segmentation, clustering, image capturing, networking, communication, planning, scheduling, etc. A data structure can be designed in the form of a tree which utilizes vertices and edges. Also, paths, walks and circuits are used to solve many problems of traveling salesman, database design, resource networking, etc. This and many other problems motivated to define fuzzy graphs. The first theory of fuzzy sets was proposed by Zadeh [41]. In 1994, Zhang [44, 45] first introduced the concept of bipolar fuzzy set. Chen et al. [5] first proposed m -polar fuzzy sets as a generalization of bipolar fuzzy sets in 2014. The first definition of fuzzy graphs was first proposed by Kaufmann [21] using the concept of Zadeh's defined fuzzy relations [41–43] in 1993. But Rosenfeld [26] introduced another elaborated definition including fuzzy vertex and fuzzy edges and several fuzzy analogs of graph theoretic concepts such as paths, cycles, connectedness and etc. The

concept of weak isomorphism, co-weak isomorphism and isomorphism between fuzzy graphs was introduced by Bhutani in [4]. After that several researchers are working on fuzzy graphs. Fuzzy planar graphs have been introduced by Samanta and Pal in [28]. Many work on generalized fuzzy graphs can be found on [1, 2, 8, 14–17, 20, 22, 27, 38–40]. Ghorai and Pal studied certain types of product bipolar fuzzy graphs [9], introduced faces and dual on m -polar fuzzy planar graphs [10], some isomorphism properties on m -polar fuzzy graphs [11], introduced planarity in vague graphs [19], given a new concepts of product m -polar fuzzy graphs [18]. The concept of m -polar fuzzy planar graph [12] is introduced. Sahoo and Pal [31] discussed the concept of intuitionistic fuzzy competition graph. They also discuss intuitionistic fuzzy tolerance graph with application [32], different types of products on intuitionistic fuzzy graphs [30], modular and homomorphic product of intuitionistic fuzzy graphs and their degree [33], intuitionistic fuzzy labeling graphs [34], certain types of edge irregular intuitionistic fuzzy graphs [29] and product of intuitionistic fuzzy graphs and degree [35]. S. Sahoo et al. [36] introduced covering and paired domination in intuitionistic fuzzy graphs. Pramanik et al. defined fuzzy ϕ -tolerance competition graphs [23], interval-valued fuzzy ϕ -tolerance competition graphs [24], interval-valued fuzzy planar graphs [25].

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Cite this: *New J. Chem.*, 2018, 42, 19707

In situ preparation of *Tricholoma* mushroom polysaccharide-*g*-poly(*N,N*-dimethyl acrylamide-co-acrylic acid)-CuO composite nanoparticles for highly sensitive and selective sensing of Th⁴⁺ in aqueous medium†

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Herein, we report for the first time the highly sensitive and selective sensing of Th⁴⁺ in aqueous solution, using mushroom polysaccharide-based graft copolymer-CuO composite nanoparticles (TMP-CuO NPs), by optical, colorimetric and electrochemical methods. The graft copolymer was prepared in water by a solution phase radical polymerization technique using *Tricholoma* mushroom polysaccharide (TMP) with a mixture of *N,N*-dimethyl acrylamide (DMA) and acrylic acid (AA) in the presence of potassium persulphate (K₂S₂O₈) as the radical initiator. The graft copolymer was characterized by ¹H NMR and FTIR spectroscopy, and FESEM analysis. The TMP-CuO NPs were characterized by UV-visible and FTIR spectroscopy, XRD, EDAX, HRTEM, FESEM, and DLS analyses. The prepared TMP-CuO NPs have unique properties for the sensing of Th⁴⁺ in water medium, which were investigated by optical, colorimetric and electrochemical methods. The UV-absorption spectra showed a significant redshift of the localized surface plasmon (LSPR) band (λ_{max}) with a gradual decrease in the absorption intensity upon each addition of Th⁴⁺ into the TMP-CuO NPs medium. Also, the reddish brown colour of the TMP-CuO NPs solution changed to colourless after the addition of a certain concentration of Th⁴⁺ ions. Electrochemical studies for the sensing of Th⁴⁺ by cyclic voltammetry showed a clear reduction peak at 1.009 V. The selective detection of Th⁴⁺ in water medium was also investigated in the presence of some environmentally relevant metal ions by using optical and colorimetric analysis. The morphological changes of TMP-CuO NPs in the presence of trace amounts of Th⁴⁺ via the formation of the CuO-Th amalgam was confirmed by XPS, XRD, FTIR, FESEM, and EDAX analysis.

Received 24th October 2018

Accepted 28th October 2018

DOI: 10.1039/C8NJ05390a

njc.njc

Introduction

Th⁴⁺ is a radioactive element that has a wide range of industrial applications in ceramics, aerospace industries, nuclear energy plants and other energy sectors. Because of its toxic nature, a trace amount of Th⁴⁺ can generate several health problems in living organisms.¹ Some human activities, such as burning coal for power generation, acidic leaching of uranium tailing piles, phosphate fertilizer production, processing of some tin ores

and exhalation of thorium containing ores, result in the release of Th⁴⁺ into the environment and mixing with ground and surface water.^{2,3} The incorporation of trace amounts of Th⁴⁺ into the human body causes various toxicological effects and increases the risk of lung, liver and pancreatic cancers.⁴ As such, the sensitive and selective detection of trace amounts of Th⁴⁺ in the water medium is necessary from the environmental point of view. The detection and determination of trace amounts of Th⁴⁺ can be done analytically by various techniques, which include mass spectrometry, X-ray fluorescence, electrochemical methods, potentiometric sensing, electroanalytical methods and others,^{5–8} however, all these methods require complex instrumental setup and time-consuming processes. Therefore, the development of a simple, reliable and selective experimental method for the determination of Th⁴⁺ has considerable importance.

The selective and sensitive detection of metal ions by optical methods has received significant research interest in recent years,

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† Electronic supplementary information (ESI) available. See DOI: 10.1039/C8NJ05390a

IMPACT OF FLUORIDE TOXICITY ON FRESH WATER FISHES: A MINI REVIEW

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ABSTRACT

Fluoride toxicity is widely spreading in different parts of the world. Excess fluoride in water is harmful for aquatic life as well as excess of fluoride in drinking water is harmful for animals and human. Fishes living in fresh water contaminated with fluoride are adversely affected. Fluoride enters and accumulates in their body and thus enters the food chain. Low level of fluoride doesn't cause life threatening issues but gradual bioaccumulation of fluoride causes toxic effects in living organisms and consequences may be fatal. A vivid knowledge of fluoride exposure and toxicity is necessary for developing proper and satisfactory control and preventive measures against fluoride pollution. Fluoride intoxication in fishes needs to be controlled in order to prevent ill health effects on human health due to consumption of fluoride intoxicated fishes as well as to improve yield of aquaculture.

Keywords: Aquaculture, bioaccumulation, fishes, fluoride, toxicity

INTRODUCTION

Aquatic fluoride contamination is an important ecotoxicological issue now a day. Across the globe, fluoride contamination in water has been critically studied. Fluoride gets into water through various ways. One significant way of fluoride contamination in water is from fluorine containing minerals in sediments and rocks¹. Another significant source of fluoride contamination in water is through pesticides and industrial effluents¹. Fluoride toxicity affects aquatic life adversely. Fresh water organisms are more severely affected compared to those in brackish water². It is reported that bioavailability of fluoride ion is decreased with increasing hardness of water². Fluoride is known to enter and accumulate in body of fishes². Studies reveal that fluoride accumulates in bones² and flesh of fish³. Fluoride is highly electronegative and so gets attracted towards the positively charged calcium ions in bones⁴. Fish is one of the most common foods in regular diet in many parts of India. Not only in India, is fish consumed abundantly in regular diet but also is consumed extensively in various other countries around the world. Fluoride which accumulates in fish body, enters human body through fluoride intoxicated fish in his diet. Studies show that small amount of fluoride is needed and is good for preventing tooth decay but excess of fluoride not only is harmful for tooth (causes dental fluorosis) but also is harmful for entire health of living organisms⁵. It has been reported that fluoride contamination below the permissible level can adversely affect the health of invertebrates and fishes². Studies suggest that dietary fishes are one of the major contributors in dental fluorosis in human beings⁶. With increasing concentration of fluoride ion in water, severity of effect of fluoride toxicity on fishes and other aquatic organisms increase⁷. Also exposure time period plays an important role in occurrence and severity of fluoride toxicity⁸. Whereas, concentration of chloride and calcium ions decreases the severity of fluoride toxicity in fishes⁹. Fluoride enters the body of fish and interferes with the various enzymes present in the body. Fluoride primarily poisons the enzymes and thus prevents their activity. Thus, various essential metabolic processes are disturbed[Fig.1]. Some such metabolic processes like glycolysis etc., are essential for maintaining normal physiology of fishes¹⁰. In this review we primarily focus on the impact of fluoride toxicity on health status of fishes living in fresh water. We have also suggested some possible remedies for preventing fluoride pollution and toxic effects of fluoride on fresh water fishes.

FLUORIDE BIOACCUMULATION

Fluoride being highly transportable inorganic pollutant enters the body of fishes via skin or gill. Bioaccumulation depends on presence of aquatic sediments, temperature and pH¹¹. Common carps like *Cyprinus carpio*, goldfish (*Carassius auratus gibelio*) and two predatory fishes: the northern pike (*Esox lucius*) and the European perch (*Perca fluviatilis*) are shown to accumulate fluoride in various organs and tissues¹². The accumulation of F⁻ in the tissues of the fish increased depending on the duration of exposure. However, adverse effects vary in species to species with accumulation in predator fishes¹². Further controversies in tissue accumulation have also been reported. Upon entry in the body of *Acipenser baerii* fluoride accumulates in various organs primarily in bone, skin, gill followed by liver, gut and muscles¹³. However, Cao et al. reported that accumulation of Fluoride was highest in the gills, followed by the liver, brain, kidneys, muscle, and gut tissues of carp (*Cyprinus carpio*)¹⁴.

REVIEW ARTICLE

Postmenopausal Health of Indian Women: A ReviewDebosree Ghosh^{1,*}, Partha Sarathi Singha² and Pratap Parida³

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Abstract: *Background:* The phenomenon of natural and spontaneous cessation of menstruation in women is termed as menopause. The phase after menopause is called post menopause. Women encounter enormous changes in various physiological factors during and after menopause.

Objective: Objectives of this article are to brief the various issues associated with health ailments in postmenopausal Indian women, to address the various factors unique to Indian women involved in the postmenopausal health issues, to discuss the differences in socioeconomic, nutritional and health status between Indian women from rural regions and those from urban regions and to discuss possible precautionary measures against the postmenopausal health issues. Prime methodology followed in composing the present review article is based on understanding the present scenario regarding the health status of postmenopausal Indian women by considering the various literature and statistics available on the topic.

Results: The changes that occur in a woman's body following menopause are deteriorative, and lead to several health issues. Though some of the health issues including amenorrhea, night sweats, frequent mood swings, cramp pains etc. which a woman experiences during the onset of menopause gradually decrease as her postmenopausal days progress, yet some new detrimental gradual changes occur in her physiological system during the postmenopausal periods.

Conclusion: Proper diet, improved lifestyle, self-care, slightest basic precautions and medical aids can help to minimise the ailments which worsen the life of a postmenopausal woman. Awareness and care for postmenopausal Indian women are extremely necessary for providing better life, improved health status and enhanced longevity to them (the mothers) leading to a healthy and developing society.

ARTICLE HISTORY

Received: March 05, 2017
 Revised: July 23, 2017
 Accepted: November 26, 2017

DOI:
 10.21955/0401000417120110025

Keywords: Menopause, Indian, women, post-menopause, health, nutrition.

1. INTRODUCTION

Average age of menopause for Indian women is 48 years to 55 years. In some women, early menopause occurs during the age of 45 to 50 years and in some other women, 'premature menopause' is observed which occurs naturally before 40 years of age. Studies reveal that postmenopausal women are at a high risk of several health issues which include osteoporosis, cardiovascular ailments, obesity etc. There are some studies on the postmenopausal health status of women from different parts of the world but there is not much report from South East Asian countries. Due to increasing population in India, the number of postmenopausal women is also rising in India. Thus postmenopausal women health issues seek major attention in India [1]. Numerous menopausal symptoms are observed in women from different parts of India [2, 3]. Postmenopausal

health issue culminates to two or three prime ailments which include decrease in bone density, heart problems and some psychological issues. Studies conducted on women of Northern part of India shows that the average age of menopause was 44 to 54 years. The primary postmenopausal health issues observed in North Indian women were reported to be arthritis and hypertension [2]. Rural women are the most ignored and they suffer severely the menopausal and postmenopausal health issues. Also there are not many studies on the postmenopausal health problems of rural women of India, though they constitute the majority of Indian women population. Few studies conducted on rural postmenopausal women pose a need for of more such studies necessary specially on rural women in order to address the health needs of postmenopausal women and to include certain important components in National health Programs [1]. Though there are some studies but they primarily focused on assessing and understanding the health status of menopausal women [4]. But actually the phase of menopause lasts for few years while postmenopausal phase and its allied health issues are carried by women till death

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A Discrete-Time $GI^X/Geo^Y/1$ Queue with Early Arrival System

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Abstract

A discrete-time batch service queue with batch renewal input and random serving capacity rule under the late arrival delayed access system, has recently appeared in the literature (Barbhuiya and Gupta in Queueing Syst 91(3):347–365, 2019b). In this paper, we consider the same model under the early arrival system, since it is more applicable in telecommunication systems where an arriving batch of packets needs to be transmitted in the same slot in which it has arrived. In doing so, we derive the steady-state queue length distributions at various epochs, and show that in limiting case the result gets converted to the continuous-time queue (Barbhuiya and Gupta in J Differ Equ Appl 25(2):1–10, 2019a). We discuss few numerical results as well.

Keywords Batch arrival · Discrete-time queue · Early arrival system · Renewal process

Mathematics Subject Classification 60K25 · 90B22

Introduction

The continuous-time batch-arrival and batch-service $GI^X/M^Y/1$ queue has been studied in the past by Economou and Fakinos [9] and Cordeau and Chaudhry [8]. Whereas, the former gave the probability generating function (pgf) of the system content distribution at points of arrivals, the later inverted the pgf given in Economou and Fakinos [9] using roots method. Recently, Barbhuiya and Gupta [3] revisited the work done in Economou and Fakinos [9] and Cordeau and Chaudhry [8] and proposed a different methodology for the analysis based on difference equation technique, which is analytically as well as computationally tractable.

Observing the limitations of continuous-time queue in modeling digital communications, computer networks, tele-traffic processes and many more (see for example, Baetens et al. [1,2]), very recently, Barbhuiya and Gupta [4] considered the theoretical and computational

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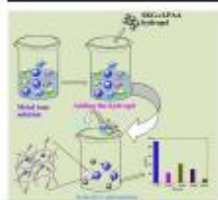
Removal of vanadium (IV) from water solution by sulfated Katira gum-cl-poly (acrylic acid) hydrogel

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GRAPHICAL ABSTRACT



ARTICLE INFO

Keywords:
Hydrogels
Hydrogel
Adsorption
Vanadium (IV) ion
Katira gum
Acrylic acid

ABSTRACT

A novel, highly anionic hydrogel, sulfated katira gum-crosslinked-poly(acrylic acid) (SG-C-PAA) was prepared by sulfation of katira gum-crosslinked-poly(acrylic acid) (KG-C-PAA) hydrogel using chlorosulfonic acid (ClSO_3H) in presence of anhydrous pyridine and formamide. Both the hydrogels KG-C-PAA and SG-C-PAA were characterized by FTIR, IR, and SEM studies. Swelling characteristics the hydrogels were studied and maximum equilibrium swelling ratio (ESR) was found to be 227% for the SG-C-PAA and 224% for KG-C-PAA at pH 5.5 and at 30 °C. The hydrogels were used for the adsorption of V (IV) ion from aqueous solution. Adsorption dynamics, kinetics and isotherms for adsorption were also evaluated. Selectivity of the adsorption of V(IV) ion with other competitive metal ions are evaluated. Equilibrium adsorption data were well fitted with the Langmuir isotherm model and maximum monolayer adsorption capacity was found to be 502 mg g^{-1} for SG-C-PAA and 454 mg g^{-1} for KG-C-PAA. Kinetic data were well explained by pseudo second order kinetic model. The negative value of ΔG° confirmed that adsorption of V (IV) ions onto the SG-C-PAA was spontaneous and favourable. The positive value of ΔH° indicated that the adsorption of V (IV) ion onto SG-C-PAA is endothermic in nature. Electrostatic attractions are mainly responsible for the adsorption.

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<https://doi.org/10.1016/j.colsurfa.2019.01.017>

Received 5 November 2018; received in revised form 1 January 2019; Accepted 9 January 2019

Available online 11 January 2019

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Contents lists available at ScienceDirect

Biocatalysis and Agricultural Biotechnology

journal homepage: <http://www.elsevier.com/locate/bsab>

Bioactive polysaccharides from natural sources: A review on the antitumor and immunomodulating activities

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ARTICLE INFO

Keywords:
Mushrooms
Fungi
Polysaccharides
Bioactivities

ABSTRACT

Polysaccharides are a structurally diverse group of biological macromolecules of well-known occurrence in nature. The mushroom, plant and other polysaccharides draw a lot of attention due to their several different biological properties, such as, anticancer, antiviral, immunomodulating, antimicrobial, antitumor, antidiabetic, antioxidant, and antitumor activities. Several bioactive glycans and heteroglycans were isolated from different mushroom, plant and bacterial cell wall. Polysaccharides have highest ability for carrying biological information compared with other biopolymers such as proteins and nucleic acids due to the structural variability. It is the focus of this review to bring together the available knowledge of the structure, and function of the different polysaccharides of the mushroom, plant and bacterial cell wall.

1. Introduction

The great bulk of the carbohydrates in nature are present as polysaccharides, which have relatively large molecular weights (Maity et al., 2014a, 2015; Xu et al., 2016). Polysaccharides have been produced as the first biopolymer on Earth (Tolmoguzaev, 2004). These biopolymers are complex carbohydrates and made up of monosaccharides joined together by glycosidic linkages (Maity et al., 2014b; Nandi et al., 2014; Shukhmanov et al., 2016). Their structures may be linear or they may contain various degrees of branching (Bhanja et al., 2013; Misra et al., 2017; Patra et al., 2012a). The high structural diversity reflects the functional diversity of these molecules (Maity et al., 2017; Meng et al., 2014; Wang et al., 2014). There is a clear correlation between allowed conformations and linking pattern (Li et al., 2018). For example, the chains in amylose tend to adopt single coiled helical (D.E.C. Cambridge, 2013) conformation while some (1 → 3)-, (1 → 6)-β-D-glucan chains adopt triple helical (Giese et al., 2013) conformation.

Polysaccharides exist in an enormous structural diversity as they are

produced by a vast variety of species; including microbes, algae, plants, and animals (Diazues and Morris, 2015; Ji et al., 2002; Ghosal et al., 2009; Karagasabapathy et al., 2011; Li et al., 2017a; Wu et al., 2006). They are able to offer the highest capacity for carrying biological information because they have the greatest potential for structural variability (Liu et al., 2014; Popov et al., 2007). Polysaccharide related technologies have played a leading role in the development of a wide range of products that include foods, pharmaceuticals, textiles, papers and biodegradable packaging materials (Licht et al., 2010; Wu et al., 2016a,b). The medicinal properties of mushrooms and plants have been confirmed through an intensive research conducted worldwide (Fan et al., 2012; Jiang et al., 2015; Oliveira et al., 2019). Different type of antioxidant, antitumor and immunomodulating polysaccharides were isolated from edible mushrooms, bacterial cell wall, and plants (Bhanja et al., 2012; Feng et al., 2016; Mandal et al., 2015; Patra et al., 2012b; Patra et al., 2013; Seidenle et al., 2008; Suo et al., 2016). These polysaccharides do not directly attack the cancer cells. They generate their antitumor effect indirectly, through stimulation of various defensive

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<https://doi.org/10.1016/j.bsab.2019.101425>

Received 3 October 2019; Received in revised form 6 November 2019; Accepted 7 November 2019

Available online 9 November 2019

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Simultaneous Electrochemical Sensing of *p*-Aminophenol and Hydroquinone by Using Grafted *Tricholoma* Mushroom Polysaccharide/Gold Composite Nanoparticles in Aqueous Media

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Herein, we report for the first time a novel electrochemical sensor for the simultaneous detection of *p*-aminophenol (*p*-AP) and hydroquinone (HQ) in aqueous medium using *Tricholoma* mushroom polysaccharide based graft copolymer-Au composite nanoparticles (TMPG-Au NPs). The graft copolymer is synthesised by radical polymerization technique in aqueous medium using a mixture of acrylamide (AA), acrylic acid (AA) and *Tricholoma* mushroom polysaccharide (TMP). Further, TMPG-Au NPs is prepared using the graft copolymer as a reducing as well as stabilizing agent by green technique.

The graft copolymer and TMPG-Au NPs are properly characterised. The detection of *p*-AP and HQ in aqueous medium is carried out by linear sweep voltammetry (LSV) and Chronoamperometry (CA) without interfering other common phenolic compounds and environmentally relevant metal ions. In LSV experiment the *p*-AP and HQ show clear and distinct oxidation peaks at 0.0814 V and -0.077 V respectively. The proposed sensor successfully detects *p*-AP and HQ with very low detection limit 0.41 μ M and 0.32 μ M respectively and effectively.

Introduction

Almost all phenolic compounds and their derivatives such as *p*-aminophenol (*p*-AP), hydroquinone (HQ) are widely used alone or in combination in several industrial fields like medicine, dye, petroleum, cosmetics, pesticides etc.^[1-4] These compounds are very much toxic in nature even at very less concentration^[5] affect respiratory system, skin, irritable to the eye and have sufficient teratogenic, nephrotoxicity effect.^[6,7] On the other hand *p*-AP and HQ are easily oxidised to quinone (Q) by consuming dissolve oxygen from the water medium. Therefore, if the industrial waste water containing *p*-AP and HQ mixed with water stream, lake and river water, they will decrease the oxygen level of water that affect to sustain the aquatic life. So, from the environmental point of view it is very necessary to detect the *p*-AP and HQ in aqueous medium.

Lots of technique are reported so far such as, gas chromatography,^[8] chemiluminescence,^[9] fluorescence spectroscopy,^[10] HPLC and electrochemical technique to detect *p*-AP and HQ separately.^[11-13] Among all, electrochemical method is more attractive due to its simple instrumentation,

low cost, fast response with outstanding sensitivity and selectivity. Although several works have been reported for the simultaneous detection of catechol (CC) and hydroquinone (HQ),^[14] *p*-AP and bisphenol^[15] but to the best of our knowledge the simultaneous electrochemical detection of *p*-AP and HQ in aqueous medium is not studied so far. Therefore, the establishment of a reliable, selective and simple experimental technique for the simultaneous detection of *p*-AP and HQ has great significance.

Over the last few years, the preparation of metal nanoparticles of different shape and size for various applications such as catalyst, toxic metal sensing, etc. is an important area of research in the field of material science.^[16-18] Although there are several methods for the synthesis of metal nano particles, chemical approach is the most popular among them. However, in the chemical methods various toxic chemicals are used that are adhered to the synthesised metal nanoparticles. Therefore, the preparation of metal nanoparticles by green technique are free from toxic hazardous chemicals and has gained much importance in several applications. Among the various nanoparticles, gold (Au) nanocomposites/nanoparticles are synthesised by green method as well as chemical method and their wide range of applications are also reported.^[19-21] Recently synthesis of various metal nanoparticles including Au by the use of polysaccharide based graft copolymer has gained considerable importance for various applications because of their eco-friendly in nature and has greater potentiality to act as reducing and capping agents.^[22,23] In the present investigation Au NPs are synthesised by green technique, using chemically modified TMP as a stabilizing and reducing agent. Mushrooms are the important source of various polysaccharides such as glucans, heteroglucans, chitin and hemicellulose

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Supporting information for this article is available on the WWW under
<https://doi.org/10.1002/nlcr.201901772>

PRODUCT OF BIPOLAR INTUITIONISTIC FUZZY GRAPHS AND THEIR DEGREE

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ABSTRACT. In this paper, bipolar intuitionistic fuzzy graphs with four operations namely Cartesian product, composition, tensor product, normal product are defined. Also, the degrees of the vertices of the resultant graphs which are obtained from two given bipolar intuitionistic fuzzy graphs G_1 and G_2 using the operations Cartesian product, composition, tensor product, normal product are determined.

Keywords: Bipolar intuitionistic fuzzy graph, Cartesian product, composition of graph, tensor product, normal product.

AMS Subject Classification: 05C72

1. INTRODUCTION

In 1965, Zadeh [30] represented the uncertainty as fuzzy subset of sets. Since then, the theory of fuzzy sets has become a vigorous area of research in different disciplines including medical and life sciences, management sciences, social sciences, engineering, statistics, graph theory, artificial intelligence, signal processing, multiagent systems, pattern recognition, robotics, computer networks, expert systems, decision-making, automata theory, etc. Graph theory has numerous applications to problems in computer science, networking routing, system analysis, electrical engineering, operations research, economics, transportation and many others. In many cases, some aspects of a graph-theoretic problem may be uncertain. The bipolar fuzzy sets have been explained by Zhang [31] in 1994. Zhang extended the fuzzy sets as bipolar fuzzy sets by assigning the membership value in the range $[-1, 1]$. In a bipolar fuzzy set, the membership degree 0 of an element means that the element is irrelevant to the corresponding property, the membership degree $(0, 1]$ of an element indicates that the element somewhat satisfies the property, and the membership degree $[-1, 0]$ of an element indicates that the element somewhat satisfies the implicit counter property.

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§ Manuscript received: March 14, 2017; accepted: April 24, 2017.

TWMS Journal of Applied and Engineering Mathematics Vol.9, No.2 © Iqk University, Department of Mathematics, 2019; all rights reserved.



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ScienceDirect

Nuclear Physics A 986 (2019) 98–106

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Astrophysical S-factor for deep sub-barrier fusion reactions of light nuclei

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Received 15 February 2019; received in revised form 18 March 2019; accepted 19 March 2019

Available online 29 March 2019

Abstract

The cross sections for deep sub-barrier fusion reaction of light nuclei are calculated within the theoretical framework of selective resonant tunneling model. In this model, assumption of a complex square-well nuclear potential is invoked to describe the absorption inside a nuclear well. The theoretical estimates for these cross sections agree well with the experimentally measured values. The features of the astrophysical S-factor are derived in terms of this model. Present formalism appears to be particularly useful for the low energy resonant reactions between two charged nuclei.

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Keywords: Sub-barrier fusion; Resonant tunneling; Nucleosynthesis; S-factor

1. Introduction

Nuclear reactions play a major role [1–3] in determining the structure of main-sequence stars, giant stars, supergiants, pre-supernovae and compact stars like white dwarfs and neutron stars and their evolution and nucleosynthesis they undergo as well as in various observational manifestations. Depending upon the density and temperature along with other parameters, stellar

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<https://doi.org/10.1016/j.nucphysa.2019.03.010>

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Contents lists available at ScienceDirect

Superlattices and Microstructures

journal homepage: www.elsevier.com/locate/superlattices

Effect of the presence of trap states in oxides in modeling gate leakage current in advanced MOSFET with multi-oxide stack

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ARTICLE INFO

Keywords:
MOSFET
Trap assisted tunneling
Fowler-Nordheim tunneling
Quantum confinement
Quantum well
Density of states
Tunneling probability
WKB approximation

ABSTRACT

A model of trap assisted tunnelling due to the presence of trap states distributed over the oxide and at the interface has been introduced to develop a complete analytical model for gate tunneling current in advanced nano-scale MOSFET in addition to the ideal direct tunneling current with double layer silicon oxide-titanium Oxide stack used as gate dielectric. Trapping-detraping of charge carriers is mostly subjected to multiphonon transitions and thus is dependent on temperature, gate bias and the distribution of trap states across oxide. Relative contribution of the direct tunneling and trap-assisted tunneling has been estimated even in the Fowler-Nordheim regime. The assumption of simplified parabolic energy band dispersion with proper boundary conditions in Wentzel-Kramers-Brillouin (WKB) effective mass approximation is employed to determine the probability density of electrons at different materials throughout the MOS structure. It is then modulated by the tunneling probability to estimate the total amount of tunneling current as a function of effective oxide thickness and gate-biasing.

1. Introduction

To cope with the gate leakage in nano-scale MOS devices multi-oxide or oxide-nitride-oxide stack are increasingly being used as gate dielectric [1–4]. Usually different high dielectric constant rare earth oxides like La_2O_3 , ZrO_2 , HfO_2 are used along with ultrathin SiO_2 layer. High ionic radius of the rare earth materials generates lattice stress at the hetero-interface that creates deep level surface states and also these oxides in normal condition are grown with oxygen vacancies almost uniformly distributed over the bulk. These surface states and defect sites act as charge trap centers. The trap states are distributed deep inside the energy gap of the oxide thereby enabling transition of electrons from inversion region to the trap centers, the probability of which is determined by the traps distribution both in energy space and on their physical locations. The diffusion of electrons through traps involves multiple hopping transitions often come with phonon assistance [5]. Conduction of electrons via traps through hopping is percolation limited and will be dependent on trap distribution. This belies the purpose of using rare earth oxides of larger thickness in controlling gate leakage current. It is not only important for other applications of MOS and power loss but very important for retention time degradation in EPROM and Flash Memories [6]. For simplification, most of the models to determine trap assisted leakage current assume a constant capture cross section for all the trap states [7–9]. But the traps are located at different distances from the interface and at different energy values and hence they should have different capture cross sections. Since the flat-band voltage due to Fermi level mismatch and the gate biasing voltage almost appear across the high relative oxide region, position of the traps at different distances from the

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Received 15 January 2019; Received in revised form 24 February 2019; Accepted 18 March 2019

Available online 23 March 2019

0749-6036/ © 2019 Published by Elsevier Ltd.



iSleep: thermal entropy aware intelligent sleep scheduling algorithm for wireless sensor network

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Received: 1 March 2019 / Accepted: 26 November 2019
© Springer-Verlag GmbH Germany, part of Springer Nature 2019

Abstract

The optimal operation of Wireless Sensor Network (WSN) requires a sustainable topology. A dead node may result in a breach of end-to-end connectivity in the network. The thermal sensitivity of any sensor affects the lifetime of the node. Every sensor node has a typical operating temperature zone. Beyond the operating temperature threshold, the system reduces the performances and consequently forms a disconnected network. Network entropy represents the evaluation of the anisotropy of the temperature distribution profile of the system that measures the network stability. In this work, an intelligent sleep scheduling algorithm ‘iSleep’ is proposed based on available neighboring nodes, associated network entropy, and traffic flow pattern. iSleep enables the sensor nodes to auto-control the sleep state of the nodes and maintain network connectivity for a longer amount of time. The proposed algorithm is tested for numerous representative networks on MATLAB 2016a and the Cooja simulator on Instant Contiki-2.7 with two energy models of Tr mote Sky and Zolertia Z1. It is found that the proposed algorithm outperforms the existing scheduling algorithms in terms of the lifetime of a network for both the energy models.

1 Introduction

Research and industrial applications show that the functions of Wireless Sensor Networks are considerably affected by the onboard temperature of the nodes. The sensors nodes are randomly deployed for outdoor applications. They are subject to work in a high, low or fluctuating temperature environment. The on-board temperature of the nodes varies according to this thermal exposure and results in a characteristic curve depicted in Fig. 1. Temperature variations significantly affect clock

drift (Hasler et al. 2008), battery capacity (Park et al. 2005), and the quality of wireless links (Barnister et al. 2008). Change in clock drift affects the latency of the nodes, while the quality of wireless links degrades with an increase of temperature of the sensors and a quantitative account is given in (Barnister et al. 2008).

The sensors in WSN are usually randomly deployed in a wide application region and remain unattended for a long period. The nodes come across direct interaction with the environmental parameters. Exposure to sunlight, diurnal and seasonal variation of temperature, moisture content of air and others affect the usual functioning of the sensor nodes (Hati et al. 2019; Boano et al. 2014; Beutel et al. 2011; Sun and Cardell-Oliver 2006). Figure 1 shows the on-board temperature variations of sensor nodes deployed outdoor. All these nodes are within each other’s transmission range and experience highly different temperatures. The values are recorded over the course of a summer day by Sun and Cardell-Oliver (2006). Figure 2 shows the experimental result of the variation of Packet Receive Ratio (PRR) with temperature. It is observed that as and when there is an increase in temperature, PRR has been recorded low. Added to this, the temperature of a sensor node increases due to Joule heat generation in the electronic or electrical circuitry of the nodes. The heat

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RL-Sleep: Temperature Adaptive Sleep Scheduling using Reinforcement Learning for Sustainable Connectivity in Wireless Sensor Networks

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ARTICLE INFO

Article history:
 Received 5 March 2019
 Received in revised form 11 January 2020
 Accepted 15 February 2020
 Available online 20 February 2020

Keywords:
 Temperature
 Intelligent sleep scheduling
 Heterogeneous wireless sensor network
 Reinforcement learning
 Energy

ABSTRACT

Temperature variations have a significant effect on the sustainable operation of the power-constrained wireless sensor networks. The characteristics of wireless communication links deteriorate considerably with increase of temperature. Proactive measures may not always perform well in a dynamic environment where both the wireless links and sensor nodes are supposed to behave unexpectedly. Environment adaptive efficient sleep-schedule strategy can preserve the resources of the low power sensor nodes and thereby alleviate the adverse effects of temperature. In this paper, temperature adaptive intelligent sleep-scheduling strategy (RL-Sleep) for the wireless sensor nodes has been proposed. This algorithm is based on Reinforcement Learning which enables a node in the network to perceive the environment and decide autonomously about the action (transmit, listen or sleep) conducive for a stable operation of the network. Simulation results exhibit a good performance of the proposed approach in terms of sustainable operations of the network and connectivity.

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1. Introduction

Wireless Sensor Networks (WSN) comprise of a number of battery-powered nodes capable of sensing, data processing and low range communication. These nodes are deployed for performing very specific tasks for a particular application in the region of operation. Usually, the sensor nodes are randomly deployed for outdoor applications. They are supposed to work in a fluctuating temperature environment for a long period without any manual intervention. Temperature variations significantly affect clock drift [1], battery capacity [2], and the quality of wireless links [3]. Each of the parameters influences the performance of the WSN with respective characteristics. A random clock drift causes a lack of synchronization among the nodes. A downgraded battery capacity leads to a reduced node-lifetime. Poor link quality results in unpredictable data loss.

The sensor nodes are equipped with sensing module, processor unit and transceiver unit such that the nodes can sense the

surroundings, process the data and communicate the processed data to the designated sink. Communication and data processing are the two major causes of energy consumption in sensor nodes. Temperature also results in significant energy loss when the sensor nodes are deployed outdoor under direct sunlight. Prolonged solar exposure causes higher local temperature variation. Therefore, the nodes that are placed in direct sunlight perform differently from their identical peers placed in shadow.

Nodes are subject to traffic adaptive working schedule depending on the relative position of the nodes in the network. A node with a dense neighbourhood is supposed to experience more traffic than a node with sparse neighbourhood. A busy node placed in direct sunlight for a long time experiences a high increase in local temperature. This elevated temperature results in deterioration of performance of the network. Some of the affected properties are Received signal strength (RSS), packet-delivery-ratio (PDR), expected transmission delay (ETX) of a network, node lifetime. The correct operation of the network depends on the coordinated functioning of the nodes. Temperature-dependent variation of transmission range affects the neighbourhood of the nodes. A dense neighbourhood may lead to unnecessary traffic for a node while communication in a sparse neighbourhood is a challenge for the node. An optimal sleep/awake strategy of the nodes makes a trade-off between these two extreme situations. The sleep sched-

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FLUORIDE AND BRAIN: A REVIEW

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Keywords:

Brain, Fluoride, Metabolism,
Neurotransmitters, Oxidative stress,
Brain diseases, Blood-brain barrier

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ABSTRACT: The mammalian central nervous system is composed of the brain and spinal cord. The brain is protected by the blood-brain barrier (BBB) that allows selective traffic of substances into the brain. Fluoride is a highly toxic and reactive element. We get exposed to fluoride due to its common use in toothpaste, dental gels, non-stick pans, razor blades, etc. Fluoride also enters our food chain through fishes that are cultivated in water bodies, which get contaminated with fluoride from running water from farms around it. Fluoride can accumulate on our body and cause toxic effects. In the context of fluoride, it is reported that fluoride exposure causes various toxic effects in our body, including the central nervous system as well. Fluoride is known to cross the blood-brain barrier and enter our brain tissue. It interferes with the normal metabolic process of the brain, generates free radicals and causes various toxic effects therein. Fluoride has been found to be linked to various pathogenic conditions of the brain as well. In this review, we have discussed the effects of fluoride on the different parts of the brain and the remedies in use.

INTRODUCTION: Fluoride, the extremely electronegative halogen in the periodic table, is a natural contaminant that coexists as compounds with other microelements in lateritic soil and rocks percolating in groundwater and freshwater of many regions across the world. In India, many regions have been summoned as fluoride endemic. In those areas, the human population is at risk of developing fluoride toxicity and so also fluorosis¹. Fluoride not only enters the physiological system through drinking water but also through fortified health products and food chains, including plant sources, animals, and fishes².

Fluoride is usually absorbed through the gut and enters the circulation where some amount is accumulated in hard and soft tissues, remaining being excreted by the kidneys. Excess fluoride, however, accumulates in blood cells, soft tissues, and hard tissues leading to systemic disorders. Bones and teeth being maximally affected and visual change of skeletal fluorosis and dental fluorosis may be observed³.

Soft tissues exhibit histopathological as well as functional alterations probably because of fluoride mediated free radical generation, buckling of antioxidant enzyme activities, and second messenger pathway interference, ultimately leading to cellular damage and death. It is well known that vital organs such as liver, kidneys, lungs, heart, including coronary arteries, are some important sites of high fluoride accumulation⁴. However, the brain has now also been recognized as an organ for high fluoride build-up⁵.

QUICK RESPONSE CODE



DOI:
10.13040/IJPSR.0975-8232.11(5).2011-17

This article can be accessed online on
www.ijpsr.com

DOI link: [http://dx.doi.org/10.13040/IJPSR.0975-8232.11\(5\).2011-17](http://dx.doi.org/10.13040/IJPSR.0975-8232.11(5).2011-17)



IJCRR
Section: Healthcare
Sci. Journal Impact
Factor: 6.1 (2019)
ICV: 98.99 (2019)
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A Current Review on the Pathogenesis and Treatments of Vitiligo

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ABSTRACT

Vitiligo is recognized as an acquired autoimmune depigmentation disorder. Normally, the disease occurs before forty years of age but it has been reported to be affecting people irrespective of age and sex. Body produces antibodies against melanocytes and destroys them. As a result, white patches appear in the body. Vitiligo may be segmental or non-segmental. Objectives of this review article is to understand the underlying mechanism of occurrence of vitiligo, brief an updated information about the available treatments and the possible precautionary measures against vitiligo. All available literature about vitiligo and its treatment procedures were studied and thus all available information has been reviewed and briefed in this article to represent a compact scenario of the pathogenesis and treatments of vitiligo to make the understanding of the disease clear. Vitiligo has significant social and psychological impacts and physiological adverse effects like hypopigmentation or depigmentation in the patient. The social and psychological impact that the disease brings with it is severe in most cases. Vitiligo is not completely curable but treatments include topical corticosteroids, immune-modulators, and UV therapy which causes repigmentation of white patches, micro pigmentation etc.

Key Words: Autoimmune, Depigmentation, Hypopigmentation, Melanocytes, Vitiligo

INTRODUCTION

Vitiligo is an autoimmune disorder in which depigmentation of the skin occurs and white patches appear in different parts of the body. In vitiligo, both humoral and cell-mediated immune system work hand in hand and destroy melanocytes.¹ Several studies have been conducted all around the world to understand the etiology of the disease. It is possible to fight back disease or find out an effective defence against any particular disease only and only if the detailed causative mechanism of the disease is comprehended. So far, considerable progress has been made in understanding the vitiligo and underlying mechanism of the disease. Investigations have revealed various causes and mechanism of occurrence of the disease. The disease has been surely recognized as an autoimmune disorder. It is a chronic pathological condition. Currently, vitiligo has been topographically classified into segmental, zosteriform & nonsegmental, areata, vulgaris, acrofacialis and mucosal.² Some people experience itching before a new patch appears.³ Studies show that white patches of vitiligo are often surrounded by a prominent pigmented

border which is termed as the 'trichrome vitiligo'.² Vitiligo has been found to have morphological variations. The various morphological variations of vitiligo are trichrome, quadri-chrome, penta-chrome, blue and inflammatory vitiligo.² There is no specific treatment to cure the condition. But there are some medicines and ointments that can restrict the spread of the white patches. Around 1% of people around the world is the victim of vitiligo.³ Studies have shown that stress to melanocytes leads to vitiligo.⁴ Mechanical stimulus or chemical exposure or sunburn may induce stress to melanocytes thus altering their normal physiology. This initiates a cascade of the autoimmune response in which body destroys melanocytes. As a result of this, white patches appear. Nowadays oxidative stress is linked with triggering the autoimmune response which is responsible for the occurrence and spread of vitiligo.⁵ 90% of vitiligo patients studied were found to have higher activity of superoxide dismutase (SOD) enzyme compared to normal people establishing the involvement of oxidative stress in vitiligo.⁴ Oxidative stress may also simulate the targeting of melanocyte by promoting antigen presentation.⁶ Interleukin (IL)-17-mediated responses and Interferon

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ISSN: 2231-2196 (Print) ISSN: 0975-5241 (Online)

Received: 21.05.2020

Revised: 13.07.2020

Accepted: 03.10.2020

Published: 12.11.2020



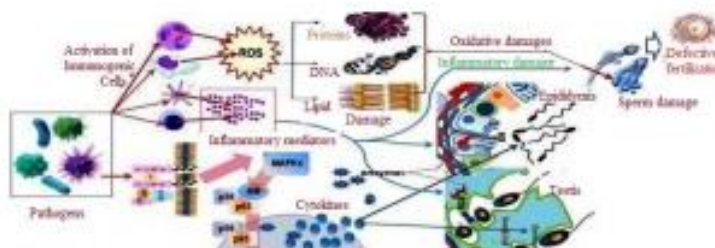
Current perspectives of Male Infertility induced by Immunomodulation due to Reproductive Tract Infections

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Submitted on: 26-Dec-2019, Accepted on: 27-Feb-2020 and Published on: 16-Mar-2020

ABSTRACT



Globally, approximately 15% of couples of reproductive ages suffer from reproductive sterility. Almost half of such cases involve male sterility which is normally an asymptomatic condition, and, in most cases, the condition is reversible with proper treatment. Uropathogens and ascending sexually transmitted infections (STIs) are recognized as one among many other causes of inflammatory diseases of male genital tract which in turn are common reason of male infertility. Thus, any suspicion of inflammatory infection of the male genital tract should be immediately diagnosed followed by further clinical evaluation in order to rule out any pathogenic situation due to infection of male genital tract which can lead to male sterility. Proper recognition and timely treatment can help to overcome such problems.

Keywords: ascending sexually transmitted infections, infertility, inflammatory diseases, reproductive sterility, uropathogens

INTRODUCTION

Incidence of male infertility is showing an increasing trend and is above 50% globally. Male urinary tract infection accounts for 10% cases of male infertility.¹ The pathogens including bacteria, virus, fungi and parasites have their individual distinct pattern for building up such problems. These

organisms affect organs like the testis, epididymis and accessory sex glands. The infections may be acute or chronic and is known to affect male fertility adversely. Production of normal and healthy sperm is one of the prime determining factors of male fertility. The process of spermatogenesis is regulated by various factors and their synchronization. Presence of pro-inflammatory cytokines, tumor necrosis factor-alpha (TNF- α), interleukin-1 alpha (IL-1 α) and interleukin 1 beta (IL-1 β) cytokines in normal level in the male reproductive tract (testis, epididymis and sperm) are necessary for normal physiological functions. Infection and inflammation of the male genital tract causes production of several proinflammatory factors in profuse which is higher than their normal physiological level and is very harmful for production of sperm.² Thus, infection and inflammation of the male reproductive tract deteriorates the spermatozoa function,

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Cite as: Chem. Biol. Lett., 2020, 7(2), 85-91.
DOI:10.26434/chem.lett.2020.7.08

© ScienceIn Publishing ISSN: 2347-4625 <http://www.sciencein.org/hi>



Contents lists available at ScienceDirect

International Journal of Biological Macromolecules

journal homepage: <http://www.elsevier.com/locate/ijbiomac>

Structural studies of immunomodulatory (1 → 3)-, (1 → 4)- α glucan from an edible mushroom *Polyporus gramocephalus*

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ARTICLE INFO

Article history:

Received 11 July 2020

Received in revised form 13 November 2020

Accepted 17 November 2020

Available online xxxxx

Keywords:

Polyporus gramocephalus

NMR studies

Immunostimulation

ABSTRACT

A water soluble polysaccharide (PGPS) with molecular weight $\sim 1.4 \times 10^5$ Da was isolated by alkali treatment from an edible mushroom *Polyporus gramocephalus* and purified by gel chromatography using sepharose-6B column. Monosaccharide analysis revealed that PGPS was made up of glucose only. PGPS contained (1 → 3)- α -D-GlcP and (1 → 4)- α -D-GlcP moieties in a molar ratio of nearly 1:2. Through a series of chemical and spectroscopic (1D/2D NMR) investigations, the repeating unit of the glucan was established as:

$\rightarrow 3\text{-}\alpha\text{-D-GlcP}(1 \rightarrow 4)\text{-}\alpha\text{-D-GlcP}(1)_{n-1}$

This α -glucan was observed to stimulate some prime components of immune system, namely, macrophages, splenocytes, and thymocytes.

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1. Introduction

Mushrooms are attractive functional food and also considered as an important renewable source for the development of immune-active drugs [1]. Mushroom polysaccharides, especially glucans have become a prime theme of research for immunobiologists due to their immunomodulatory and antitumor properties [2–7]. Numerous bioactive β -D-glucans with diversified structural features have been isolated from edible mushrooms [8–10]. Apart from the β -D-glucans, various linear and branched α -D-glucans have also been reported. Linear (1 → 3)- α -D-glucan from *Armillariella tabescens* [11] and *Termitomyces microcarpus* [12], (1 → 6)- α -D-glucan from *Termitomyces eurhizus* [13] and *Pleurotus florida* [14], (1 → 3)-, (1 → 6)- α -D-glucan from *Termitomyces eurhizus* [13], (1 → 4)-, (1 → 6)- α -D-glucan from *Agericus blazei* [2,15] and *Tricholoma matsutake* [16] have been reported to show their immunomodulating and antitumor activities. A branched α -D-glucan having α -(1 → 4)- α -glucopyranosyl main backbone chain with (1 → 6)- α - α -glucopyranosyl side chain has been identified from the fruiting bodies of *Coprinus comatus* [17]. Moreover, linear glucans containing both α - and β -glycosidic linkages such as α -(1 → 4),

β -(1 → 6)-D-glucan from *Astraeus hygrometricus* [18] and α -(1 → 4), β -(1 → 3)-D-glucan from *Termitomyces microcarpus* [19] have also been reported.

Polyporus gramocephalus is an edible mushroom commonly found in the hill areas of West Bengal, India. It generally occurs on dead hard wood causing white rot and occasionally growing as a parasite on living trees. *Polyporus gramocephalus* contains 20.6% of protein, 41.11% of carbohydrate, 24.62% of crude fibre, 8.75% of free amino acids, 2.03% of fat and sufficient amount of important minerals such as calcium, potassium and phosphorus, etc. [20]. As claimed by a published report, *P. gramocephalus* contains essential oils, phenols, terpenes, steroids, fatty acids, sugars, anthraquinones, coumarins, anthrones, tannins, flavonoids, and alkaloids [21]. So, it can be considered as an excellent and safe dietary component. *P. gramocephalus* is also known to show significant antioxidant, antimicrobial and NOS activation properties [22,23]. Different solvent extracts of *P. gramocephalus* showed cytotoxic and chemo protective effects [21,24]. Bioactive components isolated from certain *polyporus* species like *P. confluence*, *P. umbellatus*, *P. sulphureus*, *P. badus*, and *P. sclerotium* have been reported to exhibit antitumor, immune-enhancing, antibacterial, anti-inflammatory, antiviral, anti-aldosterone & diuretic effects [25–29]. The present article deals with an immunoenhancing (1 → 3)-, (1 → 4)- α -glucan which was isolated from the alkaline extract of the fruit bodies of *Polyporus*

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Medium effects on the electrical and Hall conductivities of a hot and magnetized pion gas

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 (Received 8 June 2020; accepted 21 September 2020; published 15 October 2020)

The electrical and Hall conductivities in a uniform magnetic field are evaluated for an interacting pion gas using the kinetic theory approach within the ambit of relaxation time approximation. The in-medium cross sections *via* ρ - ρ *via* the relaxation time for $\pi\pi$ scattering are obtained using a one-loop modified thermal propagator for the exchanged ρ and σ mesons using thermal field theoretic techniques. For higher values of the magnetic field, a monotonic increase of the electrical conductivity with the temperature is observed. However, for a given temperature, the conductivity is found to decrease steadily with magnetic field. The Hall conductivity, at lower values of the magnetic field, is found to decrease with the temperature more rapidly than the electrical conductivity, whereas at higher values of the magnetic field, a linear increase is seen. Use of the in-medium scattering cross section is found to produce a significant effect on the temperature dependence of both electrical and Hall conductivities compared to the case where the vacuum cross section is used.

DOI: 10.1103/PhysRevD.102.076007

I. INTRODUCTION

The study of strongly interacting matter in the presence of a background magnetic field has significant applications in many physical systems (see Ref. [1] for a review). In noncentral heavy ion collisions (HICs) at the RHIC and LHC, strong magnetic fields of the order of $\sim 10^{18}$ G [2,3] or larger may be generated due to the collision geometry. Note that in natural units, 10^{18} G $\approx m_\rho^2 \approx 0.02$ GeV². Thus, the fields produced in HICs are comparable to the QCD scale, i.e., $eB \approx m_\rho^2$, and hence, it can noticeably influence the deconfined medium of quarks and gluons known as quark-gluon plasma (QGP). This has motivated a large number of investigations on the properties of hot and

dense QCD matter in the presence of a background magnetic field in recent times involving several novel and interesting phenomena such as chiral magnetic effect [2,4–6], magnetic catalysis [7–11], and inverse magnetic catalysis [12,13] of dynamical chiral symmetry breaking which may cause significant change in the nature of electroweak [14–17], chiral, and superconducting phase transitions [18–21], electromagnetically induced superconductivity and superfluidity [22,23], and many more. In addition to heavy ion collisions, such magnetic fields of the order of $\sim 10^{15}$ G can also be realized on the surface of certain compact stars called *magnetars*, while in the interior it is estimated to reach magnitudes of the order of $\sim 10^{18}$ G [24–26]. Cosmological model calculations, in fact, predict that during the electroweak phase transition in the early Universe, extremely strong magnetic field as high as $\sim 10^{23}$ G might have been produced [27,28].

The estimation of transport coefficients of relativistic systems in the presence of a magnetic field is important in the context of magnetized neutron stars, cosmology, and relativistic HICs. In the case of HICs, transport coefficients such as the shear and the bulk viscosities and the diffusion coefficients are essential to describe the hydrodynamical evolution of the matter transiently produced in such collisions. In the presence of a magnetic field, this evolution is described by magnetohydrodynamics

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Contents lists available at ScienceDirect

Journal of Transport & Health

journal homepage: <http://www.elsevier.com/locate/jth>



Traveler as a risk factor for migration of COVID-19 in India

ARTICLE INFO

Keywords:
COVID-19
SARSCoV-2
Traveler
Prevention

To the Editor,

Today, one of the most dangerous health issues is the wide outbreak of COVID-19 infection. An outbreak of coronavirus disease 2019 (COVID-19) caused by the 2019 novel coronavirus (SARS-CoV-2) began in the city of Wuhan in China and has widely spread worldwide (Wang et al., 2020; Huang et al., 2020). More than 200 countries and territories all around the world have confirmed imported cases of SARS-CoV-2 infection (<https://www.who.int/>, 2020), and the disease (COVID-19) has been declared as a Public Health Emergency of International Concern (PHEIC). Major initial symptoms of COVID-19 include fever, cough, muscle & joint ache, soreness of throat, and dyspnea (Tan et al., 2020; Zhu et al., 2020). Some patients showed typical symptoms, such as diarrhea and vomiting, while some remained asymptomatic. Considering the massiveness of transmissibility of the disease the World Health Organization has declared it a pandemic, and till date, 10.04.2020, it has affected around 1439,516 people in more than 200 countries and territories resulting over 85,711 deaths (MoHFW, 2020; Worldometer, 2020; <https://www.mogov.in/covid>, 2020). The WHO has declared the coronavirus pandemic as a global health emergency.

International and national flight ticket sales have increased significantly over the past decade. COVID-19 remains one of the most important health problems encountered by travelers to developing countries, the risk being widespread throughout the world. India is the neighboring country of China. In many Indian students are going to different Universities in China for studies. All these students are returned home in air travel due to outbreak of COVID-19 in China. A total of 650 people were brought back from Wuhan in China on 1st & 2nd February 2020 by two 747 Boeing Air India aircrafts after the massive outbreak of the novel Coronavirus in China. More than 500 people from COVID-19 stricken Italy were also airlifted.

The population of India is 138.2 crores and it is the second most populated country in the World (after China) with a population density of nearly 464 per square kilometer (Worldometer). The first case in India confirmed in Kerala's Thrissur district when a student had returned home from Wuhan University in China. According to the up to date report of the Ministry of Health, Govt. of India, there are a total of 5709 confirmed COVID-19 affected cases in India which includes 47 foreign nationals. 504 of them have been discharged, while 199 have deceased (MoHFW, 2020; Worldometer, 2020; <https://www.mogov.in/covid>, 2020). COVID-19 was spread rapidly human-to-human transmission either via respiratory droplets or via contact. India is therefore at high risk of COVID-19 transmission, and in order to prevent spreading of the disease the Govt. of India has taken some preventive actions (<https://boi.gov.in/content>), such as:

- All the 34 international airports in India have been equipped with thermal scanners and it was decided that all the flights coming from China or other Countries would be scanned and suspicious passengers would be quarantined compulsorily for a minimum period of 14 days.
- A maximum travel time of 20 hours would be permissible for such commercial passenger aircraft to land in India.

<https://doi.org/10.1016/j.jth.2020.100915>

Received 10 April 2020; Received in revised form 8 July 2020; Accepted 17 July 2020

Available online 21 July 2020

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Contents lists available at ScienceDirect

Environmental Nanotechnology, Monitoring & Management

Journal homepage: www.elsevier.com/locate/enmm

Green synthesis of Ag@Au bimetallic composite nanoparticles using a polysaccharide extracted from Ramaria botrytis mushroom and performance in catalytic reduction of 4-nitrophenol and antioxidant, antibacterial activity

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ARTICLE INFO

Keywords:
Ag@AuCNPs
Antioxidant properties
Antibacterial activity

ABSTRACT

An eco-friendly synthetic procedure was used to prepare silver-gold bimetallic composite nanoparticles (Ag@AuCNPs) using a mixture of aqueous solutions of silver nitrate, chloroauric acid and Ramaria botrytis mushroom polysaccharide (RBPB) at 80–85 °C in water medium. The synthesized Ag@AuCNPs were characterized by using UV–vis spectroscopy, X-ray diffraction (XRD) analysis, high resolution transmission electron microscopy (HRTEM), field emission scanning electron microscopy (FESEM), energy dispersive X-ray spectroscopy (EDAX) and X-ray photoelectron spectroscopy (XPS). The synthesized Ag@AuCNPs showed potential antioxidant activities towards DPPH radical, NO[•] radical, hydrogen peroxide scavenging assays and ferric ion reducing assay. Besides that Ag@AuCNPs showed powerful antibacterial activity towards a gram negative bacterium *Pseudomonas aeruginosa* (ATCC 16244). Catalytic activity of Ag@AuCNPs was tested by considering 4-nitrophenol reduction as a model reaction in aqueous medium at room temperature using UV–vis spectroscopy. The catalyst concentration was varied to find out the optimum conditions. The rate constant was evaluated by using pseudo first order kinetic model. The prepared nanoparticles showed a good catalyst towards p-nitrophenol reduction, a good antioxidant and a moderate antibacterial agent towards *Pseudomonas aeruginosa*. These observations signify that such green method opens up new avenues in nano biotechnology for the synthesis of nanoparticles with immense industrial and biomedical applications.

1. Introduction

Bimetallic nanoparticles have gained tremendous attention compare to monometallic components due to their enhanced physical properties such as size, shape, surface morphology etc. (Jiao et al., 2002; Ghosh Chandhkar and Paris, 2012). The unique surface characteristics of bimetallic composite nanoparticles provide wide variety of potential applications in sensing (Mondal et al., 2008), catalysis (Fu et al., 2008; Tripathy et al., 2017), antioxidant (Vaz et al., 2001; Swamy et al., 2015), antimicrobial (Kalya et al., 2015a,c; Banerjee et al., 2011; Kalya et al., 2015a,b), anticancer (Ghosh et al., 2015a,b) and anti-diabetic activities (Ghosh et al., 2015a,b) etc.

Antioxidant resistance prohibits the body from the destructive effect of free radicals which are generated as by-products during normal metabolism (Wickens, 2001). Several cellular metabolisms evolve

reactive oxygen species (ROS) which are present as radical and non-radical forms and are generated by the partial reduction of oxygen (Gil and Tuteja, 2010a,b). Lower amount of ROS are required for cellular processes like cell defence, cell progression, whereas higher amount of ROS or lower efficiency of antioxidant system to control ROS levels causes oxidative stress (Slovak et al., 2007).

Chemically synthesized antibiotics inhibit bacterial growth and survive living cell from harmful diseases but most of those antibiotics have bad side effects and expensive, hence a unique way of developing antibacterial agents is a growing field of attraction now a day's (Gil and Tuteja, 2010a,b). In these fields of applications, bimetallic composite nanoparticles derived from natural products have promising applications. Now a day, new antibacterial agents consisting of bimetallic nanoparticles have gained enormous interest in that biological research field.

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<https://doi.org/10.1016/j.enmm.2020.100341>

Received 30 April 2020; Received in revised form 25 June 2020; Accepted 3 July 2020



Contents lists available at ScienceDirect

International Journal of Biological Macromolecules

journal homepage: <http://www.elsevier.com/locate/ijbiomac>Structural characterization of a heteroglycan from an edible mushroom
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ARTICLE INFO

Article history:

Received 18 August 2019

Revised in revised form 28 December 2019

Accepted 11 February 2020

Available online 18 February 2020

Keywords:

Termitomyces heimii

heteroglycan

NMR studies

ABSTRACT

A water soluble heteroglycan (THPS) of an average molecular weight $\sim 1.08 \times 10^6$ Da was isolated from the aqueous extract of the fruit bodies of an edible mushroom *Termitomyces heimii*. Structural characterization of THPS was carried out using acid hydrolysis, methylation analysis, periodate oxidation, Smith degradation and 1D/2D NMR studies. Sugar analysis indicated the presence of glucose, mannose, galactose, and fucose in a molar ratio of nearly 6:2:2:1. The repeating unit of the THPS had a backbone consisting of four [1 \rightarrow 3]- β -D-glucopyranosyl, one [1 \rightarrow 6]- α -D-glucopyranosyl, two [1 \rightarrow 3]- α -D-mannopyranosyl, and two [1 \rightarrow 6]- α -D-galactopyranosyl residues, out of which one [1 \rightarrow 3]- β -D-glucopyranosyl residue was branched at O-6 position with terminal β -D-glucopyranosyl residue and one [1 \rightarrow 6]- α -D-galactopyranosyl residue was branched at O-2 position with terminal α -L-fucopyranosyl residue.

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1. Introduction

Mushrooms are nutritionally and medicinally renewable natural gift for humankind. Now a day, it's most important constituent like polysaccharides have drawn the attention of chemist and immunobiologist on account of their potent immunological application field [1,2]. *Termitomyces heimii* is a basidiomycete and agaric-type fungus belonging to the genus *Termitomyces* in the family of Lyophyllaceae [3,4]. It is known as "termite mushroom" due to its symbiotic relationship with termite infested soil and also it have been identified as an edible mushroom with a unique taste and flavor [4,5]. Naturally this mushroom was collected from India during monsoon season [6]. This mushroom is extensively used as a dietary calcium supplement in people suffering from hypocalcaemia and osteoporosis. It is also used in regulation of blood pressure, blood lipid, immune response, inflammation, and apoptosis. Thus, the result supports the beneficial claims of this mushroom [7]. These mushrooms showed DPPH radical scavenging activity, hydroxyl radical scavenging activity, inhibition of lipid peroxidation, β -carotene bleaching assay, reducing power, and total antioxidant

activity [8–10]. Its protective role in human lymphocytes was reported [11]. This mushroom shows varying immune-stimulatory activities [12]. Decolorisation capacity of laccase from *Termitomyces heimii* was reported [13]. *T. heimii* showed noticeable antibacterial activities [14]. This mushroom species may act as a potential source for the antihypertensive proteins [15]. So, *T. heimii* would be beneficial for health purposes and also used as medicine of selected diseases of humankind. Different mushrooms of the genus *Termitomyces* including *Termitomyces striatus* [16], *T. earhizus* [17], *T. microcarpus* [18], *T. robustus* [19], *T. robustus* var [20], and *T. rigensatus* [21] have been identified and characterized by our group. Different extract of mushroom *T. heimii*, alkaline extract polysaccharide was identified as β -glucan [11] whereas aqueous extract polysaccharide was characterized as heteroglycan (THPS). THPS contains important sugar residue α -L-fucose which is used for human breast cancer [22] and infertility treatment [23]. Heteroglycan act as a potent immunostimulating agent on splenocyte, thymocyte and macrophage-dependent immune systems [24,25] and also showed protective role on human lymphocytes [26]. Mushroom polysaccharides are protected the living body from oxidative damage causing by different reactive oxygen species (ROS) which are considered to be the most toxic substances [27]. Therefore, a detailed investigation was carried out on the polysaccharide of this mushroom and the results of structural studies are reported herein.

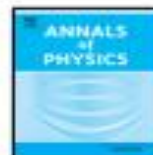
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Contents lists available at ScienceDirect

Annals of Physics

journal homepage: www.elsevier.com/locate/aop

Gravitational waves from non-radial perturbations in neutron stars

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ARTICLE INFO

Article history:

Received 17 October 2019

Accepted 18 February 2020

Available online 29 February 2020

Keywords:

Nuclear EoS

Neutron star

Core-crust transition

Crustal Mel

r-mode instability

ABSTRACT

In the present work, we explore the Rossby mode perturbations in case of neutron stars as sources of continuous gravitational waves. The intensity and time evolution of the emitted gravitational waves in terms of the amplitude of the strain tensor are estimated in the slow rotation approximation using β -equilibrated neutron star matter obtained from density dependent M3Y effective interaction. For a wide range of neutron star masses, the fiducial gravitational and various viscous time scales, the critical frequencies and the time evolutions of the frequencies are calculated. Unlike other non-radial perturbations, amplitude of Rossby mode perturbation increases due to the emission of gravitational waves which carry angular momentum of the star to infinity. Hence, existence of such perturbation in a star implies a positive rate of change in the angular momentum transfer. It, therefore, implies that for a particular neutron star, the intensity of gravitational wave emission increases with time until the angular frequency reduces down to a critical value below which the star stops emitting radiation.

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Available online at <http://icik.org>
J. Math. Comput. Sci. 10 (2020), No. 6, 2383-2389
<https://doi.org/10.28919/jmcs/4867>
ISSN: 1927-5307

ON GRAPH CLIQUISH FUNCTIONS

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Abstract. In the present paper we introduce a new notion of graph cliquish functions from a topological space to a metric space and study its relation with other types of generalized continuity. We also give a characterization of that new notion of generalized continuity on a dense set of points.

Keywords: graph continuity; graph quasi-continuity; quasi-continuity; cliquish functions; graph cliquish functions.

2010 AMS Subject Classification: 46A30.

1. INTRODUCTION AND BASIC NOTATIONS

In 1977 Z. Grande [2] introduced the notion of F -continuity for functions from $[0,1]$ to \mathbb{R} . Lately A. Zaharescu [11] called this type generalized continuity appropriately the graph continuity. K. Sakalava [8],[9] gave a relationship between graph continuity and quasi-continuity. A. Mikuka [3] in 2003 introduced the notion of graph quasi-continuity.

In what follows X is a topological space and Y is a metric space with metric d . For a subset $A \subseteq X$, $f|_A$ denotes the restriction of a function $f: X \rightarrow Y$ on A . If $G(f)$ denotes the graph of $f: X \rightarrow Y$ then the symbol $cl(G(f))$ denotes the closure of $G(f)$ in the product topology of $X \times Y$. By $C(f)$

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Received July 21, 2020

Probabilistic Inventory Model under Flexible Trade Credit Plan Depending upon Ordering Amount

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Received July 27, 2020; Revised August 31, 2020; Accepted September 29, 2020

Cite This Paper in the following Citation Styles

(a): [1] Piyali Mallick, Lakshmi Narayan De , "Probabilistic Inventory Model under Flexible Trade Credit Plan Depending upon Ordering Amount," *Mathematics and Statistics*, Vol. 8, No. 5, pp. 596 – 609, 2020. DOI: 10.13189/ms.2020.080515.

(b): Piyali Mallick, Lakshmi Narayan De (2020). Probabilistic Inventory Model under Flexible Trade Credit Plan Depending upon Ordering Amount. *Mathematics and Statistics*, 8(5), 596 – 609. DOI: 10.13189/ms.2020.080515.

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Abstract In this work, we propose a stochastic inventory model under the situations that delay in reimbursement is acceptable. Most of the inventory model on this topic supposed that the supplier would offer the retailer a fixed delay period and the retailer could sell the goods and accumulate revenue and earn interest with in the credit period. They also assumed that the trade credit period is independent of the order quantity. Limited investigators developed EOQ model under permissible delay in payments, where trade credit is connected with the order quantity. When the order quantity is a lesser amount of the quantity at which the delay in payment is not permitted, the payments for the items must be made immediately. Otherwise, the fixed credit period is permitted. However, all these models were completely deterministic in nature. In reality, this trade credit period cannot be fixed. If it is fixed, then retailer will not be interested to buy higher quantity than the fixed quantity at which delay in payment is permitted. To reflect this situation, we assumed that trade credit period is not static but fluctuates with the ordering quantity. The demand throughout any arrangement period follows a probability distribution. We have calculated the total variable cost for every unit of time. The optimum ordering policy of the scheme can be found with the aid of three theorems (proofs are provided). An algorithm to determine the best ordering rule with the assistance of the propositions is established and numerical instances are provided for clarification. Sensitivity investigation of all the parameters of the model is presented and deliberated. Some previously published results are special cases of the

consequences gotten in this paper.

Keywords Probabilistic Inventory Model, Trade Credit, Permissible Delay in Payments

1. Introduction

In developing traditional optimal ordering policy of an inventory model, it is generally assumed that the retailer must pay to supplier for the products at the time receiving of substances as every business owner would like to have all sales on a cash basis. However, in practice it is not always possible in competitive market place. Supplier allows retailer a certain a delay period (credit period) for settling down the account and no interest is charged on the unsettled account if the account is settled by the end of the credit period. The supplier will charge higher interest if the account is not settled within the trade credit period. Using this trade credit policy, suppliers can attract additional customers by not demanding cash up front. Trade credit can be advantageous for the new retailer incapable to raise capital or secure business loans, yet needs stock quickly. Using trade credit, business to be flexible, adapting to market demands and seasonal variations so that retailer has a constant supply of goods even when his/her finances are not stable. Supplier can mix trade credit with bulk discounting to encourage buyers to speed more. Supplier's trade credit can prevent buyers from looking elsewhere and

Effect of Price Concession Strategy and Preservation Technology on Inventory Model for Decaying Products with Partial Backlogging and Price-Stock-Dependent Demand

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Abstract

This paper develops an economic order quantity model for deteriorating products that assumes price and stock depending demand. Shortages are permitted with partial backlogging. The proposed model focused on two things. The first one is the consideration of the fact that the deterioration rate can be reduced by the use of preservation technology investment and the second one is using the assumption that the unit purchase cost has a hostile bond with the order size to maximize the total profit. The idea of salvage/recover cost is considered and merged in this model. The solution technique of proposed optimization model is exemplified by a couple of numerical illustrations. Concavity of the average profit function is shown by plotting graphs. Sensitivity investigation is done to study the effect of changing the value of all parameters in the projected maximization model.

Keywords: Inventory, Partial backlogging, Preservation investment, Price Discount, Stock & Price dependent demand.

1. INTRODUCTION

Inventory or stock of products/items is most challengeable to provide smooth administration in business enterprises and organization. So, concentration in the study of inventory management or control is constantly growing. Over the last few years, different inventory models have been explored by several researchers. Ford Harris [1] was the creator who first developed a classical economic order quantity (EOQ) model with constant demand.

One of the vital things in market is customer's demand, which directly depends upon different factors like display of the items/level of inventory, retailing price of the product, time, advertisement, price rises etc. Till now, many inventory models have been introduced by several researchers assuming various types of demand rate together with other different aspects. Customers prefer to purchase products from a shop which has large piles of goods in its shelf space due to visibility and variety of items. In contrast, less stock of items might raise the perception that they are not so fresh. In many years, researchers & practitioners have realised the fact that the demand for some items may be based on the stock on display. Levin et al. [2] pointed out that bulky piles of goods exhibited

in a supermarket will lead the buyer to buy more. Stock dependent demand is usually suitable for different kinds of manufacturing sectors such as treated and raw food industry, garments (fabrics, costumes etc.) industry, automobile industry and electronics & electrical industry etc. Padmanabhan and Vrat [3] solved an inventory model for deteriorating items by a non-linear goal programming technique where demand is depending upon on stock of products on display. Giri et al. [4] created an EPQ model for deteriorating items having inventory level dependent consumption rate.

On the other hand, in several sectors particularly food sectors, the demand of raw food items such as vegetables, fruits, fishes, eggs, meat, dairy product, rice, wheat etc., in a shop and treated food in hotel or restaurant are price sensitive. Customers like to purchase from a shop which has low selling price. If the seller increases the retailing price of the product, the customers would move other shopping places to satisfy their demand. There are numerous studies have been done on the effect of price variations. Kotler [5] incorporated marketing strategies into inventory decisions and discussed the connection between economic order quantity and pricing decision. Again, thinking the importance of stock and price both, Urban and Baker [6] well-thought-out an EOQ model for multivariate price, time and stock-induced demand.

Deterioration of product is a key issue in the inventory control policy. We cannot disregard this in the current study. There are some items like milk, ice-cream, vegetables, dairy product, grocery items which deteriorates over time. Whitin [7] was the innovator, who first studied an EOQ model of deteriorating items. An inventory model of deteriorating items which deteriorates exponentially is developed by Ghare and Schrader [8].

So, inventory system of deteriorating items has been studied for a long time, but little is known about the effect of investing in reducing the rate deterioration. Hsu et al. [9] developed an inventory model where the retailer invests on the preservation technology. Lee and Dye [10] first formulated a deteriorating inventory model with stock dependent demand by allowing preservation technology cost as a decision variable. Mishra [11] developed an inventory model of instantaneous deteriorating items with controllable deterioration rate using preservation

Human Journals
Review Article
December 2020 Vol:20, Issue:1
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Coronavirus Disease 2019 (COVID-19): A Summative Review



IJPPR
INTERNATIONAL JOURNAL OF PHARMACY & PHARMACEUTICAL RESEARCH
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Submitted: 12 November 2020
Revised: 02 December 2020
Accepted: 22 December 2020



HUMAN JOURNALS

www.ijppr.humanjournals.com


Keywords: Coronavirus, Genomics, Occurrence, Treatment, Remdesivir

ABSTRACT

At present scenario, severe acute respiratory syndrome, caused by novel coronavirus (2019-nCoV) has created a worldwide pandemic situation. This virus was first identified in bats in Wuhan, Hubei province, China in December 2019 but in humans, this virus was transmitted through unknown intermediary animal. Till date, millions of cases have been reported. Inhalation and contact with infected droplets are the main way of transmission. Fever, cough, sore throat, breathlessness, fatigueless, diarrhea are various symptoms of this infection. In progression, in case of older population pneumonia, Acute Respiratory Distress Syndrome (ARDS), comorbidities, multi organ dysfunction also can be observed and these may be responsible for the death of the effected people. Many people are asymptomatic. Fatality rate ranges from 2 to 4%. The molecular test of saliva and nasal secretion are being used as the diagnostic tool of this disease. Common laboratory findings include normal/low white cell counts with elevated C-reactive protein (CRP). All the treatments available are mainly supportive treatment. Various antiviral agents are being used just as booster of the immunity power of the people. Prevention entails home isolation of suspected cases and those with mild illnesses and strict infection control measures at hospitals that include contact and droplet precautions. Some vaccines are already been formulated by laboratory personnel of different countries. These vaccines are going under human trial to find out whether they are potent to produce antibodies against COVID19 or not. Treatment is essentially supportive; role of antiviral agents is yet to be established. The virus spreads faster than its two ancestors the SARS-CoV and Middle East Respiratory Syndrome coronavirus (MERS-CoV) but has lower fatality. The global impact of this new epidemic is yet uncertain.

Human Journals
Review Article
June 2020 Vol.:18, Issue:3
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A Comprehensive Review on the Physiological Effects of Benzoic Acid and Its Derivatives

<p> IJPPR INTERNATIONAL JOURNAL OF PHARMACY & PHARMACEUTICAL RESEARCH An official Publication of Human Journals</p> <p>Mousumi Dutta¹</p> <p><i>¹Government General Degree College, Kharagpur-II, Ambegaria, Madpur, Paschim Medinipur- 721149, West Bengal, INDIA</i></p> <p>Submission: 24 May 2020 Accepted: 31 May 2020 Published: 30 June 2020</p>	<p>Keywords: Benzoic Acid, Biological Activities, Derivatives, Paraben, Sodium Benzoate</p> <p>ABSTRACT</p> <p>Benzoic acid is an organic chemical. It is metabolised in the liver and is excreted out as hippuric acid. This compound and its derivatives are reported to be used as food, drug preservatives, cosmetic products and pharmaceuticals. Various literature surveys explore various biological properties such as antifungal, antimicrobial, gastrointestinal tract modulator, enhancer of biological metabolism, anti-inflammatory, genotoxic agent etc. The present study will give comprehensive information of the biological activities of this benzoic acid and its derivatives.</p>
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Bacteria: Salubrious Microbes

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Received: 05-03-2020; Revised: 18-04-2020; Accepted: 25-04-2020.

ABSTRACT

Bacteria are the most abundant form of life on the planet. They are found in most every environment, from Antarctic ice, to boiling hydrothermal vents, to inside your stomach. Most of these do not hurt us. Actually, many of these organisms are very important to our survival. Bacteria have lived in and on animals—constituting their microbiome—since multicellular life evolved about 1 billion years ago. Hosts derive many benefits from their bacterial guests. Bacteria have a bad reputation of causing disease but not all of them are bad, in fact most of them do not cause any harm and are absolutely essential for life. It may be hard to believe but we actually harbour 100 trillion bacteria, most of which are found in the intestine. They are called intestinal flora and weigh about 1.5-2 kg (as much as the liver). Scientists call them the "Forgotten Organ" because they influence our life, safeguard our health and shape our bodies. Besides, bad effects there are lots of beneficial utilities of bacteria for the society. And, the main focus of this review is to enlighten the beneficial utilities of bacteria as a whole.

Keywords: Bacteria, Beneficial effect, Harmful effect.

INTRODUCTION

In the 19th century, the Germ Theory was proposed by Louis Pasteur and Robert Koch where it was said that diseases were caused by germs. In 2001, first the term "gut microbiome" was coined by Joshua Lederberg. In time, this work is expected to shed new light a wide range of health conditions. Bacteria don't have proper nucleus within the cell but they have a systemic genetic material in the cell. They can exist everywhere in the environment.¹

Beneficial effects of bacteria was explored first after the discovery of the two bacteria *Agrobacterium tumefaciens* and *Thermus aquaticus* which have causes a phase change in the research domain of molecular biology and biotechnology i.e. development of crown gall tumor and DNA amplification in PCR.² Eventually antibiotic discovery was the another impetus exploring the profuse role of bacteria in the field of research.

In this review the main objective is to unveil into the various beneficiary sides of the bacteria and its potential application in the field of research.

Decomposition of the dead matters/organic compounds

The nature continuously is getting rid of the dead matter through the decomposition by bacteria. The organic compounds are trapped in the dead matter are being recycled by bacteria because they use them as a source of nutrients. Normally other organisms can easily use these simpler forms of organic compounds/nutrients released from the dead matter by various bacteria.³

Nitrogen Fixation for availability to Plants

Atmospheric nitrogen is being converted to nitrates and nitrites by various bacterial species such as *Rhizobium* sp. and *Cyanobacteria* sp. via the process of nitrogen fixation, as a part of their metabolism.⁴ This process makes the environmental nitrogen available to the plants. The bacteria live in the roots of some plants (leguminous plants) in the form of mutualistic association and become beneficial to the plant kingdom (Fig 1).⁴

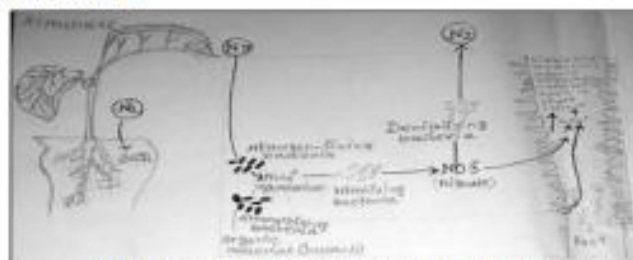


Figure 1: Schematic diagram of the process of nitrogen fixation.





Covering problem on fuzzy graphs and its application in disaster management system

Sonia Mandal¹ · Nupur Patra² · Madhumangal Pal¹ Published online: 26 August 2020
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Abstract

Nowadays the fuzzy graphs gained popularity due to their wide applications in different areas of science, engineering, social sciences, etc. In this paper, we consider covering problem in fuzzy graph. Different types of covering problems have been defined in this paper. Almost all problems are new. For each of these problems separate study is required. Also, the covering set, strong covering set, minimal covering set, etc., are defined and explained with examples. In a graph, each vertex can cover only those vertices that lie within its covering radius along shortest path and no vertex can cover itself. Here, an algorithm is designed to find the different types of covering sets on a fuzzy graph. An imprecise number, instead of a real number, namely interval number and triangular fuzzy number are considered as arc length of a fuzzy graph. To the best of our knowledge no works are available for covering problem on fuzzy graphs/networks. An application of covering set in natural disaster management is discussed to highlight the importance of the covering problem. In this application, an algorithm is designed to find all the facility vertices (or supply vertices) for given vertex and covering radius.

Keywords Fuzzy graph · Fuzzy paths · Covering set · Strong covering set · Facility location problem

1 Introduction

Set covering problem (SCP) is a very important topic in network optimization known as combinatorial optimization. Set covering problem has received special attention due to the huge evolution of mobile communication, social networks such as Facebook, ResearchGate, Twitter, LinkedIn along with the different types of applications built on them. Graph network used in modern applications starting from mobile communication to VLSI design is identified to be highly dynamic structures, changing at high rates. Another feature

Communicated by V. Loia.

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of networks that has recently gained attention by researchers in recent years is their social nature. In many applications a network is constructed by a set of users that want to maximize their individual profit.

The vertex covering is one of the widely studied problem in graph theory as it is used to solve facility location problem and many other problems in operations research particularly in transportation problem. A vertex cover of a graph is a set of vertices such that each edge of the graph is incident to at least one vertex of the set. Obviously, the set of all vertices of the given graph is a vertex cover. So, the problem is to find a minimum vertex cover of a graph and it is well-known NP-complete problem.

Several variations of vertex covering problem are available in literature for crisp graphs. Let $G = (V, E)$ be a simple, undirected and connected graph. Here, it is assumed that the vertex set V denotes the set of sites or demand points. These points must be covered by some facilities. In general, the sites or demand points may be a vertex of the graph or it may be any point on an edge. But, for simplicity, it is assumed that all sites or demand points and facilities are simply the vertices of the given graph.

Each vertex $u \in V$ is associated with the following two numbers:

Impact of altered Energy metabolism and Immune regulation in reproductive health of Aged Men

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Submitted on 13-July-2021, Accepted and Published on 10-Sept-2021

Review Article

ABSTRACT



The age of having a first child has increased all around the world. With advancing age, the reproductive system encounters several complications in both males and females. With increasing age in men, increased mitochondrial damage increases, oxidative stress, leading to disruption of immune system. All these are closely associated with one another, and together contribute to age-induced reproductive dysfunctions in men. Changes associated with ageing in men adversely affect steroidogenesis and spermatogenesis. Immuno-senescence causes the altered immunoregulation and accounts for diminished quality and quantity of sperms in men. Various factors like the interaction of sex hormones with environment and genetic factors are the determinants of immune status in an individual. With ageing increased inflammation of the male urogenital tract is also known to account for infertility in men. Further, cytokines and adipokines in age induced obesity adversely affects fertility in men. Thus, there exists an axis connecting age, energy metabolism, sex hormones, immunity and reproductive health. The aim of this review article is to brief the role of various immunoregulatory factors associated with ageing and the impact of age-induced changes in energy metabolism on male reproductive health. Administration of antioxidants or anti-inflammatory agents separately or in combination may be beneficial in treating or mitigating age induced infertility in men.

Keywords: Energy metabolism, hormones, immune regulation, reproductive health, sperm

INTRODUCTION

Ageing causes several changes in the physiological system.^{1,2} Besides its impact on the cardiovascular system, respiratory system, nervous system, digestive system etc., ageing also has a significant impact on the reproductive system in both males and females.^{3,4} Increased age of marriage and childbearing has come up with issues of difficulties in having a healthy child and infertility.^{5,6} The impairment of reproductive health and its effect on infertility and child health is well known but age mediated

impairment of male reproductive health is now yet well established. There have been some studies related to male reproductive health impairment with ageing and studies around the world are in progress. Certain interesting and useful information have been revealed with those studies. With ageing, the occurrence of reduced sperm chromatin quality and damaged DNA in sperm etc. are reported. Studies reveal that ageing causes significant detrimental changes in male reproductive health which includes changes in semen, altered testicular morphology and function, reduced sperm count, hormonal changes, damages in sperm DNA etc.⁷ Changes in semen quality due to ageing include improper spermatogenesis, reduced sperm motility and reduced sperm viability.^{8,9} On the other hand, remarkable changes in the testis are also noticed with ageing. Testicular volume is reduced, testicular vascularization is altered adversely, changes in Sertoli cells and Leydig cells are also reported to be associated with ageing in men. Ageing is known to have a normal physiological decay of reproductive tissues and organs and thus

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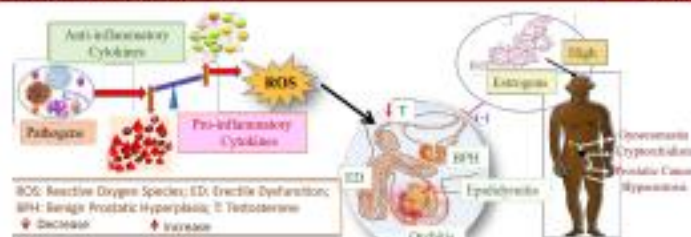
Role of estrogens in immunoenocrine regulations of male reproduction

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Submitted on: 15-July-2021, Accepted and Published on: 16-Sept-2021

Review Article

ABSTRACT



Male infertility is a multifactorial disorder. A diverse array of autocrine and paracrine factors, genetic and epigenetic factors, pathogenic perturbations, testicular dysfunctions and oxidative stress, all together may contribute to male infertility. Interactions between different cellular components of testis, other accessory sex organs and hormones within the system's milieu act in a synchronized manner to help in normal reproductive function. In addition, immune cells and hormonal interplay may also assist such mechanisms. Androgens and estrogens are known to act as antagonizing hormones. They act via multiple receptors mediated signaling, producing such effects. Nevertheless, recent cropping up evidences in support of the role of hormones in managing testicular function indicate a vital role of estrogenic influences. Dietary or occupational exposure to artificial or natural estrogen may act as teratogen and a factor for some secular diseases of male reproductive tract leading to immune endocrine imbalances contributing to male infertility. The key role of estrogen in immune modulation related to immune dysfunction and inflammatory conditions in male germ cell signaling, Sertoli cell integrity and expression of altered immune responses are a matter of great concern. Suppression of autoreactive immune cells, alterations of regulatory T cells (T_{reg}), Th1 and Th2 ratio, Th17 cell responses, manipulation of inflammatory and autoimmune response confirms the essential role of estrogen in promoting protection against inflammatory conditions. Nevertheless, evidence based extensive research is essential to overrule the possibility of adverse outcomes of this sex steroid and sustain its beneficial action of estrogen in males.

Keywords: Estrogen, Hypogonadism, Infertility, Immune modulation, Male reproductive tract infection

INTRODUCTION

Besides reproductive actions, sex hormones have a considerable influence on the development and functions of the immune system.¹ Not only innate and adaptive immunity but also immune tolerance, autoimmunity, and other immune responses involving both humoral and cell-mediated immunity are dependent on the sex hormones.² Immune dimorphism of both testosterone and estrogen has been reported.³ Though

testosterone has immune-suppressive action making the testis an immune-privileged organ, estrogen has immune-modulatory action in the sense that it enhances immune responses.⁴ The historical prospects of estrogens on male reproduction generate a preview that estrogen and phytoestrogens or any compound have structural mimicry to estrogen-an environmental toxicant may subside normal male gonadal function.⁵ Since 1930, fetal exposure to a high dose of estrogen is known to be responsible for malformation of the male reproductive tract.⁶ Customarily, estrogens are considered as female hormones, their roles in male reproduction cannot be overruled as supported by the recent literature.^{6,7} In addition, estrogen receptors have been recognized in males since development till adulthood.⁸ Studies reveal the presence of estrogen receptors in testis, epididymis, and seminal plasma of rats and other mammals.⁹ In fact, a fine-tuning between testosterone and estrogen is of utmost necessity in all mammals for maintaining a healthy reproductive vitality.⁹ Indeed, multiple paracrine and endocrine factors contribute to such functional

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ELSEVIER
© ScienceDirect Publishing (ISSN: 2349-6025)
<http://dx.doi.org/10.1016/j.cbl.2021.08.001>



One-loop Kubo estimations of the shear and bulk viscous coefficients for hot and magnetized bosonic and fermionic systems

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 (Received 11 November 2020; accepted 16 April 2021; published 18 May 2021)

The expressions of the shear viscosity and the bulk viscosity components in the presence of an arbitrary external magnetic field for a system of hot charged scalar bosons (spin 0) as well as for a system of hot charged Dirac fermions (spin $\frac{1}{2}$) have been derived by employing the one-loop Kubo formalism. This is done by explicitly evaluating the thermomagnetic spectral functions of the energy-momentum tensors using the real time formalism of finite temperature field theory and the Schwinger proper time formalism. In the present work, a rich quantum field theoretical structure in the expressions of the viscous coefficients in nonzero magnetic field are found, which are different from their respective expressions obtained earlier via kinetic-theory-based calculations; though, in the absence of a magnetic field, the one-loop Kubo and the kinetic-theory-based expressions for the viscosities are known to be identical. We have identified that Kubo and kinetic-theory-based results of viscosity components follow a similar kind of temperature and magnetic field dependency. The relaxation time and the synchrotron frequency in the kinetic theory formalism are realized to be connected, respectively, with the thermal width of propagator and the transitions among the Landau levels of the charged particles in the Kubo formalism. We believe that the connection of the latter quantities is quite new and probably the present work is the first time addressing this interpretation along with the new expressions of viscosity components, not seen in existing works.

DOI: 10.1103/PhysRevD.103.096015

I. INTRODUCTION

The heavy ion collision experiment at relativistic energy can produce a superhot quark gluon plasma, which may be exposed under a strong magnetic field B if the nucleus-nucleus collision is noncentral. This magnetic field could be of the order of $\sim 10^{18}$ G and comparable to the quantum chromodynamics (QCD) scale ($eB \sim m_\pi^2$ for RHIC-LHC energies) [1], for which many interesting QCD-linked phenomena [2–5] can be observed. Among a long list of interesting quantities, transport coefficients like shear viscosity and bulk viscosity are our aimed quantities in the present work. Owing to this fact, a long list of Refs. [6–34] have focused on the microscopic calculation of the transport coefficients, like the shear viscosity in Refs. [6–17], bulk viscosity in Refs. [18–21] and electrical conductivity in

Refs. [22–34] for the hot and/or dense QCD matter in the presence of a magnetic field. If we analyze the frameworks of those microscopic calculations, they are mostly in the kinetic-theory-based approaches.

For the shear viscosity in the presence of an external magnetic field, one can get five independent traceless tensors, with which five shear viscosity components will be linked, while a single traceless tensor with isotropic shear viscosity is found in the $B = 0$ case. There are two possible sets of these five independent traceless tensors as proposed in Refs. [35,36], respectively. Using the former set, proposed in Ref. [35], the authors of Refs. [6,8–12,17] have obtained five shear viscosity components $\tilde{\eta}_s$ ($s = 0, 1, 2, 3, 4$); while, using the latter set proposed in Ref. [36], the authors of Refs. [14,15] have obtained their five shear viscosity components η_s . However, the $\tilde{\eta}_s$'s and η_s 's are interconnected and ultimately can be expressed in terms of the parallel, perpendicular and Hall components [10]. The general expressions of $\tilde{\eta}_s$ are obtained in the relaxation time approximation (RTA) of kinetic theory approach in Refs. [8,10–12,17] and the same using the strong magnetic field approximation in Refs. [6,9]. In Ref. [14], the authors have obtained η_s in RTA-based moment methods but its RTA-based kinetic theory calculation can be seen in Ref. [10].

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Dilepton production from magnetized quark matter with an anomalous magnetic moment of the quarks using a three-flavor PNJL model

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✉ (Received 4 February 2021; accepted 22 April 2021; published 24 May 2021)

Dilepton production from hot, dense and magnetized quark matter is studied using the three-flavor Polyakov loop extended Nambu–Jona-Lasinio (PNJL) model in which the anomalous magnetic moment (AMM) of the quarks is also taken into consideration. This is done by first evaluating the thermomagnetic spectral function of the vector current correlator employing the real time formalism of finite temperature field theory and the Schwinger proper time formalism. The constituent quark mass which goes as an input in the expression of the dilepton production rate (DPR), has been calculated using the three-flavor PNJL model employing Pauli-Villars (PV) regularization. The obtained constituent quark mass being strongly dependent on the temperature, density, magnetic field and AMM of the quarks, captures the effect of “strong” interactions specifically around the (pseudo) chiral and confinement-deconfinement phase transition regions. The analytic structure of the spectral function in the complex energy plane has been analyzed in detail and a nontrivial Landau cut is found in the physical kinematic domains resulting from the scattering of the Landau quantized quark/antiquark with the photon which is purely a finite magnetic field effect. Due to the emergence of the Landau cut along with the usual unitary cut, the DPR is found to be largely enhanced in the low invariant mass region. Owing to the magnetic field and AMM dependence of the thresholds of these cuts, we find that the kinematically forbidden gap between the unitary and Landau cuts vanishes at sufficiently high temperature, density and magnetic field leading to the generation of a continuous spectrum of dilepton emission over the whole invariant mass region. In order to see the effects of strangeness and confinement-deconfinement, the rates are compared with the three-flavor NJL and the two-flavor NJL and PNJL models. Finally, an infinite number of quark Landau levels is incorporated in the calculation so that no approximations are made on the strength of the background magnetic field like strong or weak as usually done in the literature.

DOI: 10.1103/PhysRevD.103.096021

I. INTRODUCTION

The main objective of heavy ion collision (HIC) experiments in Relativistic Heavy Ion Collider (RHIC) and Large Hadron Collider (LHC) is to study deconfined state of strongly interacting quarks and gluons in local thermal equilibrium, commonly known as the quark-gluon plasma

(QGP). The hot and dense matter created after the HIC goes through different stages while it cools via rapid expansion under its own pressure. However, the whole process is very short lived (few fm/c) and direct observations are not possible. So to investigate microscopic as well as bulk properties of QGP, many indirect probes and observables are proposed [1] among which the electromagnetic probes, i.e., photons and dileptons, have been extensively studied in the literature [2–11]. A prime benefit of this probe over hadrons, which are emitted from the freeze out surface after undergoing intense rescattering, is that photons/dileptons are emitted during all the stages of the expanding fireball. Since they participate only in electromagnetic interaction, their mean free paths are much larger than the typical size and lifetime of this novel state of matter. Consequently once produced, they leave the hot and dense medium without suffering further interactions and reach the detector

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Thermomagnetic modification of the anomalous magnetic moment of quarks using the NJL model

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(Received 10 March 2021; revised 22 April 2021; accepted 29 April 2021; published 8 June 2021)

The effective photon-quark-antiquark ($\gamma q\bar{q}$) vertex function is evaluated at finite temperature in the presence of an arbitrary external magnetic field using the two-flavor gauged Nambu-Jona-Lasinio model in the mean field approximation. The lowest order diagram contributing to the magnetic form factor and the anomalous magnetic moment (AMM) of the quarks is calculated at finite temperature and external magnetic field using the imaginary time formalism of finite temperature field theory and the Schwinger proper time formalism. The Schwinger propagator, including all the Landau levels with nonzero AMM of the dressed quarks, is considered while calculating the loop diagram. Using sharp as well as smooth three-momentum cutoff, we regularize the UV divergences arising from the vertex function and the parameters of our model are chosen to reproduce the well-known phenomenological quantities at zero temperature and zero magnetic field, such as pion-decay constant (f_π), vacuum quark condensate, and vacuum pion mass (m_π), as well as the magnetic moments of proton and neutron. We then study the temperature and magnetic field dependence of the AMM and constituent mass of the quark. We found that the AMM as well as the constituent quark mass are large at the chiral symmetry broken phase in the low temperature region. Around the pseudo-chiral phase transition, they decrease rapidly and at high temperatures both of them approach vanishingly small values in the symmetry restored phase.

DOI: 10.1103/PhysRevD.103.116008

I. INTRODUCTION

The influence of an external magnetic field on the vacuum structure of quantum chromodynamics (QCD) and its modifications at finite temperature and/or chemical potential can play an important role in many physical systems (see Ref. [1] for review). For example, it is conjectured by some cosmological models that, during the electroweak phase transition in the early Universe, extremely strong magnetic field as high as $\sim 10^{23}$ G might have been produced [2,3] (note that, in natural units, 10^{28} G $\approx \alpha_s^2 \approx 0.02$ GeV²). The magnetic field on the surface of certain compact stars called “magnetars” is on the order of $\sim 10^{15}$ G, while in the interior it is estimated to

reach about $\sim 10^{18}$ G [4–6]. Most importantly, in noncentral or asymmetric heavy-ion collisions (HICs) at the Relativistic Heavy-Ion Collider and LHC, strong magnetic fields of the order of $\sim 10^{18}$ G [7,8] or larger may be transiently generated. It is, however, predicted that the presence of a finite electrical conductivity of the hot and dense medium created during HICs can delay the decay of these time-dependent magnetic fields substantially [9–12]. Thus, being comparable to the QCD scale, i.e., $eB \approx m_\pi^2$, such high magnetic fields can influence substantial change in the deconfined medium of strongly interacting quarks and gluons known as the quark-gluon plasma, which is supposed to be created in such HICs. So far, a considerable amount of research has been conducted in the last few decades to understand the consequences of this background magnetic field on the QCD matter; this results in a large number of novel and interesting phenomena, such as the chiral magnetic effect [7,13–15], magnetic catalysis [16–19], and inverse magnetic catalysis [20,21] of dynamical chiral symmetry breaking, which may cause significant change in the nature of electroweak [22–25], chiral, and superconducting phase transitions [26–29], electromagnetically induced superconductivity and superfluidity [30,31], and many more.

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Kubo estimation of the electrical conductivity for a hot relativistic fluid in the presence of a magnetic field

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✉ (Received 19 May 2021; accepted 8 September 2021; published 28 September 2021)

We have explored the multicomponent structure of electrical conductivity of relativistic Fermionic and bosonic fluid in the presence of a magnetic field by using the Kubo approach. This is done by explicitly evaluating the thermomagnetic vector current spectral functions using the real time formalism of finite temperature field theory and the Schwinger proper time formalism. In the absence of a magnetic field, the one-loop diagrammatic representation of the Kubo expression of any transport coefficients is exactly the same with a relaxation time approximation (RTA)-based expression, but this equality does not hold for a finite magnetic field picture due to a lack of proper implementation of quantum effect in a latter approach. We have shown this discrepancy for a particular transport coefficient—electrical conductivity, whose starting point in the Kubo approach will be an electromagnetic current-current correlator and its one-loop skeleton diagram carrying two scalar/Dirac propagators for a scalar/Dirac fluid. Through a numerical comparison between RTA and Kubo expressions of conductivity components (parallel and perpendicular), we have attempted to interpret a detailed quantum field theoretical effect, contained by the Kubo expression but not by the RTA expression. In a classical RTA expression we get a magnetic field independent parallel conductivity due to zero Lorentz force but in the field theoretical Kubo expression, it decreases and increases with the magnetic field for a scalar and Dirac medium, respectively, due to the Landau quantization effect. This parallel component of conductivity can be interpreted as a zero momentum limit of quantum fluctuation with the same Landau level internal lines, while for a perpendicular component of conductivity, fluctuation with Landau level differences ± 1 are noticed, which might be a new realization of transportation in a field theoretical sector.

DOI: 10.1103/PhysRevD.104.056030

I. INTRODUCTION

Research on quark gluon plasma (QGP), which can be produced in heavy ion collision (HIC) experiment facilities is a mature branch of high energy physics, where a broad band of basic physics from classical mechanics to quantum mechanics to statistical mechanics to quantum field theory are largely cultivated. As interesting as it is, the creation of very strong magnetic fields of the order 10^{19} – 10^{20} G during noncentral or asymmetric HICs has thrown a plethora of questions requiring a careful study. Novel phenomena such as the chiral magnetic effect [1], magnetic

catalysis [2], and inverse magnetic catalysis [3–5] ask for a deep understanding of the underlying theoretical aspects of QGP. An extensive discussion of the effects of a magnetic field on hot quantum chromodynamics (QCD) matter was discussed in Ref. [6]. In nature, strong magnetic fields of the order 10^{12} – 10^{13} G in neutron stars and an even higher magnitude of 10^{15} – 10^{16} G in magnetars are known to exist [7,8]. These values are smaller as compared to values of the magnetic fields created at the Large Hadron Collider (LHC) and the Relativistic Heavy Ion Collider (RHIC). Therefore HIC provides us with a unique opportunity to investigate properties of hot QCD matter under the influence of magnetic fields.

Being an important quantity, transport coefficients of QGP is also suspected to be modified due to a strong magnetic field. Their microscopic estimations become quite important as they enter as input of evolving QGP. Based on that interest, microscopic calculations of transport coefficients like shear viscosity [9–17], bulk viscosity [18–22], and electrical conductivity [12,23–35] for the relativistic systems in the presence of a magnetic field have been rigorously studied recently. Relaxation time

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Contents lists available at ScienceDirect

Journal of the Indian Chemical Society

journal homepage: www.elsevier.com/locate/jis

Variations of structures on changing the ratios of metal ions in rare Ca(II)–Zn(II) hetero-metallic self-assembled coordination polymers of hexamethylenetetramine and benzoate

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ARTICLE INFO

Keywords:
Calcium(II)
Zinc(II)
Heterometallic
Hexamethylenetetramine
Benzoate
Polymers

ABSTRACT

Two rare hetero-metallic calcium(II)–zinc(II) complexes $[Ca_2Zn_2(OH)_2(\mu_2\text{-hmt})_2]$ (1) and $[Ca_2Zn_2(OH)_2(\mu_2\text{-hmt})_2]$ (2) have been synthesized using basic zinc carbonate, benzoic acid (HOBz), hydrated calcium chloride and hexamethylenetetramine (hmt) by varying the molar ratio of the reactants. Both the complexes have been analyzed by elemental analysis, IR spectroscopy and X-ray crystallography. The complex 1 is a 1D polymer which contains one calcium ion and four zinc atoms in the asymmetric unit together with two benzoates and two hmt. The polymer has been constructed by the alternate joining of paddle-wheel $Zn_2(OH)_2$ units and Zn_2Ca trimeric species by μ_2 -hmt bridging molecules connecting Zn^{2+} ions. Zinc atoms have five coordinate square pyramidal geometries and four coordinate tetrahedral geometries in $Zn_2(OH)_2$ and Zn_2Ca moieties, respectively, whereas calcium atoms have six-coordinate distorted octahedral geometry. Complex 2 is also a 1D polymer but unlike complex 1, it contains four independent zinc and two independent calcium atoms in the asymmetric unit together with twelve benzoates and two hmt. By contrast, the polymeric structure of complex 2 has been formed by the connection of Zn_2Ca trimeric species via μ_2 hmt bridging molecules at Zn centers. Complex 2 is also a 1D polymer but unlike complex 1, it contains four independent zinc and three independent calcium atoms in the asymmetric unit together with twelve benzoates and two hmt. All four zinc atoms are four coordinate with tetrahedral environments and the calcium atoms are six coordinated (two are located on a center of symmetry) exhibiting a distorted octahedral geometry.

1. Introduction

The design and synthesis of both discrete and extended metallo-supramolecular assemblies by utilizing facile strategies are of enormous interest in the field of crystal engineering due to their interesting molecular networks and unusual properties [1–4]. In 1987, Lehn first described the novel idea of supramolecular architecture [15]. The various non-covalent interactions like hydrogen bond, stacking, hydrophobic, electro-static and charge-transfer interactions along with metal ion coordination [16,17] are the heart of supramolecular Chemistry. The small molecular building blocks form supramolecular networks with the

help of coordinate covalent bonds, H-bonds, C–H/π, π-π, anion-π and cation-π interactions [18–21]. In order to control the network topology and the dimensionality of such extended supramolecular architectures, the selection of molecular building blocks are very much important. The structure of molecular building blocks can be controlled and modified by the choice of metal ions depending on their suitable geometry and coordination number and organic ligands with appropriate structure, denticity and flexibility. Evidently, by the proper choice of solvent system and varying the reactant ratios it is possible to construct molecular building blocks with different structures [22,23].

In this context, hexamethylenetetramine (hmt) is potentially an

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<https://doi.org/10.1016/j.jis.2021.100097>

Received 14 May 2021; Received in revised form 15 June 2021; Accepted 2 July 2021
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Contents lists available at ScienceDirect

International Journal of Biological Macromolecules

journal homepage: <http://www.elsevier.com/locate/ijbiomac>

Review

Biologically active polysaccharide from edible mushrooms: A review

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ARTICLE INFO

Article history:

Received 15 April 2020

Received in revised form 16 November 2020

Accepted 12 January 2021

Available online 16 January 2021

Keywords:

Edible mushrooms

Polysaccharides

Structure

Bioactivities

ABSTRACT

Mushrooms are renewable natural gift for humankind, furnished with unique taste, flavor and medicinal properties. For the last few decades study of mushroom polysaccharides has become a matter of great interest to the researchers for their immunomodulating, antimicrobial, antioxidant, anticancer, and antitumor properties. Molecular mass, branching configuration, conformation of polysaccharides and chemical modification are the major factors influencing their biological activities. The mechanism of action of mushroom polysaccharides is to stimulate T-cells, B-cells, natural killer cells, and macrophage dependent immune responses via binding to receptors like the toll-like receptor-2, dectin-1. The present review offers summarized and significant information about the structural and biological properties of mushroom polysaccharides, and their potential for development of therapeutic materials.

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Review

A review on antiviral and immunomodulatory polysaccharides from Indian medicinal plants, which may be beneficial to COVID-19 infected patients



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ARTICLE INFO

Article history:

Received 29 December 2020

Received in revised form 14 March 2021

Accepted 25 March 2021

Available online 29 March 2021

Keywords:

COVID-19

SARS-CoV-2

Plant polysaccharides

Antiviral

Immunomodulatory

ABSTRACT

The emergence of the novel coronavirus, SARS-CoV-2 has pushed forward the world to experience the first pandemic of this century. Any specific drug against this RNA virus is yet to be discovered and presently, the COVID-19 infected patients are being treated symptomatically. During the last few decades, a number of polysaccharides with potential biological activities have been isolated from Indian medicinal plants. Many polysaccharides, such as sulfated xylomannan, xylan, pectin, fucoidan, glucans, glucosaminans, and arabinosylans from Indian medicinal plants, have been shown to exhibit antiviral and immunomodulating activities. Plant polysaccharides exhibit antiviral activities through interference with the viral life cycle and inhibition of attachment of virus to host cell. Intake of certain immune stimulating plant polysaccharides may also protect from the virus to a certain extent. In process of continuous search for most potent drug, Indian plant polysaccharides may emerge as significant biomaterial to combat COVID-19. This review explores a number of polysaccharides from Indian medicinal plants which showed antiviral and immunomodulating activities. It is aimed to provide an overview about the composition, molecular mass, branching configuration and related bioactivities of polysaccharides which is crucial for their classification as possible drug to induce immune response in viral diseases.

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Genetic variations and epigenetic modulations in CYP genes: Implications in NSAID-treatment of arthritis patients

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Received: 28 June 2021 / Accepted: 10 September 2021
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Abstract

Drugs show specific pharmacodynamic properties and a plethora of adverse drug reactions depending on the genetic makeup of their users. Pharmacogenomics explains the variations of effects of drugs in humans depending on their race, ethnicity, age and gender. It has been extensively reported in the literature that variations in drug metabolism is associated with genetic polymorphism. Non-steroidal anti-inflammatory drugs (NSAIDs) are prescribed for pain management in arthritis. Cytochrome P450 (CYP) 2C9 is responsible for the metabolism of a wide range of drugs including the NSAIDs. The gene encoding for this enzyme is found in different polymorphic forms. People with CYP variants, CYP2C9*2 and CYP2C9*3 have been found to exhibit marked differences in NSAID metabolism and clearance compared to individuals with the wild type CYP gene (CYP2C9*1). There are several reports indicating epigenetic regulation of the CYP promoter that influences expression and functionality of this enzyme complex. Complications like adverse drug reactions involving gastro-intestinal bleeding are often fatal in NSAID treated patients with genetic polymorphism. In this review, complications associated with the use of NSAIDs and CYP polymorphism including drugs that are under investigation to bypass CYP polymorphism-linked adverse drug reactions, are discussed.

Keywords Genetic polymorphism · CYP genes · NSAIDs · Adverse drug reactions

Corresponding Editor: Somnath Paul; Reviewers: Sakat Biswas, Pritha Bhattacharjee, Kosal Das, Sumon Datta.

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Abbreviations

AS	Ankylosing spondylitis
ASA	Acetyl salicylic acid
AUGITB	Acute upper gastro-intestinal tract bleeding
CAR	Constitutive androstane receptor
CDC	Centers for disease control and prevention
COX	Cyclooxygenase
CPIC	Clinical pharmacogenetics implementation consortium
CV	Cardiovascular
CYP	Cytochrome P450
DNMTs	DNA methyltransferase
GA	Gouty arthritis
mPGES-1	Microsomal prostaglandin E2 synthase-1
hPH	Human primary hepatocytes
HNF4	Hepatocyte nuclear factor 4
mg/d	Milligrams per day
MC	Mediator complex
MED25	Mediator complex subunit 25
NF- κ B	Nuclear factor- κ B
NO-NSAIDS	Nitric oxide producing NSAID

একটি তুলসীগাছের কাহিনী : ভাঙা দেশ আর ভাঙা মানুষের কাহিনী অনামিকা মণ্ডল

দীর্ঘ ব্রিটিশ শাসনাধীন থাকার পর আমরা আমাদের কাঙ্ক্ষিত স্বাধীনতা পেলাম অনাকাঙ্ক্ষিত দেশ বিভাজনের মধ্য দিয়ে। ১৯৪৭ সালের ১৪ ও ১৫ই আগস্ট এবং তার দু-এক বছর আগে পিছে গেলে আমরা বুঝতে পারব কত হাজার হাজার মানুষের কাছে এই দ্বিখণ্ডিত দেশ এই স্বাধীনতা আসলে হতে উঠেছে রক্তক্ষরণের ইতিহাস, যন্ত্রণার ইতিহাস। “মোরা এক বৃন্তে দুটি কুসুম হিন্দু- মোসলমান।/মুসলিম তার নয়নমণি, হিন্দু তাহার প্রাণ।/এক সে অকল মায়ের কোলে/ যেন রবি শশী দোলে,/ এক রক্ত বৃকের তলে, এক সে নড়ির টান।।” ভারতের মতো এই সেকুলার দেশকে ধর্মের ভিত্তিতে দ্বিখণ্ডিত করে দেওয়া হল। যে দেশে হিন্দু মুসলমানের পারস্পরিক সহাবস্থান ছিল, সৌজত্ব ছিল সে দেশেই দেখা গেল জাতি- ধর্মের উর্ধ্বে গিয়ে গোটা মানব সত্তার চরম অবমাননা।

স্বাধীনতার ঠিক এক বছর আগে ৪৬-এর দাঙ্গায় মানুষ দেখেছে মানুষেরই ভয়ংকর প্রতিমূর্তি। ধর্মকে কেন্দ্র করে মানুষ কীভাবে অ-মানুষে পরিণত হয়ে যেতে পারে গোটা দেশ হুচক্ষে তা দেখেছে। সেই রক্তক্ষরণ, নিষ্ঠুর হত্যালীল থেকে মুক্তির আশায় হয়তো সেদিন মানুষ দেশভাগকে স্বনিকট মনে নিতে পেরেছিল। কিন্তু সেই দেশভাগ হওয়ার পর আরও কঠিন বাস্তবতার সম্মুখীন হতে হয় তাঁদের। কারণ দেশভাগের সঙ্গেই শুরু হয়ে যায় দেশ ত্যাগের পালা। মনে পরে যায় সাদাত হোসেন মাস্টার 'টোবা টেক সিং' গল্পের কথা। 'টোবা টেক সিং কোথায়? পাকিস্তানে না হিন্দুস্তানে?'- এর খোঁজ করতে করতে মানসিকভাবে ভারসাম্যহীন বিষণ সিং সীমানার একফালি জমিতে শেষ নিঃশ্বাস ত্যাগ করতে পারে। কিন্তু বাস্তবে দেখা যায় নিজেদের প্রাণটুকু বাঁচানোর তাগিদে হাজার হাজার মানুষকে তাঁদের সাত পুরুষের ভিটে মাটি ছেড়ে চলে আসতে হয়। তকমা পেতে হয় রিকিউজির।

দেশভাগের পর পাকিস্তান পরিণত হয় মুসলিম রাষ্ট্র। মুসলমানদের



Available online at <http://scik.org>

J. Math. Comput. Sci. 11 (2021), No. 1, 459-466

<https://doi.org/10.28919/jmcs/5147>

ISSN: 1927-5307

A NOTE ON GRAPH QUASI-CONTINUOUS AND GRAPH CLIQUISH FUNCTIONS

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Abstract: In this paper we study under which conditions there is exactly one quasi-continuous function whose graph is contained in the closure of the graph of a graph quasi-continuous function. Also, we study the relation between a graph cliquish function and a cliquish function whose graph is contained in the closure of the graph of the graph cliquish function.

Keywords: quasi-continuity; graph quasi-continuity; cliquish functions; graph cliquish functions; graph continuity.

2010 AMS Subject Classification: 46A30.

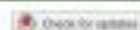
1. INTRODUCTION AND BASIC NOTATIONS

Z. Grande [1] in 1977 introduced the notion of graph continuity of functions. K. Sakalava [10], [11] studied the relation between graph continuous function f and a continuous function g such that $G(g) \subseteq cl(G(f))$ and showed that this relation is neither one-to-one nor onto i.e., there is a continuous function g whose graph is contained in the closure of the graph of infinitely many graph continuous functions and also there is a graph continuous function f such that the closure of the graph of f contains the graph of several continuous functions. A. Mikuka [5] in 2003

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Received October 28, 2020



Altitudinal partitioning of syrphid flies (Diptera) increases along elevation gradients in pollinator communities in the Eastern Himalayas, India

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ABSTRACT

The diversity and altitudinal distribution patterns of syrphid flies in the Neora Valley National Park, in the Eastern Himalaya was studied, including the ramifications of pollination by drone fly (*Eristalis tenax*) showing Batesian mimicry of honeybees. Considering the altitudinal variation and visitation rate, the study found a total of 30 Syrphidae species, among which *Eristalis himalayensis*, *E. tenax*, *Chrysogaster* sp., *Episyrphus boltonia*, *Forapus haemorrhous* and *Syrphus dolhouster* had the highest encounter rate. The maximum number of species was observed at a 2500 m a.s.l. The diversity of Syrphidae in the Neora Valley reflects the supremacy of these flies over other pollinator insects in the study area. The mean visit per hour of drone fly (*E. tenax*) was $21 \pm 2.73_{SE}$ (SE – standard error) individual at the lower altitudes but the rate was higher ($37.1 \pm 4.09_{SE}$) in the absence of honeybees at the higher altitudes. More information about the primary determinants of the dynamic nature of pollination is required in this area in order to understand plant-pollinator responses to global warming.

ARTICLE HISTORY

Received 14 January 2022
Accepted 17 October 2022

KEYWORDS

Drone fly; honeybee;
functional diversity;
pollination; Syrphidae

Introduction

The diversity of pollinators plays a significant role in maintaining balance within in ecosystems by contributing to biodiversity conservation, food production, natural selection and evolution (Real 1983; Orford, Vaughan, and Memmott 2015; Hall and Martins 2020). Social honeybees are one of the most important pollinators for wild plants as well as crops (Morse and Calderone 2000; Aslan et al. 2016; Hung et al. 2018). Owing to numerous environmental pressures, there is a decreasing trend in pollinator communities, including honeybees (Osborne, Williams, and Corbet 1991; Steffan-Dewenter and Tscharntke 1999; Steffan-Dewenter, Potts, and Packer 2005; Garibaldi et al. 2011; Potts et al. 2016). In addition, the diversity and abundance of flower-visiting flies play an important role in pollination in a variety of habitats (Mitra and Banerjee 2007; Szymank et al. 2008; Orford, Vaughan, and Memmott 2015; Klecka et al. 2018; Raguso 2020). The fact that flies are also pollinators is often overlooked, because of the limited knowledge and documentation about fly pollination compared to other groups of pollinators such as honeybees, butterflies, moths, birds and bats (Orford, Vaughan, and Memmott 2015). However, there is an emerging interest and increasing research done on syrphid flies (drone fly *Eristalis* spp.),

whose behaviour is similar to that of honeybees (*Apis mellifera*) and bumble bees (*Bombus dahlbomii*) by means of Batesian mimicry (Golding and Edmunds 2000; Polidori et al. 2013). Many syrphid flies feed exclusively on nectar and pollen (Goulson and Wright 1998; Irvin et al. 1999), and this plays a significant role in pollination, much like honeybees (Forup et al. 2008). These flies are more dominant at higher altitudes or latitudes (Kanstrup and Olesen 2000; Tuisanen et al. 2016). Pollen is highly nutritious due to its nitrogenous, carbohydrate, lipid, vitamin and mineral constituents and is required by female syrphids for normal ovarian development (Schneider 1969; Maier 1978). The pollination networks of syrphid flies make a major contribution to the agricultural production of numerous crops (Jaeker and Wolters 2008; Szymank et al. 2008; Rader et al. 2009; Inouye et al. 2015; Rader et al. 2016), even playing a dual role as pollination agents and biological control agents (Dunn et al. 2020).

The Eastern Himalayas (EH hereafter), with a total area of nearly 525,000 km², has been identified as part of the 'crisis ecoregions'; 'biodiversity hotspots'; 'mega-diverse countries'; and 'Global 200 Ecoregions' (Brooks et al. 2006; Chettri et al. 2010). The region is also a meeting ground for the Indo-Malayan, Palearctic, and Sino-Japanese biogeographical realms, with diverse



Insignificance of the anomalous magnetic moment of the quarks in presence of chiral imbalance

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Received: 28 November 2021 / Accepted: 13 April 2022

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Communicated by R. Alkofer

Abstract We incorporate the anomalous magnetic moment (AMM) of quarks in the framework of PNJL model to study hot and dense magnetized matter with chiral imbalance. For this purpose, the eigen energy solution of the Dirac equation is obtained in presence of constant background magnetic field and chiral chemical potential (CCP) along with the minimal anomalous magnetic moment interaction of the fermion. Although there is a marginal enhancement in the EMC behaviour of the quark condensate due to the combined effects of AMM and CCP, we find that the overall behaviour of the Polyakov loop and the chiral charge density is dominated by the chiral chemical potential. It is further shown that the AMM effects in presence of CCP remains insignificant even after consideration of thermo-magnetically modified moments.

1 Introduction

Quantum chromodynamics (QCD) is the established theory of strong interaction between quarks and gluons. The influence of the background magnetic field on various microscopic as well as bulk properties of strongly interacting matter at finite temperature and/or baryon density, has seen intensive research activities for the last couple of decades (see Refs. [1–3] for review). Current studies [4, 5] indicate that, in a non-central heavy ion collision (HIC) experiment, very strong transient magnetic fields of the order $\sim 10^{18}$ Gauss or

larger might be produced. The presence of sizable electrical conductivity of the hot and dense magnetized medium results in substantial delay in the decay process of these time dependent fields [6–9]. Since, the strength of the magnetic field reaches up to the typical QCD energy scale ($eB \sim \Lambda_{\text{QCD}}^2$), the properties of the QCD matter could be significantly modified [1]. Apart from that, a large magnetic field can exist in several other physical situations. For example, in the interior of magnetars [10, 11], the magnetic field strength can be $\sim 10^{15}$ Gauss whereas the value of the magnetic field during the electroweak phase transition can be as high as $\sim 10^{21}$ Gauss [12, 13].

The most fundamental features of QCD vacuum in the low energy region are the spontaneous breakdown of chiral symmetry, axial anomaly and color confinement. At vanishing baryon density, most of our current understanding of these non-perturbative aspects are derived from the Lattice QCD simulations [14–19]. However, a straightforward Monte Carlo simulation in three-color QCD on Lattice cannot be performed at finite baryon density owing to the (in)famous sign problem [19–21], although, using indirect methods results are available at baryon densities as large as $\mu_B/T \sim 2.5$ [22, 23]. An alternative approach is to work with effective model description such as the Nambu–Jona-Lasinio (NJL) model [24, 25] which respects the global symmetries of QCD, most importantly the chiral symmetry. Being an effective model, within its domain of applicability it provides a useful scheme to study some of the important non-perturbative properties of the QCD vacuum [26–29]. As the gluonic degrees of freedom have been integrated out in this effective description, point-like interaction among the quarks appears [26] which makes the NJL model non-renormalizable. Therefore, one has to choose a proper reg-

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Dilepton production from chirally asymmetric matter

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We evaluate the dilepton production rate (DPR) from hot and dense chirally asymmetric quark matter. The presence of a finite chiral chemical potential (CCP) in the electromagnetic spectral function results in the appearance of new cut structures signifying additional scattering processes in the medium which leads to a significant enhancement in the DPR at lower values of invariant mass. The constituent quark mass evaluated using a three-flavor Nambu–Jona-Lasinio model is also nontrivially affected by the CCP. These are found to result in a continuous dilepton production rate as a function of the invariant mass for higher values of temperature and baryonic chemical potential.

DOI: 10.1103/PhysRevD.105.096001

I. INTRODUCTION

The study of QCD vacuum structure under extreme conditions of temperature and/or baryon density is one of the main objectives of relativistic heavy ion collision (HIC) experiments at the RHIC and LHC. It is well established that the infinite number of energy-degenerate different vacuum configurations of QCD at zero and low temperatures can be characterized by topologically nontrivial gauge configurations with a nonzero winding number [1]. These gauge configurations are called instantons which can invoke transition between two different vacua by means of crossing a potential barrier with a height of the order of the QCD scale Λ_{QCD} . This mechanism is known as instanton tunnelling [2–4]. However, at high temperatures, for example, in the quark gluon plasma (QGP) phase of HICs, a copious production of another kind of gluon configuration, called sphalerons, is expected [5,6]. It is conjectured that the abundance of sphalerons can enhance the transition rate by crossing the barriers between different energy-degenerate vacua [7–10]. The topologically nontrivial gauge field configurations can switch the helicities of quarks while interacting with them. This in turn leads to the

breaking of parity (P) and charge-parity (CP) symmetries by creating an asymmetry between left- and right-handed quarks via the axial anomaly of QCD [11,12]. Chirality imbalance can be produced locally as there is no direct observation of the violation of P and CP in QCD globally [11–14]. This locally induced chirality imbalance is characterized by means of a chiral chemical potential (CCP) which basically represents the difference between the number of right- and left-handed quarks.

HICs with a nonzero impact parameter can give rise to very high magnetic fields of the order of few m_π^2 [15,16]. Such high magnetic fields in the presence of chirality imbalance can lead to a separation of positive and negative charges with respect to the reaction plane and induce a current along the magnetic field dubbed as chiral magnetic effect (CME) [15,17–19]. Substantial efforts have been made to detect CME in HIC experiments at the RHIC at Brookhaven. Very recently, the STAR Collaboration has performed an extensive analysis which has provided no indication of CME in HICs [20]. As a consequence, new techniques for the experimental determination of CME have been proposed [21,22].

Since a local domain of chirality imbalance is expected to be produced in QGP, in addition to the CME there have been intense studies on the phase structure [23–25], microscopic transport phenomena [17,26–28], collective oscillations [29–31], fermion damping rate [32], and collisional energy loss of fermions [31], as well as properties of electromagnetic spectral function [33] in chirally imbalanced medium. Moreover, chirally asymmetric plasma is expected to be produced in the gap regions of the magnetospheres of pulsars and black holes [34] and other stellar astrophysical scenario [29,35–38].

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Electromagnetic spectral functions in hot and dense chirally imbalanced quark matter

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✉ (Received 4 January 2022; revised 15 March 2022; accepted 3 April 2022; published 4 May 2022)

The photon self-energy from chirally imbalanced quark matter is evaluated at finite temperature and density using the real time formulation of thermal field theory. The analytic structure is explored in detail exposing the cut structure which corresponds to a variety of physical scattering and decay processes in the medium and their thresholds. The mass of the quarks in the chiral symmetry broken phase are obtained from the gap equation of the Nambu–Jona-Lasinio model. It is found that, in presence of finite chiral chemical potential, the chiral condensate tends to get stronger at low temperatures while the opposite is observed at high temperature values. A continuous spectrum is obtained for the electromagnetic spectral function and this is purely a finite chiral chemical potential effect.

DOI: 10.1103/PhysRevD.105.096005

I. INTRODUCTION

Relativistic collision of heavy ions aim to probe the QCD vacuum structure under extreme conditions of temperature and/or baryon density [1–4]. There exists in fact an infinite number of energy-degenerate different vacua of QCD characterized by an integer valued winding number and separated by a potential barrier [5]. This is probed by nontrivial topological gauge configurations which interpolate between these vacua. At small values of temperature, transition between different vacua are dominated by instanton tunneling [6–8], resulting in a lower transition rate. In Ref. [9] it is argued that, the existence of infrared instanton structure can provide a mechanism for the chiral phase transition. However, at temperatures comparable to the QCD scale, an abundant production of the QCD sphalerons, another kind of topological gluon configurations, is expected [10,11] which can lead to the significant increase in the transition rate by crossing the barriers between different vacua [12–15]. Interaction of the quarks with these topological gauge fields can change their

helicities which in turn produces an imbalance between left- and right-handed quarks and thus lead to the breaking of the parity (P) and charge-parity (CP) symmetry by means of the axial anomaly of QCD [16,17]. As there is no direct P and CP violation in QCD, there can only be local domains with chirality imbalance which vanishes globally [18,19]. The existence of chiral imbalance or a difference in the number of right- and left-handed quarks would imply the existence of a chiral chemical potential (CCP).

Off-central collisions of heavy nuclei moving with velocities close to that of light can also generate a pulse of very strong magnetic field estimated to be $\sim 10^{13}$ Tesla [20,21]. Consequently, electromagnetic interactions driven by such high magnetic fields are as strong as QCD interactions. In this situation an asymmetry between the densities of left- and right-handed quarks will induce a separation of charges or an electric current being set up along the direction of the magnetic field. This is known as chiral magnetic effect (CME) [20,22–24]. Experimental detection of this transient effect will not only provide direct evidence for the formation of a chirally symmetric deconfined QCD matter with domains where P and CP symmetries are locally violated by QCD but also prove the existence of strong magnetic fields. Intense efforts have been going on to detect CME in heavy ion collision experiments at the RHIC at Brookhaven. Recently, the STAR Collaboration performed a blind analysis of a large data sample of approximately 3.8 billion isobar collisions which so far have yielded a null result [25]. However, new methods for experimental determination of CME have been proposed [26,27]. Besides these, the chiral imbalance also

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Quantum field theoretical structure of electrical conductivity of cold and dense fermionic matter in the presence of a magnetic field

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© (Received 26 November 2021; accepted 13 July 2022; published 9 August 2022)

We have gone through a detailed calculation of the two-point correlation function of vector currents at finite density and magnetic field by employing the real time formalism of finite temperature field theory and Schwinger's proper-time formalism. With respect to the direction of the external magnetic field, the parallel and perpendicular components of electric conductivity for the degenerate relativistic fermionic matter are obtained from the zero-momentum limit of the current-current correlator, using the Kubo formula. Our quantum-field theoretical expressions and numerical estimations are compared with those obtained from the relaxation-time approximation methods of kinetic theory and its Landau quantized extension, which can be called classical and quantum results, respectively. All the results are merged in the classical domain i.e., the high-density and low-density magnetic field region, but in the remaining (quantum) domain, quantum results carry a quantized information like the Shubnikov-de Haas oscillation along the density and magnetic field axes. We have obtained a completely new quantum-field theoretical expression for perpendicular conductivity of degenerate relativistic fermionic matter. Interestingly, our quantum field theoretical calculation provides a new mathematical form of the cyclotron frequency with respect to its classical definition, which might require more future research to interpret the phenomena.

DOI: 10.1103/PhysRevD.106.036006

I. INTRODUCTION

An extremely high density and strong magnetic field [1] is naturally found in compact stars like white dwarf (WD) and neutron stars (NS), which have long been studied as a focus research problem of the nuclear and astrophysics sector. These happen to be the dead remnants of massive stars, the cores of which have collapsed during supernovae collision and a complicated layer structure has formed leading to a compact structure as the leftover; they are not massive enough to form black holes because of an incomplete collapse. Based on various studies [2,3], we know a gross range from 10^{12} G [2] to 10^{15} G [3] for the surface magnetic fields in NS. With increasing depth the density of matter increases reaching up to $\rho \approx 2.8 \times 10^{14}$ gm/cm³ [4]. At this

density nucleons cease to exist and the matter is made up of quarks. From Maxwell's equations, we know that magnetic flux is conserved. This leads to the conclusion that the strength of the magnetic field is $>10^{16}$ G in the interior of neutron stars and magnetars. The strength of the magnetic field varies depending on the nature of the core. For a core made up of neutrons the magnetic field produced is of the order 10^{18} G and for a quark core [5] it is of the order of 10^{20} G [6]. This magnetic field strength of NS can have ohmic decay profile, which depends on the electrical conductivity of the NS [7]. To solve the relativistic magnetohydrodynamics equations for simulating magnetized neutron stars or binary star mergers, the electrical conductivity of the crustal matter becomes an important input [8–12]. Due to the recently observed gravitational wave signal GW170817 [13], the binary-neutron star merger simulation has gained attention, thus unfolding a new field of research—multimessenger astronomy. In these connections, the microscopic calculation of electrical conductivity in presence of a magnetic field might be an important research topic. One can find a long history with a long list of references (e.g., Refs. [14–17]) for the microscopic calculation of electrical conductivity for compact star but those references have not considered the impact of the magnetic field. For those calculations at a finite magnetic

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Anisotropic pressure of magnetized quark matter with anomalous magnetic moment

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✉ (Received 3 June 2022; accepted 5 September 2022; published 26 September 2022)

We investigate magnetic field (eB) dependence of constituent quark mass, the longitudinal and transverse pressure as well as the magnetization and magnetic susceptibility of strongly interacting quark matter. We employ the two-flavor Polyakov Nambu–Jona-Lasinio model with the inclusion of the anomalous magnetic moment (AMM) of the quarks at finite temperature (T) and finite quark chemical potential (μ_q) capturing different stages of chiral phase transition. We find that the transverse pressure, magnetization, and magnetic susceptibility become highly oscillatory for large values of eB in the chiral symmetry broken phase. However, the oscillations cease to occur at higher values of T and μ_q , when chiral symmetry is (partially) restored and the anisotropic nature of the pressure becomes significant even at smaller values of eB . As the inclusion of AMM of the quarks leads to inverse magnetic catalysis of the transition temperature, we observe that the variations of transverse pressure, magnetization, and magnetic susceptibility are significantly modified in the vicinity of the chiral transition temperature. Furthermore, above the chiral transition temperature the magnetic susceptibility is found to remain positive for a wide range of eB , indicating a paramagnetic character of the strongly interacting quark matter. Finally, we have also examined the magnetism of strongly interacting matter in the quarkyonic phase. The obtained results could be useful for a magnetohydrodynamic evolution of hot and dense matter created in heavy-ion collisions.

DOI: 10.1103/PhysRevD.106.056020

I. INTRODUCTION

Study of hot and/or dense matter in the presence of a strong magnetic field has attracted a wide spectrum of researchers from both theoretical as well as experimental domains in the last few decades [1–9]. Numerical estimations suggest that, in noncentral or asymmetric collisions of two heavy nuclei, very strong magnetic fields of the order $\sim 10^{18}$ G or larger might be generated due to the receding spectators [10,11]. These fields are, in principle, time dependent and their decay process gets sufficiently delayed due to the presence of a large electrical conductivity of the hot and dense magnetized medium [12–15]. Apart from

this, strong magnetic fields can also exist in several other physical environments. For example, in the interior of certain astrophysical objects called magnetars [16,17], magnetic field $\sim 10^{15}$ G can be present. Moreover, it is conjectured that, primordial magnetic fields as high as $\sim 10^{23}$ G might have been produced in the early Universe during the electroweak phase transition driven by chiral anomaly [18,19]. Since the strength of these magnetic fields is equivalent to the typical quantum chromodynamics (QCD) energy scale ($eB \sim \Lambda_{\text{QCD}}^2$), various microscopic and bulk properties of the strongly interacting matter could be significantly modified (see Refs. [1,2,4] for recent reviews). Furthermore, the presence of a strong background magnetic field results in a large number of interesting physical phenomena [20–23] owing to the rich vacuum structure of the underlying QCD, e.g., the chiral magnetic effect [5,10,24,25], magnetic catalysis (MC) [26–29], inverse magnetic catalysis (IMC) [30,31], chiral vortical effect, vacuum superconductivity, and superfluidity [32,33], etc.

The spontaneous breakdown of chiral symmetry and color confinement are the most fundamental characteristics of QCD vacuum in the low energy region. The majority of our current understanding of these nonperturbative aspects

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Finite size effect on the thermodynamics of a hot and magnetized hadron resonance gas

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Received 8 August 2022

Revised 13 November 2022

Accepted 8 December 2022

Published 9 January 2023

The thermodynamic properties of a non-interacting ideal hadron resonance gas (HRG) of finite volume have been studied in the presence of an external magnetic field. The inclusion of background magnetic field in the calculation of thermodynamic potential is done by the modification of the dispersion relations of the charged hadrons in terms of Landau quantization. The generalized Matsubara prescription has been employed to take into account the finite size effects in which a periodic (anti-periodic) boundary conditions is considered for the mesons (baryons). We find significant effects of the magnetic field as well as system size on the temperature dependence of energy density, longitudinal and transverse pressure especially in low temperature regions. The HRG is found to exhibit diamagnetism (paramagnetism) in the low (high) temperature region whereas the finite size effect is seen to strengthen the diamagnetic behavior of the medium.

Keywords: Hadron resonance gas; heavy ion collision; external magnetic field; finite size effect; QCD thermodynamics.

1. Introduction

As an essential part of the Standard Model of particle physics, quantum chromodynamics (QCD) is the established theory of strong interaction between quarks and gluons. One of the most interesting predictions of QCD is that strongly interacting matter possesses at least two distinct phases: at low temperature and/or

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Contents lists available at ScienceDirect

Journal of the Indian Chemical Society

journal homepage: www.elsevier.com/locate/jics

A hexanuclear discrete assembly and a two dimensional coordination polymer constructed from heterotrinnuclear $[(\text{CuL})_2\text{Zn}]^{2+}$ nodes and dicyanamide spacer ($\text{H}_2\text{L} = \text{salen type Schiff base ligands}$)

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ARTICLE INFO

Keywords:
Copper(II)
Zinc(II)
Heterometallic
Schiff base
Dicyanamide
Polymer

ABSTRACT

Two new Cu(II)–Zn(II) complex as a discrete hexanuclear cluster $[(\text{CuL})_2\text{Zn}]^{2+}/\mu_3\text{-N}(\text{CN})_2$ (1) and a two dimensional (2D) coordination polymer $[(\text{CuL})_2\text{Zn}(\mu_3\text{-N}(\text{CN})_2)]_n$ (2) have been isolated by mixing two similar tetradentate Schiff bases H_2L^1 (*N,N'*-bis(*o*-ethylsalicylidene)-1,3-propanediamine) and H_2L^2 (*N,N'*-bis(salicylidene)-1,3-pentanediamine) separately with $\text{Cu}(\text{OAc})_2 \cdot 4\text{H}_2\text{O}$, $\text{Zn}(\text{OAc})_2 \cdot 4\text{H}_2\text{O}$ and $\text{Na}(\text{CN})_2$ at same reaction condition. The heterometallic complexes have been structurally characterized by single crystal X-ray analysis showing that both are formed by angular trinuclear nodes and $\mu_3\text{-N}(\text{CN})_2$ spacers. The trinuclear nodes $[(\text{CuL})_2\text{Zn}]^{2+}$ in 1 and $[(\text{CuL})_2\text{Zn}]^{2+}$ in 2 are produced in situ from their corresponding reactants. The two Schiff base ligands coordinating the Cu(II) ions through the N_2O_2 donor set are additionally bonded to a Zn(II) ion with the four phenoxide oxygen atoms that act as bridging atoms. The zinc ion completes its coordination geometry with two terminal nitrogen atoms of two different dicyanamide spacers. The orientation of spacers from zinc ion are convergent in 1 whereas divergent in 2. Thus, two $[(\text{CuL})_2\text{Zn}]^{2+}$ nodes are interconnected by double $\mu_3\text{-N}(\text{CN})_2$ bridges via Zn(II) centers to form discrete hexanuclear assembly of complex 1. On the other hand, $[(\text{CuL})_2\text{Zn}]^{2+}$ nodes in 2 are joined by $\mu_3\text{-N}(\text{CN})_2$ that bridge Zn(II) to Cu(II) centers of symmetry related units in order to construct a 2D coordination polymer. Consequently, the final coordination environment around Zn(II) is octahedral in both complexes whereas that around Cu(II) are square planar and square pyramidal in 1 and 2 respectively.

1. Introduction


The research on the synthesis and characterization of Coordination Polymer (CP) by using facile strategies has become a hot topic in the field of supramolecular chemistry because of their artistic architectures and exciting applications [1–10]. The term “Coordination Polymer (CP)” is defined as organometallic or inorganic polymeric entities of metal- π /metal assembly and linkers/spacers connected via coordination bonds [11]. The dimensionality as well as the topology of resulting CP can be controlled by various factors like coordination flexibility of the metal ion and ligand, pH of the reaction medium, solvent system, template, temperature and reactant ratios [12–15]. In the year 1990, Robson explained the node and spacer approach for the successful construction of predictable network with required topologies [16,17]. In this approach, the coordination bonds between nodes and spacers are established in order to form the coordination networks with desired topologies. Metal ions as

node has been chosen based on their coordination environment, HSAB behaviour and oxidation state [18]. On the other hand, organic ligand should have some important criteria like flexibility, suitable size and HSAB behaviour to act as an appropriate spacer [18].

Recently, heterometallic discrete assemblies and coordination polymers with different dimensionality have been designed and constructed by using oligonuclear nodes because of their higher geometrical flexibility [18–21]. The oligonuclear nodes contain more than two metal ions in their molecular building blocks. In this context, heterotrinnuclear neutral or cationic complexes of Schiff base ligands have been widely used as oligonuclear nodes [22–26]. The use of dicyanamide spacer along with oligonuclear nodes is quite common to build up coordination assemblies due to their ability to balance the charge of cationic nodes [15], higher flexibility, long dimension and versatile coordination modes [27]. The $\mu_3\text{-N}(\text{CN})_2$ [28,29] and $\mu_3\text{-N}(\text{CN})_2$ [30] coordination modes of dicyanamide spacer are very common. Besides, the spacer shows $\mu_3\text{-N}$

E-mail address: lakshmikanta09@yahoo.com.<https://doi.org/10.1016/j.jics.2022.100363>Received 21 October 2021; Received in revised form 17 December 2021; Accepted 14 January 2022
0019-4522/© 2022 Indian Chemical Society. Published by Elsevier B.V. All rights reserved.

Synthesis of 5*H*-Chromeno[4,3-*b*]pyridin-5-one derivatives as a backbone of natural product polyneomarine C scaffolds in presence of Et₃N and NH₄OAc in EtOH

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This paper belongs to a Regular Issue.

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Abstract

A green one-pot synthesis of 5*H*-Chromeno[4,3-*b*]pyridin-5-one derivatives which are the main core of the natural product of Polyneomarine C is described by the reaction of 4-chloro-3-formyl coumarin and different cyclic and acyclic compounds having active methylene group in presence of Et₃N and NH₄OAc in EtOH. The advantages of this strategy are good yields, no need for the chromatographic separation and the absence of heavy metal catalysts and toxic by-products. The 4-chloro-3-formyl coumarin is obtained by Vilsmeier Heck reaction of 4-hydroxy coumarin.

Keywords

5*H*-Chromeno[4,3-*b*]pyridin-5-one
green synthesis
4-chloro-3-formyl coumarin
active methylene group
Polyalthia nemoralis C

Received: 21.04.22

Revised: 07.06.22

Accepted: 07.06.22

Available online: 14.06.22

1. Introduction

In the last one or two decades, one-pot tandem chemical transformation without metal catalysts has been widely used for the synthesis of complex organic molecules. A variety of chemical conversion processes, such as oxidation, reduction, substitution, condensation, etc., has been developed using this principle [1-3]. A reaction undergoing without using toxic reagents (catalysts and solvents) has many advantages: a decrease of wastes, lower toxicity, maximum efficacy, a decrease in the energy requirements of the reactions, a possibility of designing biodegradable products, economic and time factors. Hence, heterocyclic ring formation using this green protocol is an active and attractive field. Coumarin derivatives represent the core structure of many naturally occurring compounds with significant biological activities [4-7]. Lamellarins and related pyrrole derived alkaloids isolated from diverse marine organisms are well known for their remarkable biological activities [8, 9]. The coumarin derivatives fused with azaheterocycles specially the pyridine nucleus have been reported to possess antiallergic, antidiabetic and analgesic properties [10-12]. Santiagonamine is a naturally occurring pyridine fused coumarin derivatives found in the stems and branches of Berberis darwinii Hook, which is a

shrub that abounds in South America having wound-healing properties [13, 14]. Goniothaline [15] is another a natural pyridocoumarin alkaloid, isolated from the Australian rain-forest plant Goniothalamus australis, having antimalarial activity against a chloroquine-sensitive Plasmodium falciparum line (3D7). Polyneomarine C [16] is also a natural 6*H*-chromeno[4,3-*b*]quinolin-6-one derivative, isolated from the Polyalthia nemoralis A. DC, used as Chinese herbal medicine. Coumarin fused pyridine [17-19] derivatives have been reported to possess anti-hypertensive activities, anti-HIV activity, androgen receptor antagonist activity, and optoelectronic activity; they can also act as fluorescent dyes. All these observations highlight the importance and bioactivity of pyridine fused coumarin derivatives. So the interest towards the synthesis of pyridine fused coumarin is trending among the organic chemists. Many methods [20-30] have been developed to synthesize these types of compounds using different types of Lewis acids/bases and metal catalysts with different solvents. The 5*H*-Chromeno[4,3-*b*]pyridin-5-one skeleton constitutes the backbone of Polyneomarine C. We were interested in the preparation of some non-natural analogs of this type of compounds by an easy process. Many syntheses of 5*H*-Chromeno[4,3-*b*]pyridin-5-one derivatives have been de-





A xylan from the fresh leaves of *Piper betle*: Structural characterization and studies of bioactive properties

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ARTICLE INFO

Keywords:
Antioxidant properties
Immunostimulation
NMR studies
Piper betle
Xylan

ABSTRACT

A pure water soluble xylan (PS-I) with an average molecular weight $\sim 1.1 \times 10^5$ Da was isolated from the hot water extraction of fresh leaves of *Piper betle* (paan). The xylan was found to be composed of xylose, galactose and methyl galacturonate in a molar ratio of nearly 3:1:1. The repeating unit was composed of a backbone containing three (1 \rightarrow 4)- α -D-Xylp residues, one of which was branched at O-2 position with the side chain consisting of (1 \rightarrow 4)- α -D-GalpA6Me and terminal β -D-Galp residues. This xylan exhibited macrophage, splenocyte, and thymocyte stimulatory activities. In vitro antioxidant studies demonstrated that the xylan has DPPH radical scavenging potential ($IC_{50} = 148 \mu\text{g/ml}$), ABTS radical quenching activity ($IC_{50} = 188 \mu\text{g/ml}$) and ferrous ion chelating activity ($IC_{50} = 370 \mu\text{g/ml}$). These findings elicit the need for further exploration of the xylan as a natural antioxidant and a potent immunostimulating agent.

1. Introduction

A diverse variety of polysaccharides that are being isolated from plant sources (Schepetkin & Quinn, 2006; Srivastava & Kulkarni, 1989; Wærnård, 2006) have remained a promising and potent area of exploration in the broad domain of carbohydrate chemistry. The primary research interest in this direction stems out of the medicinal attributes of these polysaccharides and the consequent possibility of them being used as alternative and complementary medicine (Pelley & Strickland, 2000) exhibiting antioxidant (Petra et al., 2015; Rao & Muralikrishna, 2006; Wang et al., 2013; Wang et al., 2016), immunomodulatory (Ehringerová et al., 1998; Liu et al., 2002; Ogawa et al., 2005) and anti-tumour activities (Ehringerová et al., 2002; Gao et al., 2017; Ghoneim, 1998; Ghoneim & Gollapudi, 2003, 2008; Peng & She, 2014), in addition to being investigated for their role in regenerative medicine and tissue engineering as drug delivery vehicles (Li et al., 2018). These have enriched the pharmaceutical industry (Fincher & Stone, 1986; Li et al., 2018) and opened up new vistas in pharmaceutical research. Apart from the medicinal traits, a host of plant polysaccharides are known to be excellent food additives (Izydorczyk & Biliaderis, 1995; Long et al., 2020; Pilmik & Rombouts, 1985; Pitkärinen et al., 2018). The

investigation of new polysaccharides from natural sources is likely to play an important role in human health in the future. So the characterization of polysaccharides obtained from various sources still remains a matter of great interest for chemists and biologists.

One of the most popular words being "paan", is associated with the daily lives of billions of Indians, refers to the deep green heart shaped leaves of the betle vine (Guba, 2006). The scientific name of "paan" is *Piper betle* which belongs to the family Piperaceae and its leaves have a strong spicy and aromatic flavor (Wirotsangthong et al., 2008). There are about 100 varieties of betle vine, distributed all over India among which 40 species is found in West Bengal (Guba, 2006). The useful and edible parts of *Piper betle* are leaves, roots, stems, stalks and fruits. Chewing "paan" forms one of the most common chewing habits among the people of the Indian sub-continent (Amonkar et al., 1986; Chen et al., 1995). This, often addictive, oral practice is more familiar in aborigines, and people involved in intense physical labor. The reason behind this is that processed betel leaf has the potential to stimulate the central and autonomic nervous systems (Daniel et al., 2003). The leaf is found to have significant pharmacological activities like antidiabetic, antitumor, antiulcer, antiplatelet aggregation, anti-fertility, antimutagenic, anticarcinogenic, antimicrobial, anthelmintic and

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<https://doi.org/10.1016/j.carbpol.2022.119570>

Received 23 December 2021; Received in revised form 21 April 2022; Accepted 2 May 2022
Available online 5 May 2022

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Available online at <http://icicik.org>
J. Math. Comput. Sci. 2022, 12:151
<http://doi.org/10.28919/jmcs/73366>
ISSN: 1927-5307

ON ONE-SIDEDLY GRAPH CLIQUISH FUNCTIONS

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Abstract: In the present paper we introduce a new notion of one-sidedly (right, left) graph cliquish functions from the real line to a metric space and study its relation with other types of generalized continuity. We also deal with some properties relating to that new notion of generalized continuity.

Keywords: graph continuity; graph quasi-continuity; graph cliquish functions; right-sidedly (left-sidedly) quasi-continuity; right sidedly (left-sidedly) cliquish functions.

2010 Subject Classification: 05C90.

1. INTRODUCTION AND BASIC NOTATIONS

In what follows Y is a metric space with metric d . Through the paper \mathbb{R} is the real line. Furthermore \mathbb{Z}, \mathbb{Q} stand for the set of integers and rational numbers respectively, ϕ denotes the empty set and $S(x, r)$ is the open sphere with centre x and radius r . For a subset $A \subseteq \mathbb{R}$, $cl(A), int(A)$ denote the closure and interior of A respectively. For a function $f: \mathbb{R} \rightarrow Y$, $G(f)$ denotes the graph of f and then the symbol $cl(G(f))$ denotes the closure of $G(f)$ in the product topology $\mathbb{R} \times Y_d$ (Y_d being the topology on Y induced by d).

The notion of graph continuity of real valued functions on the closed interval $[0, 1]$ was introduced by Z. Grande [4]. K. Sakalava [11] also dealt with that notion. A function $f: \mathbb{R} \rightarrow Y$ is

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Received March 19, 2022



Science Archives (ISSN:2582-6697)

Journal homepage: www.sciencearchives.org



<http://dx.doi.org/10.47587/SA.2022.3103>

Research Article



Ethyl acetate extract of *Terminalia arjuna* bark shows antioxidant activity and protects against oxidative stress in rat liver mitochondria

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Received: Jun 31, 2022 / Revised: Feb 28, 2022 / Accepted: Mar 1, 2022

Abstract

The antioxidant properties of *Terminalia arjuna* (TA) bark have been identified in this present study. The antioxidant properties of ethyl acetate extract of TA bark were established by DPPH radical scavenging activity, reducing power, H₂O₂ scavenging activity, scavenging activity of hydroxyl radical, superoxide radical, and nitric oxide radical. This present study also showed the protective effects of ethyl acetate extract against copper-ascorbate-induced oxidative stress in rat liver mitochondria in vitro. The ethyl acetate extract of TA bark altered the content of reduced glutathione (GSH), levels of lipid-peroxidation (LPO), and protein carbonylation (PCO) ($P < 0.001$) against copper-ascorbate treated rat liver mitochondria, in vitro. Thus, the results indicate that the ethyl acetate extract of TA bark can be considered as a therapeutic agent in the future.

Keywords Terminalia arjuna, Ethyl acetate extract, Oxidative stress, Antioxidant, Rat liver mitochondria

Introduction

In humans, oxidative stress is responsible for various diseases such as Schizophrenia, Bipolar disorder, fragile X syndrome, cancer, Sickle Cell Disease, Parkinson's disease, Alzheimer's disease, atherosclerosis, heart failure (Halliwell, 2007; Valko et al., 2007; Singh et al., 1995; Ramond et al., 2011; Boskovic et al., 2011). As mitochondria are the source of energy in cellular metabolism, the leakage of electrons from the respiratory chain is responsible for the generation of oxidative stress (Lin et al., 2010). This mitochondrial oxidative stress results in the mutation of mitochondrial DNA which is the causative factor of various enzymatic abnormalities. This situation can lead to further oxidative stress.

It has been well documented that the aqueous bark extract of *Terminalia arjuna* (TA) possesses potential antioxidant activity which can protect against oxidative stress mediated damages and thus, can enhance the cellular antioxidant defences. Both aqueous and ethanolic extract of the aqueous bark extract of TA plays a protective role against sodium-fluoride-induced hepatic and cardiac oxidative stress, DNA

damage, anticarcinogenic activity (Sinha et al., 2007; Sinha et al., 2008). The methanolic bark extract of TA protects against gastric ulcer in rats (Devi et al., 2008). The aqueous extract of TA also contains benzoic acid protects against copper-ascorbate induced oxidative stress (Datta, 2020).

To maintain good physical health bark, fruits, leaf can be taken through consumable component such as water, milk etc. (Kiritiker and Basu, 1987). Different bioactive compounds (such as tannin, saponin, ester, sugar, steroids etc.) have been identified chemically in the various parts of the plant (Kiritiker and Basu, 1935). Earlier studies revealed the gastroprotective and anti-mutagenic effects of this plant against various diseases (Devi et al., 2007; Kaur et al., 2002). The protective mechanism(s) of the aqueous bark extract has been established in several in vitro systems such as RBC, liver tissue, heart mitochondria. Now a day such extracts have been used at a higher rate as an alternative and complementary medicine for pharmaceutical industrial research (Newman et al., 2007). Addition of non-polar organic solvent to aqueous bark extract causes removal of less polar organic compounds from aqueous



Research Article



Daily food intake habits, food intake timings and sleep-wakeful cycle of the children and teenagers: a pilot-study

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Received: July 11, 2022 / Revised: Aug 1, 2022 / Accepted: Aug 10, 2022

Abstract

Human behaviour and physiology are temporally controlled by circadian rhythms (24 hrs). Circadian rhythms are interrelated with sleep/wake cycles, so, disruption of one causes the alterations of another. A risk rose from the altered circadian rhythms and sleep cycle affects a huge part of the population. Alterations in the sleeping timings cause a profound change in dietary habits which may lead to myriad metabolic ramifications. The metabolic homeostasis within the physiological system is regulated by the molecular basis and alignment of the circadian clock. Negligence of this alteration may produce deleterious effects on human health. So, various behavioral changes should be implemented to manifest a correct alignment of circadian rhythms and to enhance sleep duration, and also to regularize food habits.

Keywords Circadian rhythms, Food habits, Sleep-wakeful cycle

Introduction

Environmental seasonal changes are being produced by Earth's rotation and the organisms always try to adapt those changes. Physical, mental, and behavioral changes that take approximately 24 hours duration are referred to as circadian rhythms (from Latin words 'circa' and 'diem', about a day). The anticipation of reliable patterns in the environment evolved through over two trillion day-night cycles (Patel et al., 2015). The molecular mechanism of circadian biology remains the same in various kingdoms of life such as protozoans, cyanobacteria, algae, plants, fungi, and animals (Schibler, 2006; Rosbash, 2009).

Circadian rhythms within an organism are essential to establish coordination between behavioral activities and social activities. The most important feature of an endogenous clock is the phase relationship between the rhythms it generates and those of the external environment. Daily fluctuations in input

and output of energy for circadian phases are the most important regulators of the primary metabolic functions in the peripheral tissues (Hass et al., 2010). Alterations in the cellular respiration process cause the formation of various unnecessary metabolites. The accumulation of these metabolites causes damage to the physiological system and this situation continuously tries to establish a synchronized balance with the compensation mechanisms, such as reactive oxygen species (ROS) scavengers (Eckel-Madun et al., 2011) which may include various inhibitory feedback loops (Panda, 2016). For example, in mice, there is a synchronized mechanism between dark phase glycogenesis and light phase glycogenolysis, maintained by the hepatic clock (Koronowski et al., 2019).

Alterations in circadian rhythm and sleep disruption occur in the case of shift workers (the rest phase for humans, as diurnal organisms) (Folkard, 2008; Arendt et al., 2006). Gastrointestinal problems and various other issues including breast cancer and metabolic syndrome have been observed in



FL-Sleep: Temperature adaptive multi-attribute sleep-scheduling algorithm using hesitant fuzzy logic for Wireless Sensor Networks

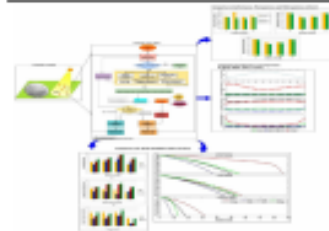
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GRAPHICAL ABSTRACT



ARTICLE INFO

Article history:

Received 26 August 2020

Received in revised form 20 April 2022

Accepted 22 April 2022

Available online 6 May 2022

Keywords:

Multiple-Criteria-Decision-Making

(MCDM)

Hesitant Fuzzy Linguistic Term Set (HFLTS)

Heterogeneous Wireless Sensor Network

Temperature

Sleep-scheduling

ABSTRACT

The sustainable operation of sensor nodes in Wireless Sensor Network depends on the nodes' adaptability with the environment. A sensor node strives to live longer using periodic sleep/wake activity. But it fails to achieve considerable success due to the node's inability to make the sleep/wake strategy adaptive to the environment. To this end, we propose an algorithm, 'FL-Sleep' which makes every node in the network to observe the ambient temperature and status of their parameters after every round of operation. Depending on their perception of the parameters, the nodes execute a sleep-scheduling strategy in the subsequent round. It makes the node evaluate its current state and decide the required action ('Active', 'Sleep' or 'Wake') to perform. A node working in a favorable condition would decide the action with an optimistic attitude towards the parameters. In contrast, a critical condition of a node compels it to decide pessimistically. This qualitative measurement provides a precise understanding of the environment. 'FL-Sleep' works on hesitant fuzzy logic-based Multi-Criteria Decision Making method and is found to improve the network's lifetime by 247.11% compared to BMAC, by 68.56% compared to SDPC, and by 77.2% compared to RL-Sleep. The best lifetime of nodes is obtained when the network is organized in spiral topology. 'FL-Sleep' shows better performance in terms of packet-delivery-ratio, energy efficiency, and the number of active nodes in the network compared to BMAC, SDPC, and RL-Sleep.

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Code metadata

Link to reproducible Capsule: <https://doi.org/10.24433/CO.4573283.v1>.

1. Introduction

Wireless Sensor Networks (WSNs) [1] have been developed as an integral part of many applications [2], including Smart

The code (and data) in this article has been certified as reproducible by Code Ocean: (<https://codeocean.com>). More information on the Reproducibility Badge Initiative is available at <https://www.reproducibility.com/physical-science-and-engineering/computer-science/journals>.

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<https://doi.org/10.1016/j.asoc.2022.108910>

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CGARP: Chaos genetic algorithm-based relay node placement for multifaceted heterogeneous wireless sensor networks

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Received: 30 May 2021 / Accepted: 2 February 2022
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Abstract

Relay node deployment in wireless sensor network (WSN) is significantly explored in specialized literature. There is a wide spectrum of performance issues like connectivity, coverage, energy efficiency, latency of packet delivery that have been considered as the target criteria to be optimized with the deployment strategies of relay nodes. The dynamic variation of different attributes of the sensor nodes leverages a heterogeneous topology. None of the literature has considered a heterogeneity-aware relay node placement strategy to pacify the effect of structural diversity on network performance. In this work, we propose chaos genetic algorithm-based relay node placement (CGARP) which takes care of the structural heterogeneity of WSN. CGARP is based on chaos genetic algorithm (CGA), which overcomes the problem of premature convergence of genetic algorithm. *Tent Map*-based generation of the initial population and *Logistic Map*-based chaotic crossover enable CGARP to work well in WSN. The proposed technique has been compared with other relay node placement solutions available in the literature. CGARP achieves 68% improvement in average network lifetime in a 2D grid. It also results in 27% better connectivity and 23% improvement in the usage of relay nodes compared to EERP. The results are obtained through properly designed experiments with simulated realistic environments. These results substantiate the improvements achieved by the proposed approach.

Keywords Chaos genetic algorithm (CGA) · Multiple attribute graph (MAG) · Structural heterogeneity · Gini index · Tent map · Logistic map

1 Introduction

Enormous progress in sensor technologies has created unprecedented applications in various domains like environmental monitoring, humanized computing, automation, military surveillance. Power-constrained low-cost sensor

nodes interact with the environment to sense physical quantities like temperature, moisture, vibration, etc. [1], for specific applications. The nodes can have limited data storage, data processing, lightweight computation, and short-range wireless communication [2]. These features of sensor nodes have been widely used to carry out event-driven and query-driven applications and periodic measurements [3]. Dense deployment and non-availability of periodic maintenance make WSN vulnerable to uncontrolled power dissipation and random node failure. An increasing number of failed nodes force a connected network to be disintegrated into multiple disconnected modules. Dynamic and non-uniform alteration of different attributes of sensor nodes catalyzes the appearance of disconnected sub-networks in the WSN. Therefore, sustainable connectivity is a major goal for the successful operation of WSN. To address the problem, relay nodes with powerful transceivers and stronger energy storage are generally employed at optimal locations to foster the overall energy efficiency and connectivity in the network [4, 5].

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MAHATMA GANDHI'S VIEW ON INVOLVEMENT OF WOMEN IN INDIA'S FREEDOM STRUGGLE

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ABSTRACT:

India with its long history of women's victimization and slavery has not been very congenial for their participation in the political and social sphere. Patriarchy has deprived women education, basic rights, freedom and privileges for centuries. This scene was most prevalent in the 17th and 18th century. The arrival of British in the nineteenth century drew a certain amount of attention towards the misery of the Indian women amongst the elite literate section of the society. As a result, women's enlightenment movement gained traction during this time. Women mostly belonging to elite households received education essentially political in nature. Their participation gained momentum under the leadership of Tilak and later Gandhiji.

Gandhiji's perception regarding the role of women in the nationalist movement went through a transformation during his political life. He started with a conservative outlook which saw a shift and resulted in more and more women participating in the nationalist struggle and in movements under his leadership.

Keywords: Freedom struggle, Women's victimization and Slavery, Education, Freedom, Freedom struggle etc.

INTRODUCTION:

Women's participation in the Indian nationalist movement was more quantitative than qualitative in nature. It didn't uplift their social or political position neither it promoted their leadership qualities. Ironically, their role was more or less governed by the patriarchal principles of those times. This paper will focus on how and whether Gandhiji's personality, thought and motivation affected the participation of women in the nationalist movement positively.

OBJECTIVES:

- To study the nature of women's participation in freedom struggle whether it was qualitative or quantitative.
- To study the influence of Mahatma Gandhi's persona on women.
- To analyze and interpret Mahatma Gandhi's perspective regarding women participating in the freedom struggle.

HYPOTHESES:

- Women's participation in the freedom struggle was quantitative.
- Mahatma Gandhi's 'saintly' figure positively influenced society and women.



A PRELIMINARY SURVEY OF ECTOPARASITES IN NEORA VALLEY NATIONAL PARK, WEST BENGAL

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ABSTRACT

A preliminary faunistic study was conducted explored the ectoparasites of animals in the Neora Valley National Park (NVNP), West Bengal, India. Many ectoparasites were observed on the bodies of domestic animals that graze on a regular basis in the national park. Major ones found include *Bovicola bovis* (Linnaeus, 1758), *Ixodes granulatus* Supino 1897, and *Dermacentor auratus* Supino 1897, with *B. bovis* perhaps being reported for the first time in NVNP and India. The study also found that domestic animals and humans in NVNP are exposed to different ectoparasite species of medical and veterinary importance.

Key words: Ectoparasites, mite, lice, domestic animals, wildlife, zoonotic disease, *Bovicola bovis*, *Dermacentor auratus*, *Ixodes granulatus*, Neora Valley National Park

Ectoparasites are hematophagous arthropods that are diverse and well-adapted groups of parasites. Some ectoparasite species are host-specific, while others can infest a wide variety of hosts (Nelson et al., 1975). Ectoparasites that infest domestic animals include fleas, lice, ticks, and mites (Angyireyiri et al., 2015), which are linked to the transmission of veterinary and public health-related diseases and have a major impact on the ecosystem (Ehlers et al., 2019). Several diseases, including bubonic plague, murine typhus, and tularemia, can be transmitted by them (Pourhossein et al., 2015; Shakya et al., 2019; Farid et al., 2021). Domestic animals that dwell in areas near protected forests and their infestation by ectoparasites are the subject of limited research in India. Due to a lack of information about ectoparasites and disease transmission routes among wild and domestic animals in India, the focus of this study was to document the ectoparasitic arthropods of domestic animals found in and around Neora Valley National Park, West Bengal, in order to provide a preliminary interpretation in the context of possible zoonotic disease risk based on the hosts and vectors present.

MATERIALS AND METHODS

The study was undertaken as part of the Biodiversity Assessment Programme in Neora Valley National Park

(NVNP hereafter), organised by the Department of Forest (North Division), Government of West Bengal from 2018 to 2021. NVNP is unique and ecologically important as it includes a relatively inaccessible patch of late successional forests with rich diversity, part of a larger and very important Eastern Himalayan landscape. NVNP comprises deciduous and coniferous forests, usually with an understory of bamboo. Cattle biting louse and hard ticks were collected from the bodies of goats and cows grazing regularly inside the national park by hand plucking. One sample of tick was found to stick on the upper arm of a forest guard. Just after collection, the ectoparasites were photographed and they were preserved in 70% alcohol. The description was made following Mathison and Pritt (2014).

RESULTS AND DISCUSSION

Field survey for ectoparasites in NVNP revealed the following louses and ticks as follows:

1. *Bovicola bovis* (Linnaeus 1758)

It is the common cattle biting louse, or Cosmopolitan Cattle biting louse of class Insecta, order Phthiraptera, and family Trichodectidae, distributed in temperate regions worldwide. Ajith et al. (2019) conducted an experiment in which they used Ivermectin to control



MUSCIDAE (DIPTERA)- A HISTORICAL PERSPECTIVE

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ABSTRACT

In India, the history of biological research on muscid flies has never been thoroughly reviewed. There is no useful documentation of their recent and past taxonomic, medical, veterinary, and forensic research trends, as well as natural history and ecology studies. In the 75 years since independence, efforts have mostly focused on faunistic surveys. However, new study avenues have emerged in agricultural, medical, and forensic fields, as well as other areas such as molecular, ecological, and microbial research. In order to develop a state-wise perspective, we reviewed all the available old and recent studies on family Muscidae (Diptera) throughout the country and suggested areas for future research.

Key words: Muscidae, Diptera, faunistic survey, agricultural importance, medical importance, forensic importance, molecular taxonomy, ecological study, microbial study, India

At various points throughout history, different taxonomists around the world have proposed various classificatory schemes for the Muscidae family. Linnaeus (1758) described 11 species of *Musca* and *Conops*. Those 11 specimens are now placed in the families *Fanniidae*, *Anthomyiidae*, and *Muscidae* (Pont, 1981). Brunetti (1917) described many *Muscinae* and *Anthomyiinae* as new records from India, when *Anthomyiinae* were treated as one of the subfamilies of the family *Muscidae*. Townsend (1917) synonymized the family *Calliphoridae* with the family *Muscidae*. He divided the family *Muscidae* into two subfamilies, viz., *Muscidae* and *Rhiniinae*. Zimin (1951) classified the family *Muscidae* into two tribes, namely *Muscini* and *Stomoxydini*. In the early phases of the nineteenth century, *Anthomyiinae* were regarded as one of the subfamilies of *Muscidae*. Hennig (1955), on the basis of anal vein reaching the wing margin and the presence of fine cilia on the ventral surface of the scutellum, separated Subfamily *Anthomyiinae* as a different family, as *Anthomyiidae* from the family *Muscidae*. He also proposed a classification describing the family *Muscidae* into five subfamilies: *Eginiinae*, *Fanniinae*, *Mydaeinae*, *Phaoniinae*, and *Muscinae*. Emden (1965) divided the family *Muscidae* into seven subfamilies, viz., *Muscinae*, *stomoxydinae*, *Phaoninae*, *Coenosinae*, *Lispinae*, *Fanniinae*, and *Anthomyiinae*. Fonseca (1968) excluded *Anthomyiinae* from the earlier described

classification and presented six subfamilies. Shinonaga and Kano (1971) divided the family *Muscidae* into seven subfamilies: *Muscinae*, *Stomoxydinae*, *Phaoniinae*, *Coenosinae*, *Lispinae*, *Fanniinae*, and *Eginiinae*. In continuation of the previous classification, Pont (1980) divided the family *Muscidae* into six subfamilies, viz., *Atherigoninae*, *Muscinae*, *Azeliinae*, *Phaoninae*, *Mydaeinae*, and *Coenosinae*. Later, Shinonaga and Singh (1994) divided the family *Muscidae* of Nepal into five subfamilies: *Stomoxyinae*, *Phaoninae*, *Muscinae*, *Coenosinae*, and *Mydaeinae*. They included *Atherigona* as a genus in subfamily *Phaoninae*, also mentioned *Stomoxyinae* as a subfamily, and included *Azella* as a genus under subfamily *Muscinae*. The two classificatory schemes given by Pont and Shinonaga and Singh were mostly followed by Indian taxonomists. The *Muscidae* family contains over 5000 described species spread across 170 genera (Kutty et al., 2008). Presently, there are 263 species in 35 genera of the family *Muscidae* in India (Bharti, 2008). Research on *Muscidae* is quite scanty in India except for a comprehensive work by Emden.

Muscidae research in India

A few faunistic surveys were carried out by various researchers in India. Only a few regions of the country were covered by the above-mentioned researchers, and most parts of India are still uncovered by muscid fly

REVIEW ARTICLE



Effects of Biofertilizers in Improving the Growth and Development of the Traditional Medicinal Plant *Aloe vera* L. (*Aloe barbadensis* Miller)



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ARTICLE HISTORY

Received: May 13, 2023
Revised: January 04, 2024
Accepted: January 12, 2024

DOI:
[10.21767/2474-2908.1006621693015249](https://doi.org/10.21767/2474-2908.1006621693015249)



Abstract: *Aloe vera* L. (*Aloe barbadensis* Miller) is a very common water deficit-resistant plant which has immense medicinal properties. It is a fleshy plant belonging to the Liliaceae family. *Aloe barbadensis* has enormous medicinal value. According to historical records, it has been used in folk and traditional medicine in different parts and regions of the world for ages. *Aloe vera* is widely used in Ayurvedacharya and Unani medicine. The plant is a rich source of potent medicinal phyto-components, each with pronounced medicinal properties. Primarily, *Aloe* gel is considered one of Mother Nature's magical formulations for treating and curing various health ailments, including skin diseases, hair fall, indigestion, inflammation, and many others. Studies revealed that the use of biofertilizers significantly improves the growth and development of the *Aloe* plant. The quality and quantity of the constituents of *Aloe vera* gel are also reported to improve significantly with the use of biofertilizers. Biofertilizers, when used alone or in combination, are reported to influence the length, width, biomass, and phytoconstituents of the leaves of the plant. Biofertilizers, which are environment friendly and more effective on *Aloe*, can thus be considered a better substitute for other fertilizers for boosting the qualitative and quantitative yield of the magical medicinal plant, *Aloe barbadensis*.

Keywords: *Aloe barbadensis* Miller, ayurvedacharya, biofertilizers, phyto-components, Unani, traditional medicine.

1. INTRODUCTION

Aloe barbadensis is a traditional medicinal plant, and its products have large commercial value in the pharma, food production, and cosmetic industries [1]. Moreover, the plant has economic value in many countries [2]. *Aloe barbadensis* grows widely in dry arid regions of Asia, Africa, Europe, and America. In the Indian subcontinent, the plant is found almost in all regions but widely in Rajasthan, Andhra Pradesh, Gujarat, Maharashtra, and Tamil Nadu [3]. *Aloe vera* is cultivated on a large scale in India and other parts of the world. In India, the plant is cultivated in Alwar in Rajasthan, Rajpipla in Gujarat, Satnapalli in Andhra Pradesh, and some parts of Tamil Nadu [4]. Interestingly, even though severe water stress limits the growth of the *aloe vera* plant, it increases the plant's phytochemical and biochemical properties [2]. Various biofertilizers have been found to be effective in improving the growth and quality of *Aloe barbadensis*

[5, 6]. Biofertilizers like Plant Growth Promoting Rhizobacteria, *Trichoderma* spp., arbuscular mycorrhizae, and biostimulant algae have been utilised and found to be effective in improving the growth and quality of *Aloe barbadensis*. A significant development was observed in the root weight, gel weight, and vegetative weight. Also, significant improvement was observed in the growth of shoots and the number of leaves per plant in *Aloe barbadensis* on treatment with microbial and algae-based biofertilizers [6].

The use of symbiotic microorganisms is beneficial for promoting the growth and yield of many plants (Table 1) [7]. Moreover, the use of such biofertilizers reduces environmental pollution. Whereas chemical fertilizers are often washed off to nearby water bodies, accumulate, and enter the food chain. These chemicals, when they enter living bodies, are highly toxic and cause various types of detrimental health issues [8, 9]. The use of microorganisms as fertilizer for *Aloe barbadensis* has been found to cause a significant increase in the length and width of the leaves. The gel quality was found to improve remarkably using microorganisms as fertilizer. Marked improvements in soluble

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MINI-REVIEW ARTICLE

Levothyroxine and Non-alcoholic Fatty Liver Disease: A Mini Review

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Abstract: Levothyroxine or l-thyroxine is artificially manufactured thyroxine, which is used as a drug to treat underactive thyroid conditions in humans. The drug, levothyroxine, is consumed daily in a prescribed dose to replace the missing thyroid hormone thyroxine in an individual with an underactive thyroid, and it helps to maintain normal physiological conditions. Though it is a life-maintaining drug, it replaces the missing thyroid hormone and performs the necessary daily metabolic functions in our body. Like all other allopathic drugs, it comes with certain side effects, which include joint pain, cramps in muscle, weight gain/loss, hair loss, etc. The thyroid hormone, thyroxine, is known to mobilize fat in our body, including the ones from the hepatic system. An underactive thyroid may cause an accumulation of fat in the liver, leading to a fatty liver, which is clinically termed Non-Alcoholic Fatty Liver Disease (NAFLD). The correlation between hypothyroidism and NAFLD is now well-studied and recognized. As levothyroxine performs the functions of the missing thyroxine, it is anticipated, based on certain preliminary studies, that the drug helps to mobilize hepatic fat and thus may have a crucial role in mitigating the condition of NAFLD.

ARTICLE HISTORY

Received August 26, 2022
 Revised November 24, 2022
 Accepted November 26, 2022

DOI:
 10.21767/2380-1229.2022.24.128-138



CrossMark

Keywords: Levothyroxine, thyroxine, non-alcoholic fatty liver disease, triglycerides, hepatic carcinoma, cirrhosis, Subclinical hypothyroidism.

1. INTRODUCTION

Fatty liver is a condition when fat accumulates in the hepatic tissue. In general, consumption of alcohol in excess leads to the accumulation of fat in the liver, leading to a fatty liver, which may cause cirrhosis of the liver and remarkable inflammation in hepatic tissue, leading to life-threatening conditions, which may even include hepatic carcinoma [1, 2]. Non-alcoholic fatty liver (NAFL) is the condition when fat deposits in the hepatic tissue even when the person does not consume alcohol. Studies revealed that alcoholic fatty liver is often associated with hypertension, unlike NAFL. Thus, alcoholic fatty liver is worse compared to NAFL [2]. Non-Alcoholic Fatty Liver Disease (NAFLD) is a term used for a broad range of liver conditions like NAFL, steatosis, non-alcoholic steatohepatitis (NASH), cirrhosis, and hepatic carcinoma [1]. NAFLD has been reported to be associated with certain health conditions, which include obesity, dyslipidemia, insulin resistance, etc. NAFLD is also recognized to be a risk factor for cardiovascular disease and type 2 diabetes [3, 4]. Subclinical hypothyroidism (SCH) has also been found to have a close relationship with the occurrence

of NAFLD [5, 6]. Studies revealed that thyroid function is associated with NAFLD in patients who are chronically infected with hepatitis B [6]. This further establishes the link between thyroid dysfunction and NAFLD. NAFLD and thyroid dysfunction both are associated with the genetic makeup of an individual. There might be an epigenetic connection between the two pathological conditions. The simple link between thyroid dysfunction and NAFLD is that low production of the thyroid hormone leads to reduced metabolism of fat in our body, resulting in fat accumulation in hepatic tissues, which does not get removed. The thyroid hormones are known to play a significant role in regulating the normal process of growth and also maintaining metabolism in our body [7]. This causes fatty liver, which gradually progresses and worsens daily if left undiagnosed and untreated. NAFLD is reported to be one of the leading causes of premature hepatic dysfunction, illness, and death worldwide [8]. Thyroid hormones play a significant role in regulating cholesterol and fatty acid synthesis and metabolism in the liver [9]. Hypothyroidism is reported to cause a high level of triglycerides and cholesterol in serum and NAFLD. The best and simplest solution to underactive thyroid is to administer levothyroxine, the artificially synthesized substitute of the natural thyroxine hormone [10]. Levothyroxine does what thyroxine is supposed to do in our physiological system. Eventually, levothyroxine has been reported to be effective in mobilizing

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Dilepton production from hot and magnetized hadronic matter

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© (Received 11 September 2022; accepted 23 January 2023; published 21 February 2023)

The rate of dilepton emission from a magnetized hot hadronic medium is calculated in the framework of real time formalism of finite temperature field theory. We evaluate the one-loop self-energy of neutral rho mesons containing thermomagnetic propagators for the charged pions in the loop. The in-medium thermomagnetic spectral function of rho obtained by solving the Dyson-Schwinger equation is shown to be proportional to the dilepton production rate. The study of the analytic structure of the neutral rho-meson spectral function in such a medium shows that in addition to the usual contribution coming from the Unitary cut beyond the two-pion threshold there is a nontrivial yield in the low invariant-mass region originating due to the fact that the charged pions occupy different Landau levels before and after scattering with the neutral rho meson and is purely a finite magnetic-field effect.

DOI: 10.1103/PhysRevD.107.036017

I. INTRODUCTION

The primary objective of modern heavy ion collision (HIC) experiments at Large Hadron Collider (LHC) and Relativistic Heavy Ion Collider (RHIC) is to study hot and dense nuclear matter. The collision of two nuclei at ultra-relativistic energies leads to the liberation of the fundamental constituents of the nucleons forming a deconfined state of quarks and gluons in local thermal equilibrium. This form of the nuclear matter is known as the quark-gluon plasma (QGP), which, as suggested by the phenomenological studies, is the most perfect fluid created in nature [1–3]. The fireball produced in HICs, cools via rapid expansion under its own pressure gradient going through various stages of evolution. However, the possibility of direct observation is strongly hindered as the QGP is very transient (~few fm/c). Thus, to extract microscopic as well as bulk properties of QGP, one has to rely on indirect

probes and observables such as spectra of electromagnetic probes (photon and dileptons), heavy quark production, quarkonia suppression, jet-energy loss, collective flow, J/ψ suppression, etc. (see Refs. [4–7] for a broad overview). Among these, electromagnetic probes [8–16], owing to large mean free paths, tend to leave the system without much interaction and, therefore are expected to carry the information of the stage from where they are produced. This is the major advantage of the electromagnetic probes over hadrons which are emitted from the freeze-out hypersurface after undergoing rescattering.

The study of different n -point current-current correlation functions or in-medium spectral functions of local currents is one of the primary theoretical tools to examine various properties of QGP. The electromagnetic spectral function is one such example which is obtained from the vector-vector current correlator which, in turn, is connected to the dilepton production rate (DPR) from the hot and dense medium [10,11,14–17]. In the QGP medium, the asymptotically free quarks can interact with an antiquark to produce a virtual photon, which decays into a dilepton. The emission rate resulting from these reactions has been extensively studied in Refs. [9,12,13]. However, there exist several other sources of dileptons (thermal and nonthermal) in HIC experiments [4,13,14,18] which provide a substantial background. Among these, the contribution from the DeLL-Yan process is well understood in the framework of perturbative quantum chromodynamics (QCD) [4,14,19–21]. Dileptons can also be produced from the decays of hadron resonances, such as π^0 , ρ , ω , J/ψ , for which the yield can be estimated experimentally by invariant mass analysis [4].

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Quantum version of transport coefficients in Nambu–Jona-Lasinio model at finite temperature and strong magnetic field

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Received: 24 January 2023 / Accepted: 24 May 2023
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Abstract We have estimated parallel and perpendicular components of electrical conductivity and shear viscosity of quark matter at finite magnetic field and temperature by using their one-loop Kubo expressions in the framework of Nambu–Jona-Lasinio (NJL) model. At finite magnetic field, a non-trivial medium dependence of these quantities can be found. Previously these NJL-profiles have been addressed in relaxation time approximation, where cyclotron motion of quarks with medium dependent mass plays the key role. With respect to the earlier estimations, the present work provides further enriched profiles via Kubo framework, where field theoretical descriptions of quark transport with medium dependent mass and (Landau) quantized energy have been identified as the key ingredients. Hence the present study can be considered as the complete quantum field theoretical description of the transport coefficients in the framework of NJL model at finite temperature and magnetic field.

1 Introduction

Production of strong magnetic fields in the early stages of relativistic heavy-ion collisions (HIC) is a longstanding topic, that is being extensively studied [1, 2]. The strengths of these produced fields have been estimated to be even larger than the strong-interaction scale $\Lambda_{\text{QCD}}^2 \simeq 0.06 \text{ GeV}^2$ (e.g. Pb-Pb collisions at the Large Hadron Collider estimates $eB \sim 15m_\pi^2 \gg \Lambda_{\text{QCD}}^2$; m_π is the pion mass $\sim 0.135 \text{ GeV}$) [3] which subsequently indicates that these fields heavily influence various observables in the hot and dense quark matter such as the quark condensates. Many such modifications have already been studied but the interpretations of those

modifications in the system are still ambiguous [4–7]. One of the biggest challenges to understanding these magnetic field-induced modifications is to grasp the time dependence of the produced magnetic field in the early stages of HIC. There are several schools of thought on this topic. Some of the preliminary studies indicated that the fields weaken fast as the system expands [3, 8]. Then there are also studies that suggested that the induced electric currents in the expanding matter due to the produced magnetic fields can in turn produce magnetic fields again, overall changing the longevity of the early-produced fields [9–12]. Very recent studies have again given emphasis on the short lifetime of the induced magnetic field [13] and further suggested that the search for any magnetic effects in the HIC would be highly challenging. The absence of CME signals in the isobar experiments [14] also concurs with this inference. In Ref. [15], the validity of Ohm's law has been argued in view of the rapidly evolving quark matter produced in HIC and the behavior of the time dependent conductivity has been discussed. All these studies give strong indications that electrical conductivity can be a really important quantity in this scenario. Hence, understanding the microscopic calculation of transport coefficients like electrical conductivity at finite magnetic fields might be considered an important topic to study. Electrical conductivity and other transport properties such as shear and bulk viscosity could have been computed unambiguously using Lattice QCD, a nonperturbative first-principles numerical method formulated in Euclidean space, if not for the crude inversion techniques to reconstruct the Minkowski spectral functions from Euclidean correlation functions. However, there are existing lattice QCD results for transport coefficients with SU(2) quenched simulations [16] and with full QCD SU(2+1) simulations [17]. There are also several other recent analytical nonperturbative studies of electrical conductivity

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Cite this: *CrystEngComm*, 2023, 25,
1393

Influence of non-covalent interactions on the coordination geometry of Ni(II) in Ni(II)–M(II) complexes (M = Zn and Hg) with a salen-type N₂O₂ Schiff base ligand and thiocyanate ion as the coligand†

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Antonio Frontera^c and Ashutosh Ghosh^d

A nickel(II)–zinc(II) complex, [Ni₂Zn(H₂L)–NCS]_n (1), and a nickel(II)–mercury(II) complex, [NiHg(H₂L)–SCN](SCN)₂ (2), (where H₂L = *N,N'*-bis(alkylidene)-1,3-propanediamine) were synthesized via a metallogel approach, in which the former is a 2D coordination polymer and the latter is a discrete tetramer. Single-crystal X-ray crystallography revealed that Zn(II) in 1 and Hg(II) in 2 are in a four-coordinated distorted tetrahedral environment whereas the geometry of the Ni(II) centre is distorted octahedral for complex 1 but distorted square planar for complex 2. DFT calculations were used to analyze an intramolecular weak interaction between the square planar Ni(II) ion and the N-end of thiocyanate ions, which can be defined as a π -hole interaction. Moreover, we analyzed the tetranuclear structure of 2 in terms of a self-assembled dimer via the formation of two strong spodium bonds instead of Hg–N coordination bonds, as evidenced by the QTAIM and NCI plot analysis and the magnitude of the dimerization energy.

Received 7th December 2022,
Accepted 24th January 2023

DOI: 10.1039/d2ce01633j

rsc.li/crystengcomm

Introduction

The common structures of Ni(II) complexes are tetrahedral, square planar and octahedral.¹ A smaller number of five-coordinated compounds are also known.² It is generally considered that a combination of steric and electronic factors of ligands determine the coordination number as well as the geometry of a Ni(II) compound.^{3–6} For example, steric factors evidently operate with bulky ligands favouring the tetrahedral geometry over octahedral geometry. However, a higher ligand field strength stabilizes the square planar geometry around Ni(II). Thus, Ni(II) produces tetrahedral [NiCl₄]^{2–}, octahedral

[Ni(H₂O)₆]²⁺ and square planar [Ni(CN)₄]^{2–} depending upon the ligand field strength and bulkiness of the ligand. Nickel(II) forms a stable mononuclear chelate, [NiL] with a salen-type N₂O₂ donor tetradentate di-Schiff base ligand (L).^{4,7} In such complexes, the geometry around Ni(II) is either square planar or its coordination number is extended to five or six depending upon the nature of ligands, e.g. 1,2-ethanediamine derivatives usually form square planar complexes, whereas 1,3-propanediamine derivatives yield five- or six-coordinated complexes.⁸

Thiocyanate is an interesting ambidentate ligand and it exerts different ligand field strengths on metal ions depending upon its donor sites. The sulfur atom is large in size with vacant 3d orbitals, which can be used as π -acceptors, while nitrogen is smaller in size without such π -accepting orbitals.^{9–11} In addition, the N-donor thiocyanate ion is linear, while the S-donor thiocyanate ion coordinates angularly to the metal centres.¹² Moreover, the coordination mode of thiocyanate ions is also influenced according to the HSAB (hard soft acid base) principle; it coordinates to hard metal centers via the nitrogen end and to soft centers via the sulfur end.^{13–15}

Heterometallic complexes containing Ni(II) can easily be synthesized via a metallogel approach using [NiL]^{16–20} Usually, the oxygen atoms of [NiL] coordinate to the second metal ion (M) along with the counter anions. The use of the

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† Electronic supplementary information (ESI) available: The IR spectra of the both complexes (Fig. S1 and S2), spectroscopic titration (Fig. S3) and selected bond parameters (Table S1) are included as supporting information. CCDC 2223379 and 2223380 contain the supplementary crystallographic data in CIF format for 1 and 2 respectively. For ESI and crystallographic data in CIF or other electronic format see DOI: <https://doi.org/10.1039/d2ce01633j>