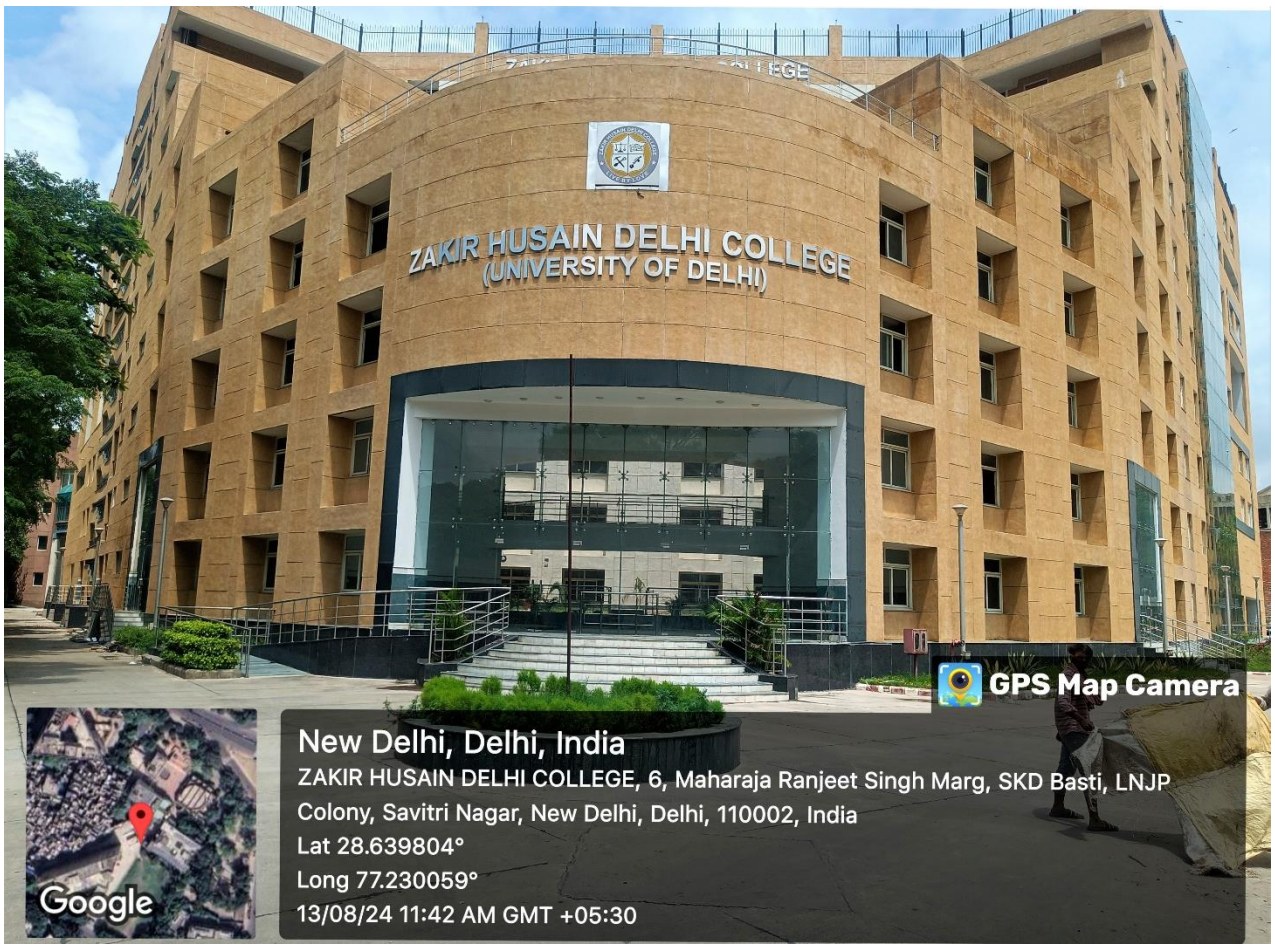
ZAKIR HUSAIN DELHI COLLEGE
UNIVERSITY OF DELHI



SUPPORTING DOCUMENT: 3.5.1

Number of functional MoUs/linkages with institutions/ industries in India and abroad for internship, on-the-job training, project work, student / faculty exchange and collaborative research during 2019 - 20

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सत्यमेव जयते

Memorandum of Understanding (MOU)
Between
Mahatma Hansraj Faculty Development Centre, Hansraj College, University of Delhi
and
Zakir Husain Delhi College, University of Delhi

As per the proposal for Faculty development programme received at MHRFDC Office from Zakir Husain Delhi College (17th Sep to 23rd Sep, 2019), the following terms and conditions are agreed upon by the two parties:

Expenditure to be borne by the Host Institution (Zakir Husain Delhi College)

1. Registration Kits for participants at the time of Registration on 17th Sep, 2019 at 8:30 am.
2. Flex, Standy etc.
3. Photography and Videography of all sessions (17th Sep to 23rd Sep, 2019).
4. Mementos / Pots/ Gifts for speakers / Chief Guest.
5. Group Photograph of all participants.
6. Working Lunch, Morning and Evening Tea arrangement for Participants and Resource Persons.
7. Payment of one Coordinator from MHRFDC (Rs. 5,000 per week).

Expenditure to be borne by MHRFDC

1. Remuneration of Resource Person with T.A. (i.e. Rs. 2,500 per session) will be provided by MHRFDC.
2. Certificates to all participants, and Programme Coordinator, Convener will be provided by MHRFDC.

16.8.19

3. Reimbursement of accommodation cost (preferably in Delhi University International Guest House, Delhi University Guest House, Delhi University hostel) for outside Delhi Participants.
4. Reimbursement of accommodation cost (preferably in Delhi University International Guest House, Delhi University Guest House, Delhi University hostel) for outside Delhi Resource Persons.
5. Provide/ Reimburse Travelling allowance to Outside Delhi participants (3rd AC by Train, Deluxe Bus, etc.)
6. Provide/ Reimburse Travelling allowance to Outside Delhi Resource Person (Economy Class Air Fare of Air India or 2nd AC by Train, taxi, car etc.)

List of Requirements from Host Institution (Zakir Husain Delhi College)

1. Proposal from host institution (Zakir Husain Delhi College)
2. Draft Brochure of the Faculty Development Programme (FDP) (including the names in MHRFDC Team) which includes the last date of registration, and the confirmation date about selection to participants.
3. Schedule (17th Sep to 23rd Sep, 2019) of FDP with details of session topics and the name of resource persons details.
4. No registration fee is to be taken from participants and the same should be printed on the Brochure of FDP.
5. Filling and submission of Registration form for FDP will be through MHRFDC website/ Google form.
6. Make Criteria for shortlisting the participants, if the registration crosses the desired number of registrations.
7. Summary of all sessions (Day wise)
8. Complete Programme Report to be submitted at the end of the programme.

16.8.19

9. Relieving letters from participants are to be collected and submitted to MHRFDC or Undertaking from those who have not submitted the relieving letter.
10. A minimum criterion of attendance is to be met for issuance of FDP Certificate.
11. Assessment / Test of FDP (Last Day).
12. Maximum two Sessions can be given to a single resource person.
13. Complete Registration Sheet for Registration on first day of FDP (i.e. 17th Sep, 2019) is to be provided to MHRFDC.
14. Attendance and Feedback form of all sessions (sheets will be provided by MHRFDC)

NOTE:

- The Terms and Conditions of MHRFDC in reference to collaboration with other institutions are subject to change programme wise in light of the proposal and fund available with the Centre.

(Programme Coordinators)
Zakir Husain Delhi College

16.8.19
(Principal)
Zakir Husain Delhi College

(Coordinator)
MHRFDC

COORDINATOR
PT. MADAN MOHAN MALAVIYA NMTT
MAHATMA HANSRAJ FACULTY DEVELOPMENT CENTRE
HANSRAJ COLLEGE, DELHI-110007

(Chairperson)
MHRFDC

PRINCIPAL
HANSRAJ COLLEGE
UNIVERSITY OF DELHI
DELHI-110007

अनुसंधान अध्ययन बोर्ड (गणितीय विज्ञान)
BOARD OF RESEARCH STUDIES (MATHEMATICAL SCIENCES)
दिल्ली विश्वविद्यालय, दिल्ली-110007
University of Delhi, Delhi-110007
Email: dean_mathsci@du.ac.in Ph.27666041

Prof. Prakash C. Jha
Chairman

Ref. No. BRS(MS)/248/2018/445
Dated: November 15, 2018

MEMORANDUM

Mr. Atul Pandey, a Research Scholar, Department of Mathematics, is hereby informed that Dr. Dhiraj Kumar Singh, Zakir Husain College & Dr. Indivar Gupta, (DRDO) have been appointed as his Supervisors in place of Late Dr. Manish Kant Dubey.

He is required to contact his new Supervisors immediately in connection with his research work.

CHAIRMAN

Mr. Atul Pandey
A-161, New Ashok Nagar
New Delhi - 110096

Copy forwarded for information and necessary action to:

1. The Head, Department of Mathematics, University of Delhi, Delhi-110007.
2. Dr. Dhiraj Kumar Singh (Supervisor) Zakir Husain Delhi College Jawaharlal Nehru Marg, SKD Basti, Press Enclave, Ajmeri Gate, New Delhi, i 110002
3. Dr. Indivar Gupta (Supervisor) DRDO Complex, SAG Metcalfe House, Delhi – 110054.
4. The Dean (Examination), University of Delhi, Delhi-110007.

SECTION OFFICER

Designing and analysis of public key cryptographic protocols using certain algebraic structures

THESIS SUBMITTED TO THE UNIVERSITY OF DELHI
FOR THE AWARD OF THE DEGREE OF

Doctor of Philosophy

in

Mathematics

By

Atul Pandey

Department of Mathematics
University of Delhi
Delhi-110007, India

April, 2022

CERTIFICATE OF DECLARATION

This is to certify that this Ph.D. thesis entitled "**Designing and analysis of public key cryptographic protocols using certain algeraic structures**" submitted to the University of Delhi, Delhi by **Atul Pandey** for the award of the degree of *Doctor of Philosophy in Mathematics*, is a record of his own research work.

The research work embodied in it is original and has not been submitted earlier in part or full or in any other form to any university or institute, here or elsewhere, for the award of any degree or diploma.

Atul Pandey
(Research Scholar)

Dr. Indivar Gupta
(Supervisor)
Scientist 'F', SAG
DRDO, Delhi

Dr. Dhiraj Kumar Singh
(Supervisor)
Associate Professor
Zakir Husain Delhi College, Delhi

Prof. Ruchi Das
Head of the Department
Department of Mathematics
University of Delhi

अध्यक्ष/Head
गणित विभाग
Department of Mathematics
दिल्ली विश्वविद्यालय, दिल्ली-110007
University of Delhi, Delhi-110007

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Annual Reports (AY: 2019-20)

NSS, ZHDC

Open Day SessionN.S.S in association with Lok Sabha TV 2019-20 one day

NSS-SwachchtaPakhwada Ministry of Jal Shakti, GOI Sparsh Ganga
2nd October, 2019

NSS-National Youth Festival Ministry of Sports and Youth Affairs, GOI
National Youth Festival 12th to 16th January, 2020

NSS-Internship Program Indian Red Cross Society Internship on Blood Donation Awareness 3 rd June, 2019 to 15 th July, 2019

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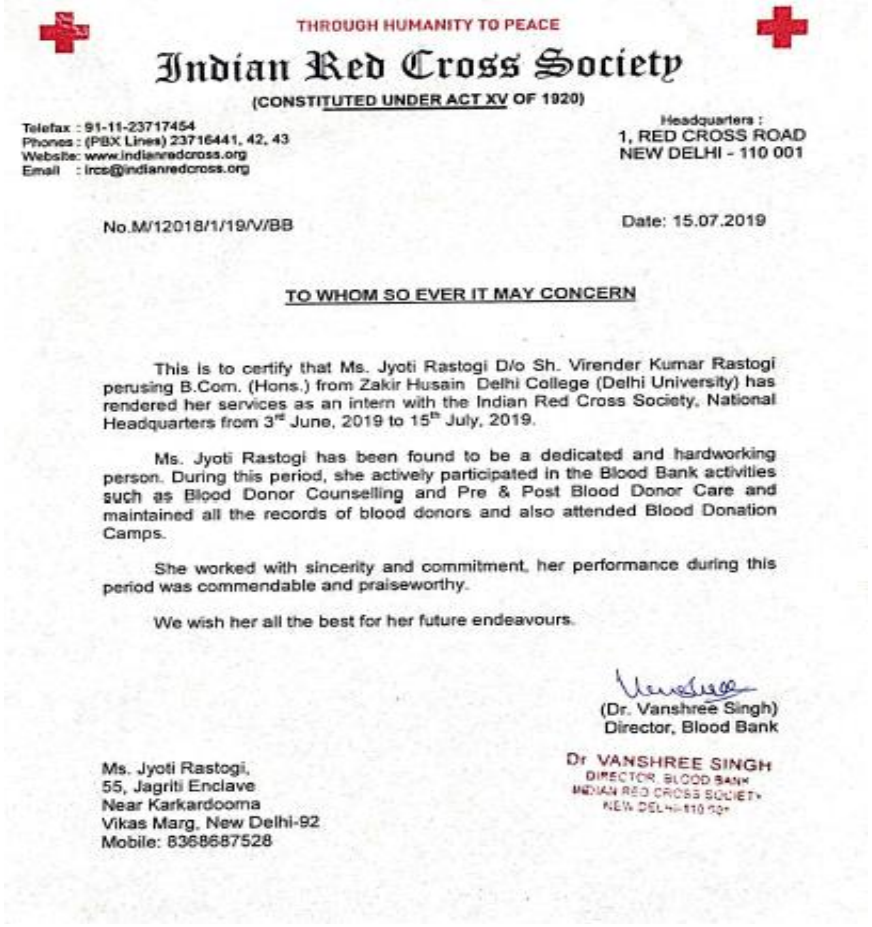

THROUGH HUMANITY TO PEACE

Indian Red Cross Society

(CONSTITUTED UNDER ACT XV OF 1920)

Telefax : 91-11-23717454
Phones : (PBX Lines) 23716441, 42, 43
Website: www.indianredcross.org
Email : ircs@indianredcross.org

Headquarters :
1, RED CROSS ROAD
NEW DELHI - 110 001

No.M/12018/1/19/V/BB

Date: 15.07.2019

TO WHOM SO EVER IT MAY CONCERN

This is to certify that Ms. Jyoti Rastogi D/o Sh. Virender Kumar Rastogi perusing B.Com. (Hons.) from Zakir Husain Delhi College (Delhi University) has rendered her services as an intern with the Indian Red Cross Society, National Headquarters from 3rd June, 2019 to 15th July, 2019.

Ms. Jyoti Rastogi has been found to be a dedicated and hardworking person. During this period, she actively participated in the Blood Bank activities such as Blood Donor Counselling and Pre & Post Blood Donor Care and maintained all the records of blood donors and also attended Blood Donation Camps.

She worked with sincerity and commitment, her performance during this period was commendable and praiseworthy.

We wish her all the best for her future endeavours.

(Dr. Vanshree Singh)
Director, Blood Bank

Dr VANSHREE SINGH
DIRECTOR, BLOOD BANK
INDIAN RED CROSS SOCIETY
NEW DELHI-110 001

Ms. Jyoti Rastogi,
55, Jagriti Enclave
Near Karkardooma
Vikas Marg, New Delhi-92
Mobile: 8368687528

Aranya- The Nature and Environment Society

Aranya- The Nature and Environment society of Zakir Husain Delhi College has worked relentlessly in order to educate students and make them realize the importance of the environment and how important it is to keep it healthy, clean and pollution free.

Furthermore, society members volunteered for India Plog Run on 2nd October 2019, organized by WWF in association with United Way. It was a 3 km walk/run in which participants picked up plastic trash and disposed of it suitably.

On October 14, 2019, an Inaugural Lecture was held,wherein Dr. Monalisa Sen delivered her talk on Various Aspects of Urban Biodiversity. This made the students aware of the facts and various avenues regarding the conservation of biodiversity.

On the occasion of Diwali, the society collaborated with Chintan Environmental group and launched a collection drive for Plastic and E waste collection was organized to ensure its proper disposal. An Inter College Monoacting Competition on the topic 'Ill effects of Diwali due to crackers.', highlighting the was also organized by the society.

Gandhi Study Circle

30th January National Gandhi Museum: **All-religion Inter-Faith prayer** in the remembrance of bapu in an event organized at National Gandhi Museum. International Sarangi player, Nabeel Khan, who is also a student of Zakir Husain Delhi College, gave a presentation of

Gandhi and Contemporary World- Dr. Sanjeev Kumar's Book Launch Event: March 3 ,2020, a day of proud and inspiration for the members of Gandhi Study Circle, Gandhi Smriti and Darshan Samiti and Indian Council of Gandhian studies, celebrated the publication of "Gandhi and Contemporary World" edited by Dr Sanjeev Kumar convener of Gandhi Study Circle

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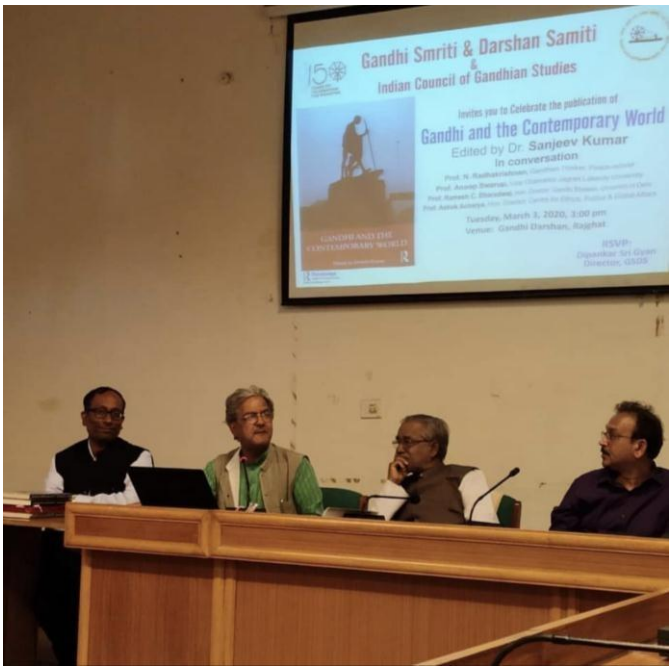

Arts and Culture Society

The Society began the winter semester with a significant event for addressing mental health issues among college students. In association with LiveJam Foundation New Delhi, the Society organised **Charcha Sessions and Open Mic: Let's Talk about Mental Health for students of the college on 29 January 2020**. The event included discussions and expert talk on mental health, Q&A sessions, Band Performance by LiveJam Band and Open Mic performances by various students and alumni of the college. The participants rated this event to be a life changing experience and need of the hour event organised by the Arts and Culture Society.

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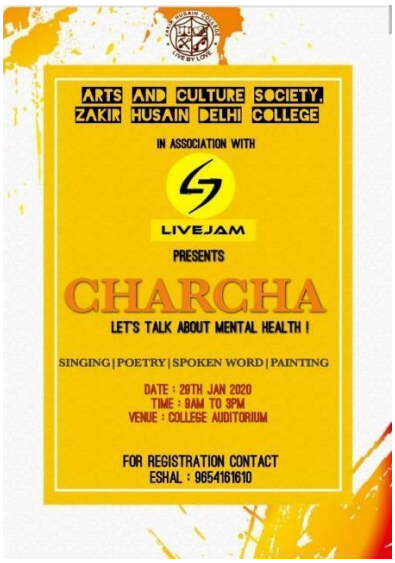

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Botany Department Report (2019-20)

The department of Botany organized started the academic session 2019-20 from July 2019. The classes were held as per the time table for the students. Along with it various cocurricular activities were also held for the students.

The department of Botany organized an outstation trip for the students of B.Sc (Hons.) second and third year to Manali, Himachal Pradesh from 16 -21 September 2019. The trip started on September 16, 2019 at 5pm from the college campus. During this trip the students visited places like Himalayan Trout Fish Farm which is famous for freshwater fish farming besides other attractions. The students visited the well-known high mountain pass –Rohtang Pass which is situated 50 Km from Manali and 3979 m above sea level. Some lichens were spotted in this area. The students also got an opportunity to visit G.B. Pant National Research Institute of Himalayan Environment and Sustainable Development, Mohal Kullu. It is an autonomous institute of Ministry of Environment, Forest & Climate Change, Govt. of India. The students got an exposure to discuss on very pertinent topics as institute is mainly focussed on activities like, Centre for Land & Water Resource Management, Centre for Biodiversity Conservation and Management, Centre for Socio Economic Development & Centre for Environmental Assessment & Climate Change.

The other institute that the students visited was IARI Regional Station Katrain, Kullu Valley, Himachal Pradesh. After a long and tedious travel, the last spot of the visiting list was Great Himalayan National Park- the UNESCO World Heritage Site. It is a home to numerous species of flora and fauna. It is known for its "outstanding significance for biodiversity conservation". The students were taken for a trek in the park where they witnessed the rich biodiversity.

Faculty members, Dr. Malti Gupta and Dr. Babeeta C Kaula (Trip incharge) organized the trip. Laboratory staff, Mr. Mohd. Afzal and Mr. Faizaan Hasan accompanied the group. The tour ended successfully on September 21, 2019. The Department also organized a field visit to **Mohan Meakin Limited Visit Ghaziabad** on March 5,2020. for B.Sc. Botany (H) students of IIIrd years.

Due to Coronavirus pandemic the classes were switched to online mode from March onwards. The students and the faculty members were provided with Microsoft Teams ID and all the classes were held on that platform.

List of faculty members and students for industrial visit of Mohan Meakin Limited, GT Road, Mohan Nagar, Ghaziabad

FACULTY MEMBERS

DR. RATNUM K. WATTAL

DR. SAVINDRA KUMAR

DR. ZEESHAN UR RAHMAN

DR. RUCHI VIR

LIST OF STUDENTS

15/1296	RAJESHWARI DE
17/42	MUSKAN
17/62	AROOP VERMA
17/114	BHANUPRIYA PASBOLA
17/140	ABHIRAMI A S
17/143	SIDDHANT PRATAP SINGH
17/157	SANA SRIVASTAVA
17/459	SANA SAIFI
17/525	KIRAN YADAV
17/612	ZILEX THOUNAOJAM
17/777	GOKUL ANIL KUMAR
17/1169	KM MADHU
17/1239	AADIL ASHRAF
17/1261	ALIZA CHAUDHRY
17/1355	ABHISHEK SHARMA
17/1406	MOHIT SINGH
17/1407	SAKINA ASGHAR

17/1443	HIMANSHI GUPTA
17/1449	MAHIMA TOMAR
17/1483	DIVYA
17/1484	NEHA SHARMA
17/1485	SAKSHI GARG
17/1486	HIMANSHI GAMBHIR
17/1487	NAHAKPAM PRABAN SINGH
17/1521	ILU CHAUHAN
17/1569	AAYUSHI CHANDRA
17/1570	ROHINI SINGH TOMAR
17/1571	TEJAS WAGHMARE
17/1585	NAOREM ROMIBAI DEVI
17/1603	MOSES LOSHU ARINA

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FAX-91-0120-2657018

ESTD. 1855

Mohan Meakin Limited

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CIN-L15520HP1934PLC000135
E-mail : mohannagar@mohanmeakin.com
Web : www.mohanmeakin.com

MOHAN NAGAR
GHAZIABAD (U.P)
PIN - 201 007 (INDIA)

(BY E MAIL)

ADS/125/JKS

Date: 02.03.2020

Dr. Savindera Chatwal
(Email: sk.chatwal@gmail.com)

Subject: CONDUCT OF INDUSTRIAL VISIT

Dear Sir,

1. Refer to your E mail dated 02 March 2020.

2. We hereby confirm that your 30 Students alongwith faculty members can visit our Plant on 05.03.2020 **from 10 AM to 12 AM.**

3. Industrial work is hazardous. You are therefore requested to ensure proper discipline of students during the visit. They should not touch any working machine since it can cause serious injury. The entire responsibility of safety of students lies with you and the Industry will not be responsible for any untoward happening.

Thanking you,

Your's faithfully,
For MOHAN MEAKIN LTD,

(COL A.D. SAINI (RETD))
MANAGER (WORKS)

Received: 2 July 2019 | Revised: 17 September 2019 | Accepted: 9 October 2019

DOI: 10.1002/jobm.201900364

Journal of Basic Microbiology

RESEARCH PAPER

HCN-producing *Pseudomonas protegens* CHA0 affects intraradical viability of *Rhizophagus irregularis* in *Sorghum vulgare* roots

Sharma Deepika[1,2] | **Amit Mittal**[1] | **David Kothamasi**[1]

[1]Laboratory of Soil Biology and Microbial Ecology, Department of Environmental Studies, University of Delhi, Delhi, India

[2]Department of Botany, Zakir Husain Delhi College, University of Delhi, Delhi, India

Correspondence
Sharma Deepika, Laboratory of Soil Biology and Microbial Ecology, Department of Environmental Studies, University of Delhi, Delhi 110 007, India.
Email: sharma.deepika09@outlook.com

Abstract

Arbuscular mycorrhizal fungi (AMF) and plant growth–promoting rhizobacteria inhabit the plant rhizosphere. Both functional groups can influence plant community structures, and interactions between them can vary from being synergistic to antagonistic. HCN-producing *Pseudomonas protegens* CHA0 is a plant growth–promoting rhizobacterium. *P. protegens* CHA0 has been shown to weakly attach to AMF hyphae. Here, we analyze the effect of *P. protegens* CHA0 on the viability of intraradical AMF hyphae. Using pot experiments, we have grown mycorrhizal and nonmycorrhizal *Sorghum vulgare* var. M35 with *P. protegens* CHA0 or HCN^- mutant *P. protegens* CHA77, which did not produce HCN. Mycorrhizal and nonmycorrhizal *Sorghum* grown without CHA0 or CHA77 served as the control. While metabolically active AMF was not detected in mycorrhizal plants grown with HCN^+ CHA0, the percentage of root colonization of metabolically active AMF in plants grown with HCN^- CHA77 was lower than in the control. Root phosphorus was highest in mycorrhizal plants grown with HCN^+ CHA0, but root Fe was higher in plants grown with the bacterial strains. Our results indicate that HCN-producing *P. protegens* can affect the viability of intraradical AMF.

KEYWORDS

AMF viability, antifungal compounds, HCN-producing bacteria, *Pseudomonas protegens* CHA0 and CHA77

1 | INTRODUCTION

Arbuscular mycorrhizal fungi (AMF), the most widespread plant symbionts, form symbiotic associations with around 80% of angiosperm families [1]. AMF-mediated nutrient uptake; alleviation of stresses from drought, salinity, heavy metal, and so on; and protection against a variety of root pathogens [2–6] bestow selective advantages on the host. AMF symbiosis can extract up to 20% of a plant's photosynthetic C [7]. Yet, in plant species that are capable of forming AMF symbioses, the nonmycorrhizal condition is almost always "unnatural" [8].

Through their pivotal position in the interphase between the roots and the soil, AMF are able to influence the root exudates that are released into the rhizosphere [9]. The control of mycorrhizas on root exudates increases the zone of influence of the rhizosphere into a larger area, called the mycorrhizosphere [10]. AMF influence the microbial community structures in the mycorrhizosphere by restricting pathogenic microorganisms and facilitating colonization by plant-beneficial microorganisms [11]. AMF may serve as energy conduits for rhizospheric bacteria like *Pseudomonas protegens* [12]. Indeed, bacteria are being viewed as the third component of the plant-mycorrhiza

Environ Monit Assess (2019) 191:419
https://doi.org/10.1007/s10661-019-7528-7

The relative impact of toxic heavy metals (THMs) (arsenic (As), cadmium (Cd), chromium (Cr)(VI), mercury (Hg), and lead (Pb)) on the total environment: an overview

Zeeshanur Rahman · Ved Pal Singh

Received: 17 January 2019 / Accepted: 8 May 2019

Abstract Certain five heavy metals viz. arsenic (As), cadmium (Cd), chromium (Cr)(VI), mercury (Hg), and lead (Pb) are non-threshold toxins and can exert toxic effects at very low concentrations. These heavy metals are known as most problematic heavy metals and as toxic heavy metals (THMs). Several industrial activities and some natural processes are responsible for their high contamination in the environment. In recent years, high concentrations of heavy metals in different natural systems including atmosphere, pedosphere, hydrosphere, and biosphere have become a global issue. These THMs have severe deteriorating effects on various microorganisms, plants, and animals. Human exposure to the THMs may evoke serious health injuries and impairments in the body, and even certain extremities can cause death. In all these perspectives, this review provides a comprehensive account of the relative impact of the THMs As, Cd, Cr(VI), Hg, and Pb on our total environment.

Keywords Heavy metal · Environment · Toxicity · Natural system · Human

Z. Rahman (✉)
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e-mail: zeeshan88ind@gmail.com

V. P. Singh
Department of Botany, University of Delhi, Delhi 110007, India

General background

In general, heavy metals are loosely defined as the elements with a density over 5 g/cm^3 (Nies 1999). Since the density of the elements is rarely a significant biological or chemical property, this definition is not widely accepted (Duffus 2002). But this arbitrary name "heavy metal" has become very common in scientific literature as this term combines different elements together for their study in ecotoxicology. Of the total 90 naturally occurring elements, 53 are considered heavy metals. They mostly belong to transition elements in periodic table. This term is also applicable to the naturally occurring actinide and lanthanide elements and some p-block elements. Moreover, a metalloid, arsenic (As), is also considered heavy metal (Nies 1999).

Heavy metals are the natural occurring elements in earth's crust. But uncontrolled anthropic inputs have severely altered the natural biogeochemical cycle of heavy metals (Vitousek et al. 1997). After releasing from the earth's crust, heavy metals persist in the environment for a long time because they are non-degradable (Wu et al. 2010), and they exert toxic effects on the associated microorganisms, plants, animals, and humans. For these reasons, the contamination of heavy metals in our surrounding has become one of the biggest environmental issues of the present time and is a great concern for the future.

Several heavy metals including iron (Fe), cobalt (Co), copper (Cu), manganese (Mn), zinc (Zn), and molybdenum (Mo) are crucial for metabolic activity at low concentrations and are considered essential elements or

Published online: 08 June 2019

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Contents lists available at ScienceDirect

Journal of Alloys and Compounds

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Elucidating the structure and optimising the photoluminescence properties of $Sr_2Al_3O_6F$: Eu^{3+} oxyfluorides for cool white-LEDs

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ABSTRACT

Herein, $Sr_2Al_3O_6F$ in hexagonal symmetry was synthesized via a solid-state methodology. The X-ray diffraction pattern of $Sr_2Al_3O_6F$ was refined by the Rietveld refinement with lattice parameters $a = 17.8232(1)$ Å and $c = 7.2168(0)$ Å. The stability of the crystal structure is further confirmed from the results of bond valence sums and the global instability index. The theoretical calculations of the electronic and optical behaviors of the $Sr_2Al_3O_6F$ were analyzed by density functional theory and the obtained results of the lattice parameters and direct bandgap were found close to the experimental data. The chemical states and elemental composition of $Sr_2Al_3O_6F$ were also authenticated by X-ray photoelectron spectroscopy (XPS). To evaluate the suitability of the $Sr_2Al_3O_6F$ structure as high efficient red phosphor, a series of Eu^{3+} doped $Sr_{2-x}Eu_xAl_3O_6F$ (x = 0.0 to 0.10) were synthesized, which showed intense red-orange emission ($^5D_0 \rightarrow {}^7F_{1,2}$) at UV and blue excitations. The photoluminescence intensity corresponding to $^5D_0 \rightarrow {}^7F_2$ transition decreased significantly for $x = 0.10$ due to the luminescence quenching. Nevertheless, further enhancement in photoluminescence of $Sr_{1.9}Al_3O_6F$: $Eu_{0.1}$ sample was realized with the substitution of 0.1 mol Ba^{2+} ion for 0.1 mol Sr^{2+} ion. The various radiative properties of the emission bands were also analyzed through the Judd-Ofelt theory. The optimized $Sr_{1.8}Al_3O_6F$: $Ba_{0.1}$/$Eu_{0.1}$ phosphor showed high red color purity (>95%), and moderate thermal stability of around 72% at 150 °C, suggesting that it could be an ideal red component for white-LEDs. A white-LED comprising the commercial yellow phosphor and the optimized sample showed bright white light having the CRI of 80.5%, CCT of 5510 K, and CIE of (0.33, 0.36) indicating that $Sr_{1.8}Al_3O_6F$: $Ba_{0.1}/Eu_{0.1}$ phosphor is an appropriate red component for cool white-LEDs.

1. Introduction

Phosphor based White-LEDs have become a very interesting topics of research due to their high-end utilization in solid-state lighting. These types of lighting exhibit excellent features including higher brightness, less energy consumption, high durability, low thermal radiation, long lifetime, etc. [1] Commercial white-LED appliances are produced by combining a yellow color emitting YAG: Ce^{3+} with a blue color emitting InGaN chip [2]. Unfortunately, this system faces some severe issues, such as thermal quenching, reproducibility of color, low color rendering index (CRI) due to the absence of red color component leads to their restricted practical applications [3]. To improve CRI, many attempts have been made by integrating red color emitting materials such as nitride phosphors ($Sr_2Si_5N_8$: Eu^{2+}) [4], sulfide phosphors ($SrGa_2S_4$/

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Synthesis, Characterization and Antibacterial Activity of Copper(II) Complexes of Acetylacetone Semicarbazone

Usha Bansal* and Swati Agrawal**

AbstRACt

Copper(II) complexes with Acetylacetone semicarbazone (acacs) have been synthesized with salts of different anions. All the complexes were characterized by elemental analysis, molar conductance measurements, magnetic moment, IR, Electronic and EPR spectral studies. Elemental analysis indicates that the complexes have composition $Cu(acacs)X_2$ where acacs=Acetylacetone semicarbazone and X=(Cl^-, NO_3^-, CH_3COO^-, $\frac{1}{2}SO_4^{2-}$). All the complexes were found to be non-electrolytic in nature. Therefore, the complexes can be formulated as $[Cu(acacs)X_2]$. IR Spectra of complexes suggest that the ligand behave as tetradentate. On the basis of electronic and EPR spectral studies, the complexes $[Cu(acacs)X_2]$ where X=(Cl^-, NO_3^-, CH_3COO^-)may have tetragonal geometry while the complex $[Cu(acacs)SO_4]$ may be assigned a five coordinated trigonally distorted square pyramidal geometry. The free ligand and its metal complexes were tested for their antibacterial activity.

INTRODUCTION

Semicarbazones show a wide range of biological applications(1,2,9,12). These and their complexes have been widely studied owing to their pharmaceutical properties. These compounds present a wide variety of biological activity like antitumoral(14),antimicrobial(3,5-7), fungicidal(1), anticancer(4,8,10,11,13) etc. These had been used for the metal analysis and in telecommunications, optical computing, optical storage and optical information processing. Hence, the study of transition metal complexes of semicarbazones is highly desirable. Reports of Copper(II) complexes of these ligands are scanty.

In this paper, we report the synthesis and characterization of Copper(II) complexes with Acetylacetone semicarbazone. These complexes are characterized by elemental analysis, magnetic moment measurements, IR, electronic and EPR spectral studies.

Our study shows that the stereochemistry of these complexes also depends on the coordinated anions i.e. when the coordinated anion is chloride, nitrate and acetate, the complexes may have hexa-coordinated tetragonal geometry. However, the sulphato complex may have penta-coordinated geometry.

EXPERIMENTAL

PREPARATION OF LIGAND:Acetylacetone semicarbazone was prepared by coupling semicarbazide hydrochloride with Acetylacetone in aq. solution in 1:1 molar ratio in the presence of

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Manganese(II) Complexes of Benzil Semicarbazone: Synthesis, Spectral and Antifungal Studies

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AbstRACt

Manganese(II) complexes with Benzil semicarbazone(bsc) have been synthesized and characterized by elemental analysis, molar conductance measurements, magnetic moment, IR, electronic and EPR spectral studies. Elemental analysis indicates that the complexes have composition $Mn(bsc)X_2$ where bsc=Benzil semicarbazone and X=Cl^-, Br^-, NO_3^-, Ac^-, SCN^-. All the complexes were found to be non-electrolytic in nature. Therefore, the complexes can be formulated as $[Mn(bsc)X_2]$. IR Spectra of complexes suggest that the ligand behave as tetradentate. On the basis of magnetic moment, electronic and EPR spectral studies, an Octahedral geometry has been assigned to the complexes. The free ligand and its metal complexes were tested for their antifungal activity.

INTRODUCTION

Semicarbazones show a wide range of biological applications[1,2,9,12]. Semicarbazones and their complexes have been extensively studied during recent years, owing to their pharmaceutical properties. These compounds present a wide variety of biological activity such as antitumoral[14],antimicrobial[3,5-7],fungicidal[1], anticancer[4,8,10,11,13] etc. These had been used for the metal analysis and application in telecommunications, optical computing, optical storage and optical information processing. Hence the study of transition metal complexes of semicarbazones is highly desirable. Reports of Manganese(II) complexes of such ligands are scanty.

In this paper, we report the synthesis and characterization of manganese (II) complexes with benzil semicarbazone. These complexes are characterized by element analysis, magnetic moment measurements, IR, electronic and EPR spectral studies. The complexes were found to have six-coordinated octahedral geometry.

EXPERIMENTAL

PREPARATION OF LIGAND: Benzil semicarbazone was prepared by coupling semicarbazide hydrochloride with Benzil in aq. solution in 1:1 molar ratio in the presence of approx. 0.1 g of sodium acetate. On stirring the solution, white coloured Benzil semicarbazone was separated out, filtered,washed with water and dried over P_4O_{10}.

PREPARATION OF COMPLEXES: A hot ethanolic solution of metal salt (0.05 mole) was mixed with a hot ethanolic solution of the ligand (0.05 mole) in a molar ratio of 1:1. The contents were refluxed for about 3-4 hours on a water bath. On cooling the contents, the complex was separated

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Synthesis, Characterization, DFT of Novel, Symmetrical, N/O-donor Tetradentate Schiff's base, Its Co(II), Ni(II), Cu(II), Zn(II) Complexes and Their in-vitro Human Pathogenic Antibacterial Activity

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A NOVEL tetradentate Schiff's base ligand Bis(furfural)-1,8-naphthalenediimine (**L**) was synthesized and characterized by physical, analytical and spectral data. Complexes of Co(II), Ni(II), Cu(II) and Zn(II) of general composition MLX_2 [L = $C_{20}H_{14}N_2O_2$ and X = Cl^- , NO_3^- and OAc^-] have been synthesized in 1:1 molar ratio of metal to ligand. The elemental analysis, molar conductance measurements, magnetic susceptibility measurements, Mass, IR, UV-Visible, NMR and EPR spectral studies of the compounds led to the conclusion that the ligand acts in a tetradentate manner in Co(II), Ni(II) and Cu(II) complexes, while in bidentate fashion in Zn(II) complex. Octahedral geometry was assigned to Co(II) and Ni(II) complexes, Tetragonal geometry for Cu(II) complexes and tetrahedral geometry for Zn(II) complexes of the Schiff's base ligand. The thermal studies suggested that the complexes are more stable as compared to ligand and absence of coordinated water molecules in metal complexes. The geometries of Schiff's base and metal complexes were optimized with respect to the energy taking the 6-31+g(d,p) basis set in Gaussian 09W programme in gaseous phase. The antibacterial studies of the compounds were examined against the human pathogenic, Gram negative bacteria i.e. *Escherichia coli*, *Yersinia enterocolitica, Klebsiella pneumoniae,* and *Salmonella typhi* and Gram positive bacteria i.e. *Listeria monocytogenes* and *Enterococcus faecalis*.

Keywords: Co(II), Ni(II), Cu(II) and Zn(II) complexes, Schiff's base, Spectral characterization, DFT, Antibacterial studies.

Introduction

In chemistry, the area of transition metal complexes of Schiff's bases and their coordination chemistry is very broad and important. Schiff's bases, the condensation products of primary amines and carbonyl compounds (i.e aldehydes or ketones), having azomethine group (-CH=N-), are very important biologically [1]. Schiff's base ligand's transition metal complexes have different types of uses e.g. analytical, chemical, industrial, biological and clinical etc. [2-14]. Schiff's bases and their metal complexes are also used for catalyzing different reactions viz. oxidation, reduction etc.[15, 16], as corrosion inhibitor [17, 18] and as sensors [19, 20]. Chemistry of tetradentate ligands is of great interest nowadays because of their biological activities e.g. antitumor, anticancer, antibacterial, antifungal, antitubercular, antiviral, antimalarial, antidiabetic [21-29] and DNA-binding [30, 31]. Biological activities of Schiff's base ligands are most probably due to the presence of oxygen, nitrogen atoms and different polar groups on side chains for interaction with different biomolecules while those of metal complexes is due to the additional different metal atoms and different anions which again enhance the attachment. Tetradentate Schiff's base can coordinate to metal as neutral molecule or after deprotonation as anionic ligands and can adopt various different coordination modes.

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Structure and optoelectronic properties of palmierite structured $Ba_2Y_{0.67}\delta_{0.33}V_2O_8$: Eu^{3+} red phosphors for n-UV and blue diode based warm white light systems

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ABSTRACT

Palmierite structured $Ba_2Y_{0.67}\delta_{0.33}V_2O_8$ in hexagonal symmetry have successfully been synthesized by employing a conventional solid state reaction. Considering the structural model of hexagonal palmierite in the *R-3m* (#166) space group, the observed powder X-ray diffraction pattern was fitted by the Rietveld refinement with lattice constants $a = 5.7797$ (1) Å and $c = 21.2894$ (3) Å. $Ba_2Y_{0.67}\delta_{0.33}V_2O_8$ showed broad blue emission at 442 nm under the UV excitation of 320 nm owing to $[VO_4^{3-}]$ group. A series of Eu^{3+} doped samples, $Ba_2Y_{0.67-x}Eu_x\delta_{0.33}V_2O_8$, showed bright orange-red luminescence ($^5D_0 \rightarrow {}^7F_{1,2}$) under the UV and blue excitations. The optimum doping amount of Eu^{3+} ions was found to be $x = 0.2$ and the energy transfer mechanism for the concentration quenching effect was determined to be dipole–quadrupole interaction. The CIE coordinates of the optimized $Ba_2Y_{0.47}Eu_{0.20}\delta_{0.33}V_2O_8$ phosphor at $\lambda_{ex} = 320$ and 394 nm are (0.67, 0.33) and (0.66, 0.34), respectively. Meanwhile, the optimized phosphor also showed high red color purity (R_a) of 99.6% and 99.4% at $\lambda_{ex} = 320$ and 394 nm, respectively, suggesting that it could be the preferred choice as a red component for white light emitting diodes. The internal quantum yield (η) and the absorption efficiency (α) of the optimized $Ba_2Y_{0.47}Eu_{0.20}\delta_{0.33}V_2O_8$ phosphor were found to be 59 and 28% respectively, at an excitation wavelength of 394 nm. Furthermore, the value of η and α for the optimized phosphor at the blue excitation of 464 nm were found to be 55% and 26%, respectively. The optimized $Ba_2Y_{0.47}Eu_{0.20}\delta_{0.33}V_2O_8$ phosphor showed excellent thermal stability (75% up to 200 °C) with an activation energy of 0.4 eV. A white light emitting diode comprising the optimized and commercial yellow phosphor showed bright white emission with a R_a of 86, color temperature of 5478 K, and CIE coordinates of (0.34, 0.33). The investigated results indicated that the $Ba_2Y_{0.47}Eu_{0.20}\delta_{0.33}V_2O_8$ phosphor is a suitable red emitting phosphor for making white light emitting diodes under near-UV and blue excitations.

1. Introduction

During the past few decades, luminescent materials that convert frequency into desired wavelengths has been widely used in various fields, such as light-emitting diodes (LEDs), upconversion, solar cells and sensors [1–5]. Nowadays, white-LEDs are considered to be the most important solid-state light sources owing to their excellent performances, such as high efficiency, high reliability, high durability, environmental friendliness, and low energy consumption [6]. Commercial methods for producing white-LEDs involve the coating of appropriate amounts of a yellow-emitting

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Energy transfer in Tb^{3+}-doped $Ba_2Y_{0.67}V_2O_8$ phosphors preferential for near white light emission

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ABSTRACT

$Ba_2Y_{0.67-x}Tb_xV_2O_8$ (x = 0.0–0.3) phosphors were produced by a solid-state methodology. The obtained compounds were isostructural with $Ba_3V_2O_8$. The UV excited $Ba_2Y_{0.67-x}Tb_xV_2O_8$ phosphors exhibited a wide emission band centered at 440 nm realized for the $[VO_4]^{3-}$ groups, and an intense green emission (545 nm) of Tb^{3+} ions. The host emission diminished and that of Tb^{3+} amplified with increasing the Tb^{3+}-dopant up to a certain level of Tb^{3+} concentration owing to the energy transfer (ET) occurrences. Meanwhile, the coloring parameters navigated from the blue to the bluish-white. The presented strategy of fine-tuning the photoluminescence via the vanadate to Tb^{3+} ET could deliver potential white light-emitting systems.

1. Introduction

The self-luminescence power of the vanadate based oxides materials in the visible region is a unique feature that makes them favorable over orthodox phosphors for many optoelectronic applications [1,2]. Such unusual visible emission under UV light is observed for the tetrahedral $[VO_4]^{3-}$ groups [3], which exhibit an efficient charge transfer band with considerable broadness within the region of near-UV attributing to the charge transfer (CT) from O^{2-} to V^{5+} [3,4]. This broad absorption band is a good counterpart with the emitting wavelength of UV based light-emitting diodes (LEDs) [5]. Consequently, the $[VO_4]^{3-}$ groups transfer the as captured energy from UV-LEDs to the active rare-earth dopants through a non-radiative transition process and, therefore, resulting in elevated emissions in rare-earth ions [6].

With the optimization of the ET mechanisms among $[VO_4]^{3-}$ groups and rare-earths (Ln^{3+}), the overall emission color from the Ln^{3+}-doped vanadates can be converted to white light under the UV excitations [7]. For example, Kunti *et al.* [8] tuned the emission color from the greenish-blue to white in Eu^{3+}-doped $CaZnV_2O_7$ phosphors with a change in the Eu^{3+}-dopant amount. Zhang *et al.* [9] reported that the effective ET from the $[VO_4]^{3-}$ of $Ca_5Mg_4V_6O_{24}$ to Eu^{3+} ions, which proved to be beneficial to tune the overall emission color to white.

Because of the above, an attempt has been made to generate the white light emission from a self-activated $Ba_2Y_{0.67}V_2O_8$ host doped with different concentrations of Tb^{3+} ions. A series of samples were prepared via a reported method [6] and examined using X-ray diffractions, UV–Visible spectroscopy, and photoluminescence to identify the potentiality of these materials as the single-phase white emitting phosphors under the UV-excitations.

2. Experimental details

The detailed synthesis procedure of $Ba_2Y_{0.67-x}Tb_xV_2O_8$ (x = 0.0–0.3) phosphors is reported in ref. [6]. The X-ray diffractions (XRD) of synthesized materials were recorded using Philip's X'pert pro diffractometer with Cu-K_α radiation. UV–Visible reflectance spectra (DRS) were recorded using Shimadzu UV 3600. The Fourier-transform infrared (FT-IR) spectra were recorded using a Bruker Alfa-E FTIR. Photoluminescence spectra were measured

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Host sensitized photoluminescence in $Sr_{2.9-3x/2}Ln_xAlO_4F$: $0.1Eu^{3+}$ (Ln = Gd, Y) for innovative flexible lighting applications

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ABSTRACT

Tetragonal structured Sr_3AlO_4F is highly strained as reported from its global instability index estimation. Moreover, our results of X-ray photoelectron spectroscopy (XPS) also ascertained that the structure of Sr_3AlO_4F is highly strained with oxygen vacancies. Herein, aliovalent substitutions of divalent Sr ions with trivalent Ln (Ln = Gd/Y) ions were carried out to improve the stability of Sr_3AlO_4F lattice, which subsequently enhanced the photoluminescence in a series of $Sr_{2.9-3x/2}Ln_xAlO_4F$: $0.1Eu^{3+}$ phosphors. All the phosphors showed intense red-orange emission ($^5D_0 \rightarrow {}^7F_{1,2}$) at excitation with UV and near-UV light. The critical concentrations of Gd^{3+} and Y^{3+} up to which the Eu^{3+} emission intensities increased linearly were observed to be x = 0.09 and x = 0.07, respectively. Nevertheless, further enhancement in the Eu^{3+} luminescence of the optimized phosphors was realized by subsequently annealing in low oxygen atmospheres. The enhancement in oxygen deficiency during the post-annealing in Ar or vacuum led the energy transfer (O^{2-}-Eu^{3+}) to a greater extent which afterward increased the Eu^{3+} luminescence. The optimized $Sr_{2.765}Gd_{0.09}AlO_4F$: $0.1Eu^{3+}$ and $Sr_{2.795}Y_{0.07}AlO_4F$: $0.1Eu^{3+}$ phosphors showed high red color purity (~99%), as well as CIE coordinates of (0.62, 0.38), indicated that these phosphors could be appropriate red-emitting components for making flexible optical films for many lighting devices. Therefore, flexible polydimethylsiloxane based films were also fabricated using optimized $Sr_{2.765}Gd_{0.09}AlO_4F$: $0.1Eu^{3+}$ phosphor. The electroluminescence of a flexible PDMS-phosphor composite film showed an intense and pure red color with good thermal stability suggesting its suitability in flexible lighting and display devices.

1. Introduction

Research on the development of efficient inorganic phosphor materials has been carried out using two general approaches' namely by exploring newer optical host lattices or by adopting different manufacturing strategies, surface modification and color-optimization of emission in well-established optical host matrices [1]. The fluoride-containing oxide hosts doped with rare-earth ions have shown great potential as light-emitting diode (LED) phosphors with their tunable luminescence properties [2–5]. The introduction of fluoride ions into an oxide crystal lattice leads to a distortion of the coordination polyhedrons i.e. generation of non-centrosymmetric sites, which causes unusual spectroscopic properties [6]. Moreover, the fluoride host matrices are known to provide a wide band gap, low phonon energy, and inter-configurational transitions whereas the oxides host matrices are known to provide high chemical stability and high absorption in UV–visible region [7]. Based on aforementioned facts, the oxyfluorides which combine the advantages of both fluorides and oxides are favorable to serve as the host materials for luminescence properties. Additionally, the ionic radii of O^{2-} and F^- ions are also comparable and thus stable crystals can be obtained in oxyfluorides at various O/F ratios. Recently, anion ordered oxyfluorides having composition Sr_3AlO_4F is emerging as one of the most widely investigated oxyfluorides phosphor due to its good chemical and thermal stability, facile synthesis conditions and efficient luminescence properties [8–12]. Lin and co-workers demonstrated white-light emission from the single-phase

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ORIGINAL ARTICLE

Ferromagnetic xyloglucan–Fe_3O_4 green nanocomposites: sonochemical synthesis, characterization and application in removal of methylene blue from water

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Abstract
In present study, novel magnetic nanocomposites based on an agro-based material, non-toxic and biocompatible xyloglucan (XG) with magnetic iron oxide (Fe_3O_4) were synthesized by a simple, safe and ecofriendly sonication method. The synthesized nanocomposites (XG–Fe_3O_4) were characterized by various analytical techniques such as powder X-ray diffraction (PXRD), Fourier transform infrared spectroscopy (FTIR), scanning electron microscopy (SEM)-energy dispersive X-ray (EDX), transmission electron microscopy (TEM)–EDX analysis and selected-area electron diffraction (SAED). The average crystallite size of the nanocomposites as estimated by the Scherrer analysis were in the range of 17–20 nm and thus exhibited no significant difference in mean particle size on changing the ratios of Fe_3O_4 and Xyloglucan. The high resolution (HR) TEM analysis revealed nanorod like shape of synthesized Fe_3O_4 nanoparticles. Lattice fringes of the individual crystallites were seen in the HRTEM image, indicative of their good crystallinity. The distance of 0.29 nm was found in between the lattice fringes that confirmed the cubic structure of nanoparticles. The FTIR spectrum of nanocomposite indicated the interaction of functional groups in XG with the Fe_3O_4 nanoparticles at the surface. The SEM analysis revealed the average crystal size of pure Fe_3O_4 nanocrystals to be 22.4 nm. The SAED analysis revealed that the nanocomposites (20 nm) were very close to behaving as superparamagnets at room temperature. A preliminary study on removal of methylene blue (MB) dye from aqueous solution indicated that the nanocomposite has potential to be used for photocatalytic and adsorptive removal of MB from aqueous solutions.

Keywords Xyloglucan · Nanocomposites · Ferromagnetic · TEM–EDX · Polysaccharide · Nanogels · Hydrogels · Dye removal

Introduction

The contamination of water streams by synthetic dyes has emerged as a serious environmental issue worldwide. During manufacturing and handling of synthetic dyes, 15–20% dyes are lost and released into waste water causing water pollution. Dyes are highly visible even at a very low concentration. Synthetic dyes present in waste water severely affect primary production in receiving water bodies and cause adverse biochemical effects on plants and aquatic animals. In humans, dyes may cause allergic dermatitis, skin problems, and cancer (Rong et al. 2014).

Different physico-chemical methods like electrolysis (Ruan et al. 2010), sorption (Lapwanit et al. 2018), photochemical destruction, membrane filtration (Karim et al. 2018), coagulation/flocculation, chemical precipitation and oxidation (Nidheesh et al. 2018; Mijinyawa et al. 2019) have been reported for the removal of dyes from the water. Sorption technique has drawn significant attention of the researchers due to its simplicity of operation, low cost and relatively high resistance to toxic substances (Lapwanit et al. 2018). The synthesis of novel and safe adsorbents with high sorption capacity following green chemistry principles to remove synthetic dyes is equally necessitated.

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Energy Upconversion in Rare-Earth-Doped Tin-Based Double Halo Perovskites, A_2SnCl_6 (A = K, Rb, and Cs)

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Review

Graphene Composites for Lead Ions Removal from Aqueous Solutions

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Abstract: The indiscriminate disposal of non-biodegradable, heavy metal ionic pollutants from various sources, such as refineries, pulp industries, lead batteries, dyes, and other industrial effluents, into the aquatic environment is highly dangerous to the human health as well as to the environment. Among other heavy metals, lead (Pb(II)) ions are some of the most toxic pollutants generated from both anthropogenic and natural sources in very large amounts. Adsorption is the simplest, efficient and economic water decontamination technology. Hence, nanoadsorbents are a major focus of current research for the effective and selective removal of Pb(II) metal ions from aqueous solution. Nanoadsorbents based on graphene and its derivatives play a major role in the effective removal of toxic Pb(II) metal ions. This paper summarizes the applicability of graphene and functionalized graphene-based composite materials as Pb(II) ions adsorbent from aqueous solutions. In addition, the synthetic routes, adsorption process, conditions, as well as kinetic studies have been reviewed.

Keywords: graphene oxide; nanoadsorbents; lead adsorption; graphene functionalization; composite; magnetite; removal efficiency

Highlights

- Contaminated waste water is one of the most serious risks for living organisms as well as to the environment.
- Nanotechnology offers best expectations over traditional technologies for wastewater treatment.
- Adsorption technology is the phenomenon of adhesion of solid substances onto the surface of adsorbent.
- Graphene-based nanoadsorbents exhibited a great potential towards effective removal of lead ions from aqueous solution.
- Graphene preparation, characterization, and applications of graphic-based composites for the removal of lead ions from aqueous solution have been discussed.

1. Background

Water decontamination is one of the most serious challenges among scientists globally due to the increasing population, pollution, and global warming [1–5]. Wastewater from developing industries, such as chemical manufacturing, metallurgical, battery manufacturing, papermaking, and mining industries produce a very large amount of various toxic pollutants in the form of heavy metal ions [6–9]. Excess heavy metal ions concentration in wastewater is a serious risk to public health as well as to other living organisms on Earth [10–12]. These toxic heavy metal pollutants are widely found in the Earth's crust which tends to bioaccumulate in living organisms; they are non-biodegradable, which can cause various diseases, genetic disorders, and lethal ecological effects [12–15]. Heavy metal ions in aqueous media pose several toxic threats to the human health as well as to the other living organisms even at low

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REVIEW PAPER

Critical analysis of polyindole and its composites in supercapacitor application

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Abstract

Polyindole-based hybrid composites are being recognized as a promising candidate to be used in energy storage field along with other conjugated organic polymers. Polyindoles themselves are affected with low electrical and electrochemical conductivity; nevertheless, high redox activity, tunable electrical conductivity, significant thermal stability, slow degradation rate, and possible blending property give them upper hand to be used as a good contender. Certain factors viz. electrolyte, concentration, morphology, pH, temperature, etc., are major components affecting performance of Polyindole and its composites. This assessment recapitulates the position of Polyindole and its hybrid composite to be used as energy harvest material; in addition, this evaluation also pronounces the future aspect of the hybrids.

Keywords Polyindole · Capacitance · Electrochemical synthesis · Charge–discharge · Hybrid composites

Introduction

In recent times, ultracapacitor/supercapacitor had emerged as a prime field of scientific concentration, attributed to the interest of scientists to figure out the behaviour and mechanism of different materials towards charging and discharging, while, on the other hand, generation of ultracapacitor/supercapacitor possess the potential to sort out the current problem of energy storage. Electric double layer capacitors (EDLC) and pseudocapacitors are the two forms in which the electric energy can be stored [1]. The charge in EDLC (Fig. 1) is stored through adsorption mechanism (non-Faradaic) hence called true capacitors, while pseudocapacitors charge generated are pseudocapacitance arise via redox reaction (Faradic) [2, 3]. The combination of these two generates a hybrid capacitor having properties of wide scan range, high power density, high rate of charge–discharge, and minimum Equivalent Series Resistance (ESR). Advanced research and scientific intelligence had provided numerous materials which are efficient in holding great amount of electrical energy thus to provide the stored energy at the time of prerequisite. However, the rendered energy by the material synthesized depends upon number of factor which defines the suitability of the material to be used as an efficient source of energy.

In the route to develop high class energy storage device, organic conducting polymers (CPs) had find their explicit position [4, 5], which were thought to be electrically insulated till year 1977, when research group of *Hideki Shirakawa* unveils their electrical conducting properties [6]. CPs are considered to be conducting in nature attributed to their rapid redox process which offers pseudocapacitance to be stored by the supercapacitor. However, these CPs (conducting polymer) possess variability in their conductance as they swing in between their two forms, i.e., conduction and insulation [4]. Among variety of CPs, Polypyrrole (PPY), Polyaniline (PANI), Polythiophene (PTH), and Poly(3,4-ethylenedioxythiophene) (PEDOT) are the most explored one owing to their high conductivity (credited to extended π

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Application of a protein domain as chaperone for enhancing biological activity and stability of other proteins

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ABSTRACT

Chaperones are a diverse class of molecules known for increasing thermo-stability of proteins, preventing protein aggregation, favoring disaggregation, increasing solubility and in some cases imparting resistance to proteolysis. These functions can be employed for various biotechnological applications including point of care testing, nano-biotechnology, bio-process engineering, purification technologies and formulation development. Here we report that the N-terminal domain of *Pyrococcus furiosus* L-asparaginase, (NPfA, a protein chaperone lacking α-crystallin domain) can serve as an efficient, industrially relevant, protein additive. We tested the effect of NPfA on substrate proteins, ascorbate peroxidase (APX), IgG peroxidase antibodies (I-HAbs) and KOD DNA polymerase. Each protein not only displayed increased thermal stability but also increased activity in the presence of NPfA. This increase was either comparable or higher than those obtained by common osmolytes; glycine betaine, sorbitol and trehalose. Most dramatic activity enhancement was seen in the case of KOD polymerase (~ 40 % increase). NPfA exerts its effect through transient binding to the substrate proteins as discerned through isothermal titration calorimetry, dynamic light scattering and size exclusion chromatography. Mechanistic insights obtained through simulations suggested a remodeled architecture and emergence of H-binding network between NPfA and substrate protein with an effective enhancement in the solvent accessibility at the active site pocket of the latter. Thus, the capability of NPfA to engage in specific manner with other proteins is demonstrated to reduce the concentration of substrate proteins/enzymes required per unit operation. The functional expansion obtained through our finding establishes NPfA as a novel class of ATP-independent molecular chaperone with immense future biotechnological applications.

1. Introduction

The biological function of a protein is dictated by its correctly folded conformation. The conformation of most of the proteins is labile and thus a slight change in physico-chemical environment may render them inactive (Colón et al., 2017). The susceptibility of proteins to various stress is a major impediment in the production, formulation, packaging, transportation and their day to day use in therapeutic and pharmaceutical practices. Inactivation during any of these processes cause significant economic loss (Romero-Romero et al., 2016). Several efforts have been made to enhance the activity and stability of proteins of biopharmaceutical importance. This includes the addition of osmotically active molecules such as amino acids, sugars and polyols, such as dextran, trehalose and sorbitol (Kaushik and Bhat, 2003; Sasahara

Abbreviations: NPfA, N-terminal domain of *Pyrococcus furiosus l-Asparag*inase; APX, ascorbate peroxidase enzyme; ARI-HAb, anti-rat IgG-Horse Radish peroxidase-linked antibody; AMI-HAb, anti-mice IgG- Horse Radish peroxidase-linked antibody; KOD, *Thermococcus kodakarensis*; PfCSP, *Plasmodium falciparum* circumsporozoite protein; OPD, o-phenylene diamine

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Study of some Vegetables Oil in Polar organic Solvent by excess values of thermodynamic properties

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ABSTRACT :

We have experimentally determined ultrasound velocity, density, and viscosity using an ultrasonic interferometer M-80, a pyknometer, and an Ostwald viscometer. Coconut Oil's estimated acoustic and thermodynamic properties in polar solvents such as acetone and acetaldehyde at varying temperatures. We have studied coconut oil's acoustic characteristics, density, ultrasonic velocity, and viscosity in a polar solvent to compute different thermodynamic and uncommon excess values. In light of the different molecules between oil and polar solvents, the interactions between coconut oil and polar solvents have been discussed.

Keywords: Acetone, acetaldehyde, ultrasonic interferometer, viscometer, refined coconut oil, and redistilled acetone.

Introduction :

Since ultrasound is now an established method, it plays a larger role in theoretical studies. At low amplitude, different densities and viscosities were detected in pure liquid and their liquid-liquid mixture. Here, we have collected redistilled liquids in their purest form and unusual compounds in binary form. Several researchers took velocity and other measurements of organic liquids.[1-3] Ultrasound and viscometric behaviour of hexadecane-butanol mixtures at various temperatures were computed by Rita Mehra and Rekha Israni[4]. Many researchers have used ultrasonic velocity measurements to detect and evaluate both weak and strong molecular interactions in binary[5-9]. At 298.15 and 308.15k, the ultrasound velocity of water-pyridine and water-picoline binary mixes was determined as a function of composition. The value of isentropic compressibility published by Sharma and Singh[10] has been used to analyse the observed data.

Experimental :

Acetone and acetaldehyde of AR/BDH quality were redistilled and purified using coconut oil. The ultrasonic interferometer M-80 from M/s Mittal Enterprises in New Delhi was used to

Discussion of Some Electrolytic properties of o, p-nitrophenol in polar solvents

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Abstract :
It has been shown in recent research that electrolysis of some solvents in polar and non-polar solvents can have significant physical and solvolytic consequences. Phenols are aromatic alcohols, and their reactive substituted o, p-nitro compounds. As a result, their electrolytic qualities require additional effort when placed in reactive liquids. Here, we used 40 degrees Celsius of o, p- nitrophenol in chloroform at a steady temperature. Other acoustic and thermodynamic parameters, such as adiabatic compressibility, lowering deformability, specific flowability, lowered flowability, specific attenuation coefficient, molar sound velocity, relative connection, different chain length, apparent molal compressibility, and solvation number, are calculated at varying molar concentrations based on the measured density, viscosity, and ultrasound velocity. As described in relation to the aforementioned variables, the quantity and character of molecular interaction.
Key Word : Solvation number, Molar Sound Velocity, p-nitrophenol

INTRODUCTION:

Since the molecules in binary non-aqueous liquid mixes are so loosely packed that there are some open inter spaces between them, the cell model theory of the liquid has been utilised to examine their interaction. Intermolecular free length, isentropic compressibility, molar volume, accessible volume, shear's relaxation time, and acoustic impedance, as well as their dependent properties, provide useful criteria for interpreting molecular contact and molecular association in organic liquid mixtures. These variables are useful for coordinating the acoustic behaviour of compound organic liquids.

Using the collision factor theory and the free length theory, Jaju et al.[1] have tried a quantitative investigation of the ultrasonic velocity in a binary liquid combination. Binary mixtures of o-cresol with aniline and phenoline have been studied by Adgaonkar et.al[2], who interpreted the results by looking at the variation of ultrasound velocity and adiabatic compressibility. There have been a number of workers[3-6] who have documented the correlation between temperature and the speed of sound.

EXPERIMENTAL:

A multi frequency ultrasonic interferometer, model F-81, produced by m/s Mittal enterprises New Delhi, was used to measure the ultrasound velocities of the solutions. Quartz crystals vary in

The Study of molecular interaction of Cotton seed oil in acetone, D.M.S.O. as the binary system at 303k & 308k by excess acoustic and thermodynamic properties

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Abstract :

In recent years, EEG signal analysis has become more reliable and accurate thanks to improvements in computers and how much they can do. It has become an important tool for diagnosing neurological problems, and it can be used in both the medical and physiological fields. Even for the most experienced neurologist, diagnosing and predicting epileptic seizures is hard because normal and abnormal signals often look the same. So, it would be best to have a fully automated Computer Aided Diagnostic (CAD) system that can use EEG signals to classify the severity of epileptic seizures. This is why the goal of the current Study is to create a computerised prediction model for figuring out how to read EEG data and make a diagnosis of epilepsy. This chapter talks about a computer-aided design (CAD) system that could find problems in the brain before and during seizures.

Keywords: ultrasonic interferometer, viscometer, pyknometer and used chemicals.

INTRODUCTION :

Understanding the behaviour of interacting molecules in their solvents requires knowledge of the physicochemical and thermodynamic properties of fluid mixtures with mole fractions and temperatures. Thermodynamic and acoustic research the[1-5] mixes of binary liquids are very useful in many fields. Cottonseed oil is a chemical with many intriguing properties, including its ability to react with acetone and dimethyl sulfoxide. The solvents acetone and dimethyl sulfoxide oleate (D.M.S.O.) contain sulfoxide groups, making cottonseed oil particularly useful. Cotton seed oil has cellulose, and other facts about it are acknowledged. At temperatures ranging from 308.15 to 323.15K, Prasad et al.[6] analysed acetophenone's ultrasonic velocities, densities, and viscosities in binary mixes with isopropanol as the common component. Ultrasound velocity, density, and viscosity are only a few parameters that can be determined experimentally for the pure components and the resulting mixes. Two intermolecular interactions can be better understood with the help of computed parameters such as isentropic compressibility, free length, interaction parameter, internal pressure, acoustic impedance, and Lennard Jones potential. In the temperature range of 303K to 313K, two binary liquid solutions, acetone-carbon tetra chloride and acetone-benzene were analysed.

Workplace Spirituality: Fallacy in the dichotomy between spirituality and religion inorganizational studies

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Abstract

This article attempts to deconstruct the dichotomy between spirituality and religion and identify the influence of religious belief that is pervasive in workplace spirituality research and paving toward the destabilization of doleful eye on religion in thetheoretical construct. The article argues that there are two basic tenets of spirituality research i.e., value of life and value of work; to find meaning of who we are and what we do in relation with others. Theoryis use to understand and to interpret reality into a meaningful conclusion. And religious belief is controlling these theories by influencing the theory making process itself. Therefore, the article is pushing toward where although there exists the dichotomy between spirituality and religion, as religion cannot be equated with spirituality; spirituality is the offshoot ofa religious belief and is essential to find common ground for an integral workplace.

Keywords: Spirituality, Religious belief, Fellowship, Soul, Respectful pluralism and Atheist.

Introduction

The workplace spirituality theme propagates the call to distance religion and harness the brighter side of spirituality in us, to lighten the workplace of modern time. The call is obvious and urgent at time when the global workplace is infected by stress, tension and low morale among the work community. Where workers feeling are alienated, their personal values are constantly undermined or even suppressed. This is evidence from bully, incivility, abuse and a constant struggle from the shadow of greed and different form of assault endure by many

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Perceived Changes in Welfare of Workers as a Result of Codification of Labor Laws

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Abstract

Labour code on wages got the assent of the President on August 8, 2019 following which ministry of law and justice has published it in the gazette. In its wake it subsumes and repeals The Payment of Wages Act, 1936, The Minimum Wages Act, 1948, The Payment of Bonus Act, 1965 and The Equal Remuneration Act, 1976. The Code on Wages is expected to regulate wage and bonus payments in the organized and un-organized sectors irrespective of their wage ceiling and type of employment. It seeks to universalise the provisions of minimum wages and timely payment of wages, which will be computed based on minimum living conditions. While the Central Government will continue making wage-related decisions for employments such as railways, mines, oil fields, central public sector undertaking etc., the State Governments shall make such decisions for all other employments including for private sector establishments. This code will impact 50 crore workers across the country. The codification of labour laws has removed the multiplicity of definitions and authorities, without compromising on the basic concepts of employee welfare and benefits. It is expected that this code will make it easier for employers, both in the organised and the unorganised sector to understand and thereby comply with the code.

However, there still are questions that need to be answered; for instance codification of labour laws is more of a consolidation of laws that retains most of the substantive provisions of the earlier laws. Though we have been able to zero in on a singular definition for the 'wage' we have not been able to reduce the complicacies in structuring of wages. We have not been able to get around the problems of increasing unemployment or decreasing skill levels. Neither have we been able to find an affirmative action that can be taken to reduce the gender and other biases. This paper is an attempt to find out how employers in the unorganised sector feel about this codification of laws and their perception of changes in the welfare of employees. We try to find out if the employers feel that this codification will lead to an improvement of remuneration, living standards and in lowering of the rate of unemployment. This study is only a brief survey of some 50 employers in the NCR and we seek to extend the survey to perception of workers.

Physics of Plasmas ARTICLE scitation.org/journal/php

Relativistic nonlinear frequency shift of laser pulse on reflection from critical layer in inhomogeneous plasma

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ABSTRACT

An analytical formalism is developed for the nonlinear frequency shift of intense laser pulse, due to relativistic mass nonlinearity (in the sub-relativistic regime), on reflection from the critical layer in an inhomogeneous plasma. As a higher and higher intensity front of the pulse approaches the critical layer, the reflection layer moves forward to higher densities, due to the relativistic increase in the electron mass, causing a red shift in the reflected wave frequency. The frequency shift increases with shortening laser pulse duration and laser intensity. For the rear portion of the pulse, the critical layer moves backward, causing a blue shift. The effect is more pronounced for shorter pulses and longer density scale lengths, consistent with recent experiments.

I. INTRODUCTION

The interaction of high power laser pulses with plasmas has been an important area of research both for studies of the fundamental aspects of the relativistic laser–plasma interaction physics and for physical applications in particle acceleration, novel radiation sources, and fast ignition inertial confinement fusion.[1–7] In these studies, the plasma density profile is a crucial parameter that controls much of the light coupling. However, the plasma density profile continuously changes throughout the interaction. The plasma in the interaction region moves on ultrafast timescales. Mostly, light coupling in short pulse laser interactions occurs at the critical surface where strong plasma oscillations can be excited.

For sub-picosecond laser pulse obliquely incident on a sharp edged plasma, the collisionless absorption takes place through the mechanism of electron vacuum heating, if the oscillation amplitude is larger than the typical nonuniformity scale length.[8] The theoretical model of the frequency shift in expanding plasma, however, has been developed when the characteristic scale lengths are larger compared to the light wavelength.[9] The frequency shift occurs when light propagates in a plasma of changing density. Coherent radiation emissions at high harmonics have also been observed in the interaction of long laser pulses with overdense plasma.[10] A train of zeptosecond pulses is produced by the reflection of a relativistically intense femtosecond laser pulse from the oscillating boundary of a overdense plasma due to the Doppler effect.[11]

Self-phase modulation and supercontinuum generation are important nonlinear effects in the intense short pulse laser plasma interaction. The phase of the laser, $\varphi = \omega t - kz$, of frequency ω (propagating along $\hat{z}$) depends on electron density n_0 and relativistic electron mass $m\gamma$ through the propagation constant $k = (\omega/c)(1 - n_0 e^2/m\varepsilon_0\gamma\omega^2)^{1/2}$, where $\gamma = (1 + a^2/2)^{1/2}$, with $a = e|A|/m\omega c$, in which A is the amplitude of the linearly polarized laser, –e and m are the electronic charge and rest mass, ε_0 is the free space permittivity, and c is the speed of light in vacuum. For a pulsed laser, γ is a function of time; hence, k becomes a function of time. The laser may also cause temporal variation of electron density by raising the ionization level of atoms or by exerting ponderomotive force and pushing electrons from a high intensity region to a low intensity region. As a consequence, the frequency of the wave becomes $\omega^{!} = \partial\varphi/\partial t = \omega - (\partial k/\partial t)z$.[12]

The frequency shift $(\omega^{!} - \omega)$ is a valuable diagnostic for the evolution of laser produced plasma and also a source of broadband radiation generation, and hence has been studied extensively in transparent optical medium and other media.[13–19] In a liquid or a gaseous

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Work motivation and job satisfaction: A study of the telecom sector

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An attempt was made to study the job satisfaction and work motivation of employees of the telecom sector. The sample of the study consisted of 120 employees. The Job Satisfaction scale by Shresthya and Ganguli (1994) and work motivation questionnaire WMQ developed by Agarwal (1990) was used for the data collection. The data were analyzed, for the first objective of studying job satisfaction and work motivation, descriptive analysis was done, within which mean and SD was calculated, for the second objective of studying the relationship between work motivation and job satisfaction, their correlation was found using inferential statistics, bivariate correlation was applied with the help of SPSS. The findings were showed that job satisfaction and work motivation were positively and significantly correlated to each other at 0.01 level of significance.

Keywords: job satisfaction, work motivation, telecommunication sector

Work motivation refers to the domain of motivational processes directed to the realm of work. Pinder (1998) defined: "Work motivation is a set of energetic forces that originate both within as well as beyond an individual's being, to initiate work-related behavior, and to determine its form, direction, intensity, and duration."

Work motivation has been studied extensively and widely in the area of organizational behavior because of some important reasons. Motivation serves as an important tool to understand the types of behavior of employees in an organizational setting. An understanding of employee motivation at workplace will help in understanding the important behaviors like job performance, absenteeism, turnover and counterproductive behaviors. Secondly, understanding of all the behavioral determinants enables us to predict the future performances of the employees. It is also beneficial in the selection of new employees, promotions of existing employees and whether employees will engage in counterproductive behaviors or not. Lastly, a better understanding of employee's motivation helps their managers to understand what keeps employees motivated at workplace which is beneficial for the effective functioning of the organizations. Every organization seeks for motivated employees and work towards it by providing a different kind of training opportunities and rewards and incentives. For example: if an organization knows that employees are highly motivated by financial incentives, this knowledge can be used to influence performance. Organizations that are aware of the needs of their employees can influence their employees in better ways comparative to those who don't have any idea about it.

In the contemporary business world, companies started considering their employees as the most important and valuable assets (Glen, 2006; Govaerts et al., 2011; Fulmer & Ployhart, 2014; Vomberg et al., 2015; Miller et al., 2017) and found out that a satisfied and motivated employee is the one who makes a difference in organization and makes their companies successful and effective compared to their counterpart. When considering job satisfaction and work motivation both play a distinctive role in the effectiveness of the organization in transition economies.

The benchmark work in the area of organizational behavior, regarding the problem of work motivation and job satisfaction, was Hawthorn experiments conducted by Mayo in 1933. Though the aim of Hawthorn studies was on increasing the productivity and the effect of supervision, incentives and the changing work conditions, this study laid the foundation of further researches in the area of work motivation and job satisfaction.

Stemming from Hawthorn experiments, there are many theories that exist in the area of work motivation and job satisfaction which can be broadly categorized as content theories and process theories. Content theories are individual based theories which attempt to explain the causes of behavior due to the deficiency or lack of some needs, both psychological and physiological. These needs are so intense that the individual compels to fulfill and act accordingly. These theories also aimed to study the influence of those blocked needs on human behavior. These theories are called individual based because of giving all importance to needs and identification of variable which is causing hindrance in its fulfillment and ignore the organizational aspects of work motivation and the process involved. Content-based theories include Abraham Maslow's theory of the hierarchy of need (1943) Alderfer's ERG theory (1969) theory X and Y by Mc Gregor, Herzberg's two-factor theory, the achievement motivation theory.

In contrast to content-based theories, another piece of work emerges which focuses on the thought and cognitive processes that take place in the mind of the people and influence their behavior. These researchers believed that content theories are being criticized on the basis that the explanation of human behavior cannot be defined wholly solely on the basis of needs, there are other phenomena like expectations, values, and perception which serves as an important factor for how people behave in certain situation, why people go out of the way for performing well and put extra amount of effort. Process theories include Equity theory, Expectancy theory, Reinforcement theory and goal setting theory, etc.

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आधुनिक संस्कृत रूपकों में वर्णित नारी पात्रों का वैवाहिक जीवन

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विवाह शब्द स्वयं में उन सभी बंधनों को द्योतित करता है जिनमें केवल दंपत्ति ही नहीं अपितु दो परिवार आपस में सभी प्रकार से बंध जाते हैं। विवाह वास्तव में दो परिवारों का मिलन है परंतु प्रथमदृष्टया जो इससे सबसे अधिक प्रभावित होता है वह नारी है। नारी अपने एक परिवार को छोड़कर दूसरे परिवार में ठीक उसी प्रकार मिश्रित हो जाती है जिस प्रकार प्रकाश की रेखा एक स्थान से दूसरे स्थान पर अपनी समान गति तथा निर्बाध रूप से सभी को प्रकाशमान करती रहती है।

विवाह के इस वास्तविक रूप को मानव समाज ने समझा भी और सराहा भी। अपनाने के इस बंधन को सभी ने पवित्र समझा परंतु कालांतर में यह विवाह अपने नियमों और मान्यताओं के कारण कई प्रकारों में बँट गया।

इस प्रकार इस पवित्र बंधन को आठ भागों में बाँटा गया। ये आठ प्रकार निम्न प्रकार से हैं–

(i) ब्रह्मविवाह
(ii) देव विवाह
(iii) आर्ष विवाह
(iv) प्राजापत्य विवाह
(v) आसुर विवाह
(vi)गान्धर्व विवाह
(vii) राक्षस विवाह
(viii) पैशाच विवाह

विवाह के इन आठ प्रकारों में प्रथम चार प्रकार अपने आप में प्रतिष्ठा को प्राप्त किए हुए हैं परन्तु अन्तिम चार समाज में अपनाए तो जाते हैं परन्तु सम्मान हीनता के साथ। ये वांछनीय अथवा अवांछनीय विवाह प्रकार कोई भी हो, अन्ततोगत्वा इससे यदि कोई सर्वाधिक प्रभावित होता है तो वह है– नारी।

प्राचीन कतिपय नाट्यकारों ने जहाँ अपनी नाट्यों में गान्धर्व विवाह को कहीं–कहीं पर ही स्थान दिया है, वहीं आधुनिक नाट्यकारों ने इसकी भीषणता और इसके सबसे निंदनीय रूप को उजागर किया है। आधुनिक समय में जहाँ समाज में वांछनीय विवाह प्रकारों पर युवाओं द्वारा कम बल दिया जाता है जो कि परिवार तथा समाज दोनों में महत्त्वपूर्ण एवं सम्माननीय होते हैं वहीं उनके स्थान पर अंतिम चार अवांछनीय प्रकारों पर अधिक बल दिया जाता है; क्योंकि समय परिवर्तन के साथ–साथ नैतिकता का जो ह्रास हुआ है उसने इन विवाह प्रकारों को बल दिया है।

नारकण्डाश्रम नाट्य की नायिका शकुन्तला जो कि भारत–पाक विभाजन में अपने परिवार से अलग हो गई थी कि कथा वर्णित है। पिता की अनुपस्थिति में गान्धर्व विवाह के द्वारा गर्भवती उस कन्या को प्रवास से लौटे पिता के द्वारा पतिगृह भेजा जाता है, परंतु गोली लगने वाली दुर्घटना के कारण शकुन्तला का पति अपनी स्मरण शक्ति खो चुका है, और इसी दृश्य के इर्द–गिर्द पूरा नाट्य अवलोकित होता रहता है।[1]

गन्धर्व विवाह की चर्चा विष्णुपद्मभट्टाचार्य जी के कञ्चुकि में भी है। आधुनिक नाट्यकारों ने विवाह के अनेक प्रकारों की चर्चा की है, लेकिन इन नाट्यकारों का मुख्य केन्द्र विवाह के स्वरूपों को दर्शाना नहीं अपितु विवाह में आ रहे व्यवधानों अथवा विवाह को करने के लिए सरल से सरल उपाय को ढूँढने का है। कई स्थलों पर नाट्यकारों ने प्रेम विवाह का समर्थन भी दिखाया है।

व्यासराज शास्त्री द्वारा रचित लीला–विलास प्रहसन में लीला का विवाह पिता और माता दोनों के ही द्वारा अलग–अलग स्थानों पर तय किया जाता है, परन्तु लीला इन दोनों के ही निश्चित वर को वरण करना नहीं चाहती। वह अपने सहपाठी विलास कुमार से प्रेम करती है और इस विषय में उसके भाई सत्यव्रत को पूर्ण जानकारी होती है। आधुनिक युग होने के कारण सत्यव्रत पुरुष होने के कारण उपरांत भी अपनी बहन के प्रेम का निर्धारक और निर्णायक बनते हुए उसका समर्थन करता है। अन्त में दस्यु के बंधन से लीला को मुक्त करवाने के फलस्वरूप विलास को लीला पत्नी रूप में प्राप्त हो जाती है।

रमा चौधरी आधुनिक नाट्यकृर्तियों में शिरोमणि हैं। उनके नाट्य आधुनिक समाज के प्रत्यक्ष प्रतिबिंब के रूप में समाज तथा उनकी सोच को उजागर करते हैं। विवाह के विषय में रमा ने अपनी नायिका पंकजनयना को उच्च कोटि का बनाते हुए उसे किसी भी पुरुष के हाथ में सौंपना स्वीकार नहीं किया है। पंकजनयना की माता अपनी पुत्री के विषय में इतनी तदस्थ है कि किसी भी अवस्था में वो अपनी पुत्री को उसके अनुरूप ही घर और वर प्रदान करना चाहती है। वो विवाहार्थी बनकर आए धनी परंतु अयोग्य वर को सीधे–सीधे

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ORIGINAL ARTICLE

MEDITATIVE FUZZY LOGIC AND AGRICULTURAL PRODUCTION PLANNING: STATE LEVEL INVESTIGATION OF WHEAT CROP IN INDIA

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Abstract: Wheat is the second most dominant food grain cultivated in India and also a major source of food security for the nation. After the Green Revolution, this crop witnessed remarkable growth. But, in the mid-1990s, doubts about the sustainability of its growth performance started cropping up. Consequently, methods to enhance the production through the best utilization of agricultural inputs were considered and Meditative Fuzzy Logic (MFL) was found to be a suitable method for incorporating agricultural production planning at crop level. Meditative Fuzzy Logic deals with inconsistent information; wherever a contradiction exists. Herein, MFL is used to construct an appropriate production planning technique to suggest increase in the productivity in wheat farming, by including eight input factors for five major states. The results clearly reveal that if agricultural inputs are used according to MFL technique, then output (productivity) of wheat crop will be much better as compared to existing productivity.

***Key words*:** Agricultural, Wheat crop, Meditative fuzzy logic, Inputs function and productivity.

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1. Introduction

Most of the population in developing countries like India is directly dependent on agriculture sector for their food and nutrition requirements. After the rice crop, wheat is the staple food in India. This crop has an important role for achieving food security in India through 'Green Revolution'. Uttar Pradesh, Punjab and Haryana are the main producer states of wheat crop. Due to surging population levels in India, there is a need to improve the agricultural production capacity from both economic and social point of view. Recently, sustainability of agriculture sector in India has been a great challenge for farmers, policy makers and academicians. Moreover, the farmers are facing different kinds of problems during the current era which need to be contextualized. Therefore, there is a need to build up mathematical models in farming practice for taking decisions to achieve optimum crop production in vague context. Meditative Fuzzy Logic (MFL) is one such suitable method for incorporating agricultural production planning at crop level.

Nowadays, ambiguity, doubtfulness, oscillation and uncertainty constitute an integral part of every decision making problem. Zadeh (1965) gave an idea to remove this kind of uncertainty or ambiguity, with the help of fuzzy logic by using membership grade/values. However, there are some cases in which human judgment plays a key role and wherein we are left with more than two answers like; "Yes" or "No" or "I cannot say" or "I do not know" *etc*. In order to accommodate Atanassov (1986) proposed intuitionistic fuzzy logic. This was an extension of fuzzy logic, which deals with membership as well as non-membership grade/values. intuitionistic fuzzy logics have the capability to handle the uncertainty caused by membership, non-membership and hesitation part of the situation. Hence, in many aspects, intuitionistic fuzzy logic is better than traditional fuzzy logic. Further, Atanassov and Gargov

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Existence and Stability of Equilibrium Points in the Problem of a Geo-Centric Satellite Including the Earth's Equatorial Ellipticity

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Abstract: This paper deals with the existence and stability of the equilibrium points in the problem of a geo-centric satellite including the earth's equatorial ellipticity. We have determined the equations of motion of the geo-centric satellite which include the earth's equatorial ellipticity parameter Γ (the satellite's angular position relative to the minor axis of the earth's equatorial section) and then we have investigated the existence and stability of equilibrium points. It is observed that there exists an infinite number of equilibrium points which lie on a circle for different values of Γ. It is shown that the effect of the earth's equatorial ellipticity parameter Γ on the location of equilibrium points is very small (i.e., the coordinates of the equilibrium points are different after the fifth decimal places). Further, we have observed that the collinear points are unstable for different values of Γ. The non-collinear points lying on the y-axis are unstable for different values of Γ. We have also found that some of the non-collinear points lying on the circle are stable and others are unstable for different values of Γ.

Keywords: *geo-centric satellite; earth's equatorial ellipticity; equilibrium points and stability.*

Mathematics Subject Classification (2010): 70F07, 70F10, 70F15.

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NUMERICAL SOLUTIONS OF STEADY FREE CONVECTIVE FLOW IN A RECTANGULAR REGION WITH DISCRETE WALL HEAT AND CONCENTRATION SOURCES

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Abstract. In this paper, numerical solutions are obtained for steady free convective flow in a rectangular region with discrete wall heat and concentration sources by using the finite volume method. The governing equations consist of the continuity, momentum, energy and mass transfer. These equations conjointly with suitable boundary conditions are solved numerically by using this method. The novel concept in this work is to generalize the SIMPLE algorithm suitably and thereby compute the numerical solutions of the flow variables such as the temperature (θ) and the concentration (C) in addition to the components of velocity and the pressure. All non-dimensional parameters are chosen suitably in accordance with the physical significance of the problem under investigation. With the help of these numerical solutions, we have depicted the profiles of the velocity, pressure, temperature and concentration along the horizontal and vertical directions of the geometric centre of the region. The validity of the numerical solutions are ensured by comparing the present solutions with the benchmark solutions. Code validation has been given for the present problem.

MSC 2010: *76D05, 76M12, 80A20*
Keywords: *control volume, discretized, temperatures, concentration, free convective flow, heat and concentration sources, horizontal and vertical directions*

1. Introduction

Free convection in a rectangular region due to heat sources placed on its walls is attaining immense significance in the present era's research. The reason for this significance is due to numerous industrial applications of free convection in a rectangular region such as in furnaces, cooling towers, electronic cooling systems et cetera.

A normal time advancing method for evaluation of flow fields of a regular fluid flow problem was deliberated by Patankar and Spalding [1]. Ghia et al. [2] have recommended benchmark solutions for a 2D incompressible flow in a square cavity by using the multigrid method. The benchmark solution for free convective flow of

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SOLUTION OF VISCOUS FLOW IN A RECTANGULAR REGION BY USING THE HYBRID FINITE VOLUME SCHEME

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Abstract. In the present work, a solution to the problem of viscous flow in a rectangular region with two moving parallel walls is obtained by using a hybrid finite volume scheme. The discretized governing equations are solved iteratively, and thereby the flow variables are computed numerically. The results for velocity and pressure in horizontal and vertical directions through the centre of a rectangular region are elucidated. The nature of velocity profiles and pressure for different Reynolds numbers in the horizontal and vertical directions through the geometric centre was analyzed with the help of pictorial representations. The present results are compared with the available benchmark results and we have found that they are not in disagreement.

MSC 2010: *76D05, 76M12*
Keywords: *components of velocity, pressure, moving parallel walls, rectangular region, hybrid finite volume scheme*

1. Introduction

The mathematical model for analysing the viscous flow in a rectangular region with two moving parallel walls occurs in industrial applications, such as chemical etching or film coating industries. There have been numerous investigations carried out over the last decade regarding viscous flow in a square cavity. However, we have discovered few studies on a viscous flow in a rectangular cavity with a moving top wall.

A time-marching numerical method for computation of correct velocity and pressure fields of a general fluid flow problem was studied by Patankar and Spalding [1]. A coupled strongly implicit multigrid method based on the stream function-vorticity formulation was suggested by Ghia et al. [2] for finding the solutions of a two-dimensional incompressible flow in a square cavity. A capable solution strategy for solution of steady incompressible flow using the automatic adaptive refinement method was investigated by Thompso and Ferziger [3]. Bruneau and Jouron [4] have investigated an efficient scheme for solving steady incompressible Navier-Stokes

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ORIGINAL ARTICLE

Efficient triads related to transportation problem with common pivotal time

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Abstract The present paper discusses a transportation problem with three objectives corresponding to the concept of common pivotal time. There may be a situation when different conflicting objectives have same pivotal time but routes consuming that pivotal time for those objectives are different. This may create a trade-off situation between the objectives over that pivotal time and thus create a desire for the associated efficient solutions. This paper explores such a situation by considering three linear conflicting objectives associated with the transportation problem. An algorithm has been proposed to obtain the desired triads of three objectives corresponding to all common pivotal followed by a theoretical justification. To exhibit the algorithm, a numerical illustration has been given at the end.

Keywords Three objectives · Transportation problem · Efficient triads · Pivotal time

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1 Introduction

Real world optimization problems associated with multiple conflicting objectives gives rise to trade-off situations. A trade-off situation is the one in which obtaining one objective worsen the possibility of other objective. Several approaches have been developed to deal with the concerned problems. Roy (1971) and Ehrgott and Gandibleux (2000) give a rich review of the available methodologies. Researches like Geoffrion (1967), Ecker and Kouada (1978), Armand and Malivert (1991) and Isermann (1979) have discussed linear nature of multiple objective problems.

Decision making with multiple objectives is associated with many consequences. Before making any decision, a decision maker (DM) must be familiar with all such consequences. Often DM faces situations where it is difficult to attain conflicting objectives (associated with transportation problem) over any certain time period during the transportation.

For instance, suppose decision maker wants to opt for a route that not just provides optimal time of transportation but incurs minimum cost of transportation and minimum cost of deterioration over this time. In other words DM has different conflicting objectives which they desire to attain over optimal time of transportation.

In trade-off situations, usually it is difficult to attain all objectives simultaneously as routes that provide minimum cost of one objective corresponding to the optimal time may or may not coincide with the routes that give minimum cost of other objectives corresponding to the same time. Over such situations, a decision maker must be equipped with all possible solutions (called efficient solutions) so that they can choose the most efficient solution

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VAGUE GROUPS REDEFINED WITH RESPECT TO t-NORM

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ABSTRACT. The basic aim of the present research paper is to the studies of vague sets and vague groups. Some properties of vague groups based on vague sets are redefined with respect to t-norm and consequently some results in the form of vague groups with respect to t-norm have been proved. We have also given some counter examples redefined vague groups with respect to our results.

1. INTRODUCTION

First introduction of fuzzy subset was given by L.A. Zadeh. In his first observation on fuzzy set in 1965, L.A. Zadeh [1] opened new avenues and wide range for the researchers in many challenging areas in many scientific fields for new research. The real-life situations are very often not crisp and cannot be answered in just yes or no. Prof. L.A. Zadeh describes this vagueness mathematically, by giving some degree of membership to each element of the given set. A very first paper on fuzzy groups was published in 1971 by A. Rosenfield [4] in which the concept of fuzzy sub groupoid and fuzzy groups was introduced. Fuzzy logic was further extended into the generalization of another logic which was first introduced by Gau and Buehrer [2] is known as vague logic. Vague logic deals not only the membership grade but also with the non-membership grade, the

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Calculus of new intuitionistic fuzzy generator: In generated intuitionistic fuzzy sets and its applications in medical diagnosis

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ABSTRACT

In this research paper, we defined the generated intuitionistic fuzzy set. We generated an intuitionistic fuzzy generator to define the generated intuitionistic fuzzy set. The generated intuitionistic fuzzy set is a generalization of the intuitionistic fuzzy set. We proved some basic properties of generated intuitionistic fuzzy set in the context of intuitionistic fuzzy sets; some results are proved by using the notion of newly generated intuitionistic fuzzy set and constructed intuitionistic fuzzy generator. A mathematical approach for the application of the generated intuitionistic fuzzy set is also given in this paper.

1. Introduction

The concept of fuzzy logic was given by Zadeh (1965), that takes into account the membership grade only. The membership function considers the grade of favorable cases and gives birth to the linguistic variables. The fuzzy logic in terms of the linguistic variable is a marvelous tool to deal with uncertainty. Due to the linguistic terminology of fuzzy logic, it plays a vital role in decision making that becomes fuzzy decision making about the jobs that possess current uncertainty. But where the membership grade is inadequate to define the current uncertainty due to the non-consideration of unfavorable cases, then it gave birth to a new logic, which consists of favorable, unfavorable and some other function to define the complete information about any object introduced by Atanassov (1986) further modified in Atanassov (1999). Intuitionistic fuzzy sets work on a theory, which considers favorable and unfavorable cases together and also defines the membership degree and non-membership degree of an element regarding its belongings, not belongings, and some other part, the sum of these three values always lies between 0 and 1. If the characteristics of an element are defined by membership and non-membership completely, then this concept turns into the concept of a vague set given by Gau and Buehrer (1993). The notion of vague logic and intuitionistic fuzzy logic is the same. However, in real-life applications, the linguistic negation does meet the requirement of the logical negation, while selecting the membership grade. There may be some kind of hesitation function in constructing the membership function as well as non-membership function. The membership function may be triangular, trapezoidal, exponential, Gaussian, bell-shaped, or any other function. So, due to this hesitation part, non-membership grade is less than or equal to the standard fuzzy complement of the membership grade. Cause of this, different approaches have been explained in defining the membership functions. There are many applications of intuitionistic fuzzy sets in the medical field given by De et al. (2001), and Szmidt and Kacprzyk (2001).

In constructing an intuitionistic fuzzy set (IFS), generators based on fuzzy logic are used. Fuzzy generators are fuzzy complements, and fuzzy complement functional is used to construct the fuzzy compliment given by Chaira (2019) which is defined as follow;

$$\emptyset(\mu(x)) = \xi^{-1}(\xi(1) - \xi(\mu(x))) \quad (1)$$

where $\mu(x)$ denotes the membership grade of the IFS and ξ is an increasing function with the condition that$\xi(0) = 0$, Sugeno (1977) used an increasing function as follows;

$$\xi(\mu(x)) = \frac{1}{\lambda}\log(1 + \lambda.\mu(x)), \lambda \geq 0$$

Then using the above function with fuzzy complement functional defined by Eq. 1, we get;

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Fuzzy Logic Inference System for Identification and Prevention of Coronavirus (COVID-19)

Nitesh Dhiman, M.K. Sharma

Abstract: ***Now a days Novel Coronavirus named COVID-19 becomes major health concern causing severe health issue in human beings and it becomes a pandemic. It's a kind of zoonotic that means it can transmit animals to humans. It may spread via polluted hands or metals. No specific treatment is available so far for COVID-19, so initial identification and preventions for COVID-19 will be crucial to control or to break down the chain of COVID-19. For this purpose, we have proposed a fuzzy inference system to diagnose the COVID-19 disease by taking six input factor like as; Ethanol, Atmospheric Temperature (AT), Body Temperature (BT), Breath Shortness (BS), Cough and Cold and the output factor has divided into three linguistic categories which denotes the severity level of the infected patients.***

Keywords: Coronavirus (COVID-19), Gaussian Membership Function, Fuzzy Inference System, Medical Diagnosis

I. INTRODUCTION

Coronavirus is the virus that may causes Middle East Respiratory Syndrome (MERS-CoV) and Severe Acute Respiratory Syndrome (SARS-CoV). After the study it has been found that the SARS-CoV was transmitted from wild cat to human. Chang *et al.* [1] shows in his study that the SARS-CoV is a novel virus that may causes the emerging and reemerging infection. Few of the studies [2] & [3] described that SARS-CoV novel virus caused the first pandemic of the paradise. The novel coronavirus called SARS-CoV-2, causes the disease COVID-19 and has never been encountered/found before. It is originated from Wuhan a city of china and till now it effects more than 180 countries and territories. Currently many scientists and researchers of different countries are doing hard work to find the appropriate vaccine for COVID-19 disease. It effects more than 180 countries and territories,
scientists and researchers are not certain about the origination of COVID-19. COVID-19 is the kind of zoonotic, initially it was transmitted from animals to humans [4] & [5] but now it is rapidly spreading from person to person and the spread rate of the infection increasing exponentially, according to this theory each infected person may infect more than 2 people and each may further infect more than 2 and so on. A study by Harvard T.H. Chan School of Public Health epidemiologist state that disease COVID-19 could infect major part of worldwide population and according to the world health organization (WHO) COVID-19 has affected more than 697,244 people globally with 33,257 death cases till now (by 31-03-2020). In china about 81,285 confirmed cases over 74,051 patients have recovered and about 3,295 have died. COVID-19 includes symptoms like; cough, fever, breathing difficulties and it may cause pneumonia and kidney failure or patient may death, in some cases patient might show no symptoms at all. According to the study of the Centers for Disease Control and Prevention (CDC) [6] these symptoms usually appear between two days and two weeks of exposure to the virus. Journal of the American Medical Association reports say that out of all COVID-19 patients 11-44% has fatigue, 76-82% has coughed and 98% have a fever. The severity level of the disease increases in the human of age between 28 to 85 years-old. Currently more than fifteen Italian citizens cases test have been found positive in India by March 2020.

Present research paper has been divided into five sections; in the second section, we have shown the effects of COVID-19 in different types of metal. In the third section of the research paper, we have given a survey on COVID-19 and in the fourth section, we have defined some fuzzy rules as shown in tab. 3 for the proposed fuzzy expert system with six inputs as shown in tab. 2 and one output which define the severity level of the infected patient as shown in fig. 5. Fifth and last section of the research paper contains conclusion part of the work.

II. BASIC CONCEPTS

A. Effects of COVID-19 on Metals

On different kind of material and surfaces like; Steel, Aluminum, Metal, Wood, Paper, Glass, Plastic Silicon and Rubber, the coronavirus may alive or it may remain infectious from 2 hours up to couple of weeks. Kampf *et al* [7] summarized the persistence of the coronavirus on inanimate surfaces and this study also shows inactivation of the coronaviruses by biocidal agent through suspension and carrier tests.

B. Fuzzy Logic in Medical Diagnosis

Fuzzy logic is a kind of computational archetype which gave us a mathematical tool for human reasoning for handling the various type uncertainties. The capability of fuzzy logic provides us to express the human knowledge in linguistic way. The framework of fuzzy logic used in different kind of disease diagnosis [8, 9, 10] in which the physicians and expert's knowledge is represented on the behalf of symptoms and diseases. In which we can frame the different type membership function for the symptoms depending upon the trend of the patient data and they have used to form a suitable fuzzy expert system

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Diabetes Diagnostic Model Based on Truth-value Restrictions Method Using Inference of Intuitionistic Conditional and Qualified Fuzzy Propositions

Nitesh Dhiman, M. K. Sharma

Abstract: ***Diabetes is a challenging problem nowadays. Not only in India, but it also spreads over worldwide, In the present research paper a novel scheme based on intuitionistic fuzzy propositions to explore the knowledge base rule system with uncertainty has been developed and for the extension of fuzzy propositions to the domain of factors causing diabetes. In this paper, we have constructed the conditional and qualified intuitionistic fuzzy proposition mathematically for the diabetes diagnostic model. We have also developed an algorithm for Truth-value restriction method using the conditional and qualified intuitionistic fuzzy proposition;with the help of developed algorithm for truth-value restriction method we will give a scheme to check this severity of the diabetes. Numerical computations have also been carried out to demonstrate our approach.***

Keywords:*Diabetes, Intuitionistic fuzzy set, Intuitionistic fuzzy relation, Intuitionistic fuzzy propositions, PIDD, Truth-value restrictions method.*

I. INTRODUCTION

Logic means the rules for the approximate reasoning and its all possible forms. Classical logic with its propositions plays a vital role in theformthat the propositions are assumed to be true or false. Every proposition has its counterpart, which is usually represented in the form of its negation. The propositions and its counterparts are required to assume the oppositional values. The other aspect of the logic, referred to be the propositional logic, deals with the combinations of arbitrary propositions. But the bitter truth of this concept is its form in the bi-valued logic with the drawback that the propositions cannot play a contingent role in the future events. Propositions about the future events are neither actually true nor actually false; hence their truth value identification is undetermined. Therefore the two valued logic may be extended into three valued logic. But when a finite set preserving the characteristic of an early stage in the evolutionary propositions is either the truth or falsity of proposition is known as fuzzy proposition and it is a matter of degree. Considering the truth and falsity are represented by values one and zero and the truth of every fuzzy proposition is represented by a number in the interval [0, 1]. In this paperwe have proposed a Truth-value restrictions method for the conditional and qualified proposition based to the diagnosis of diabetes.

Mathematically the fuzzy proposition can also be viewed as follows:

Let X is a non-empty set, and A is a subset of X. Then a fuzzy set A on X is a mapping which defined as, A: X → [0, 1]. Let "F(X)" denote the set of all fuzzy sets on X. For two non-empty sets X and Y, a fuzzy rule 'IF–THEN' is usually given as follows:

IF "x is A THEN y is B"

Where the antecedent $A \in F(X)$and the consequent$B \in F(Y)$ Further for a given fuzzy observation x isA', where$A' \in$ F(X), a corresponding output fuzzy set$B' \in$ F(Y), which means that y is B', is deduced using an inference. Thus, an inference may generally be viewed as a mapping from F(X) to F(Y). When we talk about the major health problems, then diabetes comes under this study. There are millions of people, who were dying every year because of diabetes. Especially in India, people are not aware about their physical fitness and diet plan. So this is one of the major reason that India having more diabetic patients. Zadeh [1] gave the concept of linguistic fuzzy model to express human way how to think and also introduce the compositional rule of inference but later on the bankler-kohout sub product [2] based on fuzzy rational inference was proposed which was as effective as compositional rule of inference. Later a relational inference system with the fuzzy implication [3] was introduced and this study shows the availability of residuated implications. Zimmermann [4] gave the Fuzzy Set Theory-and Its Applications which focus on the approximate reasoning and expert systems. Hájek and Kohout [5] gave concept of Fuzzy implications and generalized quantifiers in the form of fuzzy qualifier. However in real life this linguistic negation does not satisfy the logical negation, therefore while selecting the membership, there may be some type of hesitation. So due to the hesitation, non membership is less than or equal to the complement of the membership degree. This is the reason why different results may be obtained for the different membership function.

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Cyanide produced with ethylene by ACS and its incomplete detoxification by β-CAS in mango inflorescence leads to malformation

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Malformation of mango inflorescences (MMI) disease causes severe economic losses worldwide. Present research investigates the underlying causes of MMI. Results revealed significantly higher levels of cyanide, a by-product of ethylene biosynthesis, in malformed inflorescences (MI) of mango cultivars. There was a significant rise in *ACS* transcripts, ACS enzyme activity and cyanide and ethylene levels in MI as compared to healthy inflorescences (HI). Significant differences in levels of methionine, phosphate, S-adenosyl-L-methionine, S-adenosyl-L-homocysteine, ascorbate and glutathione, and activities of dehydroascorbate reductase and glutathione reductase were seen in MI over HI. Further, a lower expression of β-cyanoalanine synthase (*β-CAS*) transcript was associated with decreased cellular β-CAS activity in MI, indicating accumulation of unmetabolized cyanide. TEM studies showed increased gum-resinosis and necrotic cell organelles, which might be attributed to unmetabolized cyanide. In field trials, increased malformed-necrotic-inflorescence (MNI) by spraying ethrel and decreased MNI by treating with ethylene inhibitors (silver and cobalt ions) further confirmed the involvement of cyanide in MMI. Implying a role for cyanide in MMI at the physiological and molecular level, this study will contribute to better understanding of the etiology of mango inflorescence malformation, and also help manipulate mango varieties genetically for resistance to malformation.

Mango inflorescence is a branched raceme with pedicellate flowers arranged acropetally, which bears 500 yellowish-green bisexual and male flowers in variable proportion[1,2]. However, malformed inflorescences do not set fruit; therefore, inflorescence malformation in mango trees is a terrible disease[3] for mango farmers in that it reduces fruit productivity by 50–80 percent each year[4]. The disease was first identified in India by Marries, an expert mango grower from the Darbhanga district of Bihar[5,6]. Since then, it has been recognized in other mango producing countries such as Pakistan, the Middle East, Egypt, South Africa, Brazil, Sudan, Central America, Mexico, Cuba, Malaysia, Australia, Israel, UAE, Bangladesh, Sultanate of Oman, Southern Spain, China, United States and Senegal[6]. Mango malformation is a complex and destructive disease, which is exacerbated by the inadequate knowledge of its etiology.

Previously, we have reported higher content of ethylene in MMI[7,8]. In addition to producing ethylene[9], *Fusarium mangiferae* leads to the overexpression of key mango genes[10,11], which affects plant hormone homeostasis[12] and results in stress hormone ethylene formation[7]. Cyanide, a co-product of ethylene synthesis exerts adverse, toxic and long-term effects on plant growth and development[13,14]. Therefore, cyanide derived from ethylene could contribute to the development of malformation. In non-cyanogenic plants, cyanide is usually not detoxified by the β-CAS enzyme under adverse condition[13]. Thus, the accumulated unmetabolized cyanide

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Original Article

The role of miRNA in somatic embryogenesis

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ABSTRACT

Somatic embryogenesis (SEG) is one of the best techniques for mass production of economically important plants. It is also used for the study of morphology, anatomy, physiology, genetics and molecular mechanism of embryo development. Somatic Embryos (SE) are bipolar structures that develop from a cell other than a gamete or zygote. SEG reflects the unique developmental potential of plant somatic cells, resulting in the transition of the differentiated somatic cells to embryogenic cells to follow the zygotic embryo stages. There are several biochemical and physiological processes that transformed a single somatic cell to a whole plant. SE studies provide insight into cell mechanisms governing the totipotency process in plants. Previously, in vitro studies have suggested the role of various regulatory genes in embryogenic transition that are triggered by plant hormones in response to stress. The omic studies identify the specific genes, transcripts, and proteins required for somatic embryogenesis development. MicroRNAs (miRNAs) are small, 19–24 nucleotides (nt), non-coding small RNA regulatory molecules controlling a large number of biological processes. In addition to their role in SEG, miRNAs play vital role in plant development, secondary metabolite synthesis and metabolism of macromolecules, hormone signal transduction, and tolerance of plants to biotic and abiotic stresses. During last decade several types of miRNAs involved in SEG have been reported. Among these miRNAs, miR156, miR162, miR166a, miR167, miR168, miR171a/b, miR171c, miR393, miR397 and miR398 played very active role during various stages of SEG. In this review, we highlighted the role of these as well as other miRNAs in some economically important plants.

1. Introduction

The life cycle of most of the plants rests on embryogenesis; embryos are formed after successful fertilization of egg. However, in few exceptional cases such as in *Nigritella* adventitious embryony, a type of apomixes, occurs that gives rise to embryos from the somatic tissues [1,2]. The formation of embryos from the vegetative tissues can also be induced under in vitro condition. A somatic embryo (SE) is a bipolar structure that has no vascular connection with the maternal tissue of the explant [3]. The process of somatic embryogenesis (SEG) could vary depending on if SE developed directly from explant or from an intervening callus phase.

The technique of SEG is of paramount importance because of its basic and practical applications in plant biology. It is the process through which we can understand fundamental concepts of natural embryogenesis. New improved and economically important plants can be regenerated by the use of SEG [4]. SEG is a very complex process and is regulated by a number of external and internal factors. Since, its inception, SEG has been reported in large number of plants, still new reports are coming out [5,6] but the full mechanism involved in the SEG has a long way to go [7]. In recent years the latest techniques such as high throughput sequencing, qRT-PCR decodes the relationship between MicroRNAs (miRNAs) and their targeted genes. miRNAs are small, 19–24 nucleotides (nt), non-coding small RNA regulatory molecules controlling a large number of biological processes [8] including SEG [9]. Additionally, a gel-free shotgun proteomic analysis tool has been exploited to categorize proteins to identify possible targets during the course of SEG [10]. The reports [5,9,11–16] on the role of miRNAs in SEG of several economically important plants showed the importance of miRNAs regulation. The results obtained in these reports improved our level of understanding on this complicated process. These recent development needs to be summarize at one place for easy accessibility. This review will explain the importance of SE, SEG, their advantages, miRNAs, their role in SEG and its possible underlying mechanism in some selected economically important plants.

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Predicted concentrations of anticancer drugs in the aquatic environment: What should we monitor and where should we treat?

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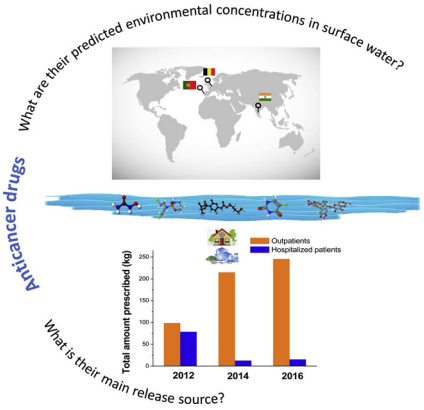
GRAPHICAL ABSTRACT



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ABSTRACT

Anticancer drugs have been detected in the aquatic environment, they have a potent mechanism of action and their consumption is expected to drastically increase in the future. Consequently, it is crucial to routinely monitor the occurrence of anticancer drugs and to develop effective treatment options to avoid their release into the environment.

Prior to implementing a monitoring program, it is important to define which anticancer drugs are more prone to be found in the surface waters. In this study the consumption of anticancer drugs in the Lisbon region (Portugal), Belgium and Haryana state (India) were used to estimate the concentrations that can be expected in surface waters.

Moreover, one important aspect is to define the major entry route of anticancer drugs in the aquatic environment: is it hospital or household effluents? The results disclosed in this study showed that in Belgium and Lisbon, 94 % of the total amount of anticancer drugs were delivered to outpatients, indicating that household

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SHORT COMMUNICATION

Development of cost-effective RP-HPLC methods for detection of cyclophosphamide, etoposide and paclitaxel

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Quantification of cyclophosphamide, palcitaxel and etoposide in water sample using simple analytical technique is challenging. In this study, we have developed a simple, sensitive, robust and accurate method for the detection and quantification of cyclophosphamide, etoposide, and paclitaxel using high-performance liquid chromatography and validated the same. The analytical conditions were achieved by the high-performance liquid chromatography system on a C_{18} column (250 mm × 4.6 mm × 5 μm) under isocratic mode. The retention time for cyclophosphamide, paclitaxel and etoposide were 2:40.1, 3:32.3 and 3:49.3 min respectively. We validated the method by evaluating system sensitivity and linearity. We anticipate the method to be useful in quantification of cyclophosphamide, paclitaxel and etoposide in water sample.

KEYWORDS
cytostatic compounds, method standardization, validation

1 | INTRODUCTION

In today's world, the population of cancer patients is increasing day by day [1,2], consequently the consumption rates of cytostatic drugs are also increasing. Cytostatic compounds are delivered into the environment from different sources such as hospital effluent and municipal effluent of outpatients [3–6]. The occurrence of cytostatic compound and other pharmaceutical drugs have been widely reported in the aqueous environment [5,7–12]. Cytostatic compound's presence in the environment is a potential threat [13]. The major cytostatic compounds that are detected in the environmental water samples are cyclophosphamide, paclitaxel, and etoposide (REF). Cyclophosphamide is an alkylating agent (MW-261.086), Paclitaxel is a plant alkaloid (MW-358.906) and Etoposide (MW-588.557) is a topoisomerase inhibitor that is used widely at a very higher rate (kg/year) in the hospitals for treatment of cancer patients [2,8]. Presence of these compounds in aqueous environment poses severe threat and may even cause genetic diseases upon consumption. Therefore it is critical to detect their presence and to quantify them in environmental samples [12].

Although there are several literatures on individual or simultaneous detection of paclitaxel, cyclophosphamide and etoposide [2,8,14–17], these reported methods usually require very costly solvent as a mobile phase. Therefore, there is a need for simple and low cost technique to detect these compounds.

The aim of present study is to develop a simple, sensitive, robust and reliable RP-HPLC analytical method for the determination and quantification of cyclophosphamide, etoposide and paclitaxel in environmental water samples.

2 | MATERIALS AND METHODS

2.1 | Chemicals and reagent

HPLC grade ACN and water was procured from Merck, cytostatic compound Cyclophosphamide was purchased from Hi-Media (RM8152), Etoposide from TCI (E0675), Paclitaxel from Hi-media (RM9750), and 0.2 μm syringe filter used in this study is from axiva (SFNY13RB).

Article Related Abbreviation: RT, Retention time.

biomolecules

MDPI

Article

Improved Pullulan Production and Process Optimization Using Novel GA–ANN and GA–ANFIS Hybrid Statistical Tools

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Abstract: Pullulan production from *Aureobasidium pullulans* was explored to increase yield. Non-linear hybrid mathematical tools for optimization of process variables as well as the pullulan yield were analyzed. The one variable at a time (OVAT) approach was used to optimize the maximum pullulan yield of 35.16 ± 0.29 g/L. The tools predicted maximum pullulan yields of 39.4918 g/L (genetic algorithm coupled with artificial neural network (GA–ANN)) and 36.0788 g/L (GA coupled with adaptive network based fuzzy inference system (GA–ANFIS)). The best regression value (0.94799) of the Levenberg–Marquardt (LM) algorithm for ANN and the epoch error (6.1055×10^{-5}) for GA–ANFIS point towards prediction precision and potentiality of data training models. The process parameters provided by both the tools corresponding to their predicted yield were revalidated by experiments. Among the two of them GA–ANFIS results were replicated with 98.82% accuracy. Thus GA–ANFIS predicted an optimum pullulan yield of 36.0788 g/L with a substrate concentration of 49.94 g/L, incubation period of 182.39 h, temperature of 27.41 °C, pH of 6.99, and agitation speed of 190.08 rpm.

Keywords: Pullulan; genetic algorithm; artificial neural network; fermentation

1. Introduction

Pullulan is a biopolymer of high commercial importance and utility [1]. Pullulan which is mostly available in powdered form, can also be formulated to thin films. These films have numerous applications in food, pharma, and healthcare industries. The most popular and commercially successful application of pullulan films is in Listerine® mouth freshener. Pullulan has also received wider acceptance in the food sector, and due to its intensifying nature has become an accepted ingredient in soups, sauces, and beverages [2]. Pullulan can be used in pharmaceuticals, such as in coatings on pills and capsules, including sustained-release formulations [2].

For fermentative production of pullulan, *Aureobasidium pullulans* is the preferred microbial source. Pullulan as an exopolysaccharide is produced by *A. pullulans* in response to external pH change and nutrient deficiency [3]. *A. pullulans*, as well as its upstream processing, has been the subject of an increasing body of research in fermentation studies. For an efficacious full fermenter system analysis,

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SHORT COMMUNICATION

Development of cost-effective RP-HPLC methods for detection of cyclophosphamide, etoposide and paclitaxel

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Quantification of cyclophosphamide, palcitaxel and etoposide in water sample using simple analytical technique is challenging. In this study, we have developed a simple, sensitive, robust and accurate method for the detection and quantification of cyclophosphamide, etoposide, and paclitaxel using high-performance liquid chromatography and validated the same. The analytical conditions were achieved by the high-performance liquid chromatography system on a C_{18} column (250 mm × 4.6 mm × 5 μm) under isocratic mode. The retention time for cyclophosphamide, paclitaxel and etoposide were 2:40.1, 3:32.3 and 3:49.3 min respectively. We validated the method by evaluating system sensitivity and linearity. We anticipate the method to be useful in quantification of cyclophosphamide, paclitaxel and etoposide in water sample.

KEYWORDS
cytostatic compounds, method standardization, validation

1 | INTRODUCTION

In today's world, the population of cancer patients is increasing day by day [1,2], consequently the consumption rates of cytostatic drugs are also increasing. Cytostatic compounds are delivered into the environment from different sources such as hospital effluent and municipal effluent of outpatients [3–6]. The occurrence of cytostatic compound and other pharmaceutical drugs have been widely reported in the aqueous environment [5,7–12]. Cytostatic compound's presence in the environment is a potential threat [13]. The major cytostatic compounds that are detected in the environmental water samples are cyclophosphamide, paclitaxel, and etoposide (REF). Cyclophosphamide is an alkylating agent (MW-261.086), Paclitaxel is a plant alkaloid (MW-358.906) and Etoposide (MW-588.557) is a topoisomerase inhibitor that is used widely at a very higher rate (kg/year) in the hospitals for treatment of cancer patients [2,8]. Presence of these compounds in aqueous environment poses severe threat and may even cause genetic diseases upon consumption. Therefore it is critical to detect their presence and to quantify them in environmental samples [12].

Although there are several literatures on individual or simultaneous detection of paclitaxel, cyclophosphamide and etoposide [2,8,14–17], these reported methods usually require very costly solvent as a mobile phase. Therefore, there is a need for simple and low cost technique to detect these compounds.

The aim of present study is to develop a simple, sensitive, robust and reliable RP-HPLC analytical method for the determination and quantification of cyclophosphamide, etoposide and paclitaxel in environmental water samples.

2 | MATERIALS AND METHODS

2.1 | Chemicals and reagent

HPLC grade ACN and water was procured from Merck, cytostatic compound Cyclophosphamide was purchased from Hi-Media (RM8152), Etoposide from TCI (E0675), Paclitaxel from Hi-media (RM9750), and 0.2 μm syringe filter used in this study is from axiva (SFNY13RB).

Article Related Abbreviation: RT, Retention time.

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Iron oxide nanoparticle-induced hematopoietic and immunological response in rats

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The application and use of iron oxide nanoparticless (IONPs) in the biomedical field are steadily increasing, although it remains uncertain whether IONPs are safe or should be used with caution. In the present study, we investigated the toxicity profile of ultrafine IONPs in rats administered with 7.5, 15 and 30 mg IONPs/kg body wt intravenously once a week for 4 weeks. IONP treatment reduces bone marrow-mononuclear cell proliferation, increases free radical species and DNA damage leading to growth arrest and subsequently apoptosis induction at 15 and 30 mg doses. It also induces apoptosis in undifferentiated hematopoietic stem cells. IONP treatment significantly increased the pro-inflammatory cytokine (Interleukin (IL)-1β, TNF-α, and IL-6) level in serum. The induction in inflammation was likely mediated by splenic M1 macrophages (IL-6 and TNF-α secretion). IONP treatment induces splenocyte apoptosis and alteration in the immune system represented by reduced CD4+/CD8+ ratio and increased B cells. It also reduces innate defense represented by lower natural killer cell cytotoxicity. IONP administration markedly increased lipid peroxidation in the spleen, while the glutathione level was reduced. Similarly, superoxide dismutase activity was increased and catalase activity was reduced in the spleen of IONP-treated rats. At an organ level, IONP treatment did not cause any significant injury or structural alteration in the spleen. Collectively, our results suggest that a high dose of ultrafine IONPs may cause oxidative stress, cell death, and inflammation in a biological system.

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1. Introduction

Iron oxide nanoparticles (IONPs) attracts great scientific interest in biomedical fields due to high bio-availability, generation of heat in alternating magnetic field, and localization into specific tissue under the influence of an external magnetic field.[1,2] Due to this unique property, IONPs hold immense potential in biomedical applications such as MRI contrast agent, targeted drug delivery, tissue engineering, tissue repair, thermal ablation therapy, noninvasive *in vivo* cell tracking, and magnetic transfections.[2–5] Recently IONPs, feridex (ferumoxides) and feraheme (ferumoxytol) have been approved by U.S. FDA for MRI, and iron deficiency treatment respectively.[2] Additionally, there are other clinical trials (NCT01411904, NCT01995799, NCT01895829 *etc.* http://clinicaltrials.gov) ongoing exploring the IONPs' utility in imaging, tracking and disease detection.[2] Increasing applications and use of IONPs raise serious public concern about adverse effects of IONPs on human health.[2] A number of studies have described the acute toxicity of the IONPs in animals.[6–9] while other studies reported no apparent signs of toxicity.[3,9,10] Understanding the toxicological profiles of IONPs, a transition metal is vital to ensure that the products are safe and developed with maximum benefits and minimal risks.[11,12] Multiple *in vitro* studies have demonstrated the IONPs-induced cytotoxicity.[1,2,10,12,13] In contrast, other studies failed to observe any significant toxic effects of IONPs.[14,15] Therefore, it is still an open question whether IONPs is cytotoxic or not. Previously, we reported the IONPs-induced oxidative stress and alteration in blood cell counts in rats.[16] Therefore, present study aimed at to investigate the underlying molecular mechanism of IONPs-induced oxidative and hematopoietic injury.

2. Materials and methods

2.1. Chemical

Dry iron oxide nano-powder (Fe_2O_3) was purchased from Intelligent Materials Pvt. Ltd. (Wilmington, DE, USA). 2,7-Dichlorofluorescin diacetate (DCFH-DA), 5,5-dithiobis-(2-nitrobenzoic acid) (DTNB), 2-thio-barbituric acid, reduced glutathione (GSH), propidium iodide, ethylene diamine tetraacetic acid (EDTA), bovine serum albumin and pyrogallol were purchased from Sigma-Aldrich (St. Louis, MO, USA).

2.2. Nanoparticles characterization

IONPs were characterized as described previously.[1,11,13] IONPs suspension (50 μg ml^{-1} in PBS) was drop casted on a copper grid, air dried at room temperature (25 °C) and then analyzed by

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RESEARCH ARTICLE

Cumulative effects of manganese nanoparticle and radiofrequency radiation in male Wistar rats

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ABSTRACT

Radiofrequency radiation (RFR) is a type of non-ionizing electromagnetic radiation that includes radiowaves and microwaves with a frequency range between 3 KHz and 300 GHz. Mobile phones operate with RFR and are used tremendously resulting in increased and continuous exposure of humans to these radiations. On the other hand, nanoparticles are also being used extensively in various fields. The increasing use of radiofrequency radiations and nanoparticles has become a concern to the general public. Not many studies have reported the cumulative effect of these stressors. Hence, the present investigation was aimed to find out their cumulative effect on the mammalian system. In this study manganese nanoparticles (MNPs) were synthesized and characterized. Adult male Wistar rats were exposed to MNPs and mobile phone radiation for 45 days and their separate, as well as cumulative impact, was investigated. The effect of the MNPs and RFR on liver, kidney, and reproductive parameters were studied. Histopathology as well as liver and kidney parameters were altered when exposed to MNPs and RFR separately. However, their combined treatment did not show a synergistic toxic response in liver and kidney functions which may be due to the fact that the radiation level is low, specific absorption rate (SAR) is subthermal (0.04 W/kg) and liver and kidney are located intra abdominally, hence they would absorb comparatively lesser radiation than the testicles. MNPs and RFR both caused a highly significant decrease in sperm count, which further decreased in the combined treatment (MNPs + RFR). These results indicate that the combined treatment of these stressors can have an additive toxic response to the male reproductive system.

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KEYWORDS
Radio frequency radiation; manganese nanoparticles; liver function; kidney function; reproductive system

Introduction

Mobile phones have become a necessity as communication tools. They emit, non-ionizing radiofrequency radiation (RFR) in the environment, radio waves that exert environmental stress, and acts as a pollutant (Phillips *et al*. 2009). Various hazardous effects of RFR on health have been reported. RFR enhances the reactive oxygen species (ROS) by increasing the activity of plasma membrane NADH oxidase (Desai *et al*. 2009). Chronic exposure to RFR causes prolonged oxidative stress and cause DNA damage. This may accelerate neuronal cell death and advance the processes that lead to neurodegeneration. Oxidative stress from RFR may also accelerate the cell death of spermatozoa. Such changes may lead to carcinogenesis in the brain and testis (Desai *et al*. 2009). RFR has also been implicated to cause renal impairment in rats (Oktem *et al*. 2005) and DNA damage to renal and liver cells (Trošić *et al*. 2011).

Studies on the effect of RFR on mammalian cells suggest that it can change gene and/or protein expression in some cell types (human fibroblasts and rat granulosa cells, lymphocytes, brain cells, human lens epithelial cells, mouse embryonic stem cells, and lung cells), even at intensities lower than the recommended values by International Commission on Non-Ionizing Radiation Protection (ICNIRP) (Xu and Chen 2007, Lai 2007, Trošić *et al*. 2011). Cells exposed to RFR have been observed to synthesize stress proteins (Blank 2007). The report suggests that exposure to environmental levels of RFR induces enormous immunological changes in both animals and humans (Johansson 2007). International Agency for Research on Cancer (IARC), has classified electromagnetic fields as a possible carcinogen (IARC 2013) and according to WHO's report, mobile phone radiations can cause brain cancer (Baan *et al*. 2011). Hands-free communication kits like bluetooth may reduce the risk associated with brain exposure but might cause exposure to other parts like gonads (Kühn *et al*. 2009), as one tends to carry the cell phone in a pocket or clipped to their belts at the waist in talk mode, exposing their testicles to RFR. This may increase the possibility to affect male reproductive organs. Earlier reports have suggested a possible link between mobile phone radiation and male infertility (Behari and Rajamani 2012, Gautam *et al*. 2019). Male infertility may be caused by carrying mobile phones close to reproductive organs like testes, which may result in decreased sperm production and development (Merhi 2012). Moreover, a considerable amount of mobile

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Synthesis of antibacterial, antioxidant and magnetic *Nigella sativa*-graphene oxide based nanocomposite BC-GO@Fe_3O_4 for water treatment

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ABSTRACT

The multifunctional nanocomposite BC-GO@Fe_3O_4 was prepared by incorporating magnetic Fe_3O_4 nanoparticles in cellulosic Black cumin seed powder which was functionalized with graphene oxide following co-precipitation method. The prepared BC-GO@Fe_3O_4 was characterized by employing thermal, spectroscopic and microscopic techniques that showed high thermal stability, magnetic behaviour, and the presence of large numbers of hydroxyl and carbonyl functional groups at the surface. The in vitro investigation has shown that BC-GO@Fe_3O_4 possesses significant antibacterial activities against *Gram*-negative and *Gram*-positive bacterial strains, and antioxidant capability. Thus the prepared nanocomposite is biologically safe and beneficial; therefore was tested for adsorptive removal of both cationic and anionic representative water pollutants, namely, methylene blue and arsenic from their aqueous solutions. The removal was carried out under variable conditions and the process has been investigated thoroughly. The adsorption data for both methylene blue and arsenic fitted well to the Freundlich isotherm and pseudo-second order kinetics which suggested that both these pollutants, during adsorption, bound specifically to the chemically active sites on the surface of BC-GO@Fe_3O_4. However, for comparison purpose the Langmuir capacity was determined at equilibrium which was found to be approximately 10.0 mg g^{-1} for methylene blue and 1.0 mg g^{-1} for arsenic at optimum conditions (Adsorbent dose: 1.0 g L^{-1} for both methylene and arsenic; initial concentration: 10.0 and 1.0 mg L^{-1}, and pH: 7.0 for methylene blue and arsenic, respectively). The obtained adsorption capacities were compared with previously reported adsorption capacities for various adsorbents for methylene blue and arsenic which proved the better adsorption capacities of BC-GO@Fe_3O_4 for the present study. Therefore, BC-GO@Fe_3O_4, a biologically safe and beneficial material, can be employed for adsorptive removal of dyes and arsenic from water while controlling the bacterial growth and acting as antioxidant.

1. Introduction

Arsenic, a highly notorious and toxic element, exists in combined form with other elements and gets dissolved in water aquifer. The drinking of arsenic contaminated water causes adverse health effects to human body including diabetes, neurological effects, cardiovascular diseases, and ultimately cancer of vital organs [1,2]. Arsenic poisoning is a serious threat to humanity and presence of arsenic in drinking water is reported almost all over the world and severely affected regions include India, Pakistan, Bangladesh, United states etc. where a significant fraction of the population, living in these countries, is exposed to arsenic contaminated water having concentration more than WHO guideline value of 10 μg L^{-1} [3,4]. It has been estimated that about 140 million people living in 50 countries are drinking water containing arsenic more than WHO limit [3,5]. Another serious issue, related to water pollution, is discharge of wastewater by the textile industries that contain synthetic azo dyes. The presence of dyes impart colour to water, for example methylene blue generate intense blue colour in water, even at dilute concentration. The wastewater discharged into fresh water bodies destructs the aesthetic quality, and also inhibits the penetration of sunlight which ultimately affects aquatic life [6]. Most of the synthetic dyes, being used in textile industries, released into water bodies are toxic and even carcinogenic to both animals and human beings. In addition to the presence of synthetic dyes, the wastewaters released

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ORIGINAL ARTICLE

Emotional Intelligence and Perceived Stress among Dental Undergraduates in Delhi

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Abstract

Background: Emotional intelligence (EI) is understanding one's own feeling and able to handle those feelings without disturbing themselves. Medical schools are stressful and the ability to manage stress is a major factor of success for these students. The current study contributes further insight to body of research in EI as it relates to students' stress in education, especially among dental undergraduates of Delhi.

Materials and methods: A cross-sectional, convenient sampling-based survey was conducted among 323 dental undergraduates from all the 3 dental Institutions across Delhi. The Schutte Emotional Intelligence and Perceived Stress scale instruments were administered to all the students of four professional years. The data analysis was done using SPSS V.17 and various statistical tests were used to determine significant difference.

Results: No significant differences were found among gender as well as among professional groups for EI. There was a significant difference (0.008) among gender with respect to perceived stress. Correlation analysis showed an inverse relationship between EI and PS (r = −0.227) which was found to be statistically significant.

Conclusion: Training in dental education could be quite stressful due to their time-bound work, but regular student performance assessment and associated factors would allow understanding student behavior in handling situations.

Keywords: Dental undergraduates, Emotional intelligence, Perceived stress.

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Introduction

The customary method for identifying and measuring student success and their later success during their dental practice has been overcome by nontraditional cognitive skills. One approach to measure nontraditional characteristics is through emotional intelligence (EI). Research indicates that noncustomary methods of assessing intelligence such as emotional intelligence may be an enhanced predictor than customary psychometric methods like intelligence quotient and other uniform measures of educational achievement. Emotional intelligence involves one's ability to recognize accurately, appraise and express emotions, ability to access and/or create feelings when they facilitate thought, and the ability to appreciate one's emotions and its knowledge to control emotions to encourage emotional and intellectual growth.[1]

In recent years, emotional intelligence has developed great interest on its theoretical concept which to explore its relationship with various human capabilities. Emotional intelligence has now become a powerful tool to answer the question about the prediction of success stories about the leadership roles.[2]

Emotional intelligence now exists as a tool with those working in very stressful environment and managing high work pressure in different settings and in individuals with negative mood inductions, which may act as enhanced resilience.[3] The studies have proved that emotional intelligence usually advances with age and experience.[4] The various factors pertaining to emotional intelligence, such as leadership quality, communication skills, success, and ability to handle environmental stress, are all improved over a period of time and with increase in age. Dental and medical school may be stressful and the potential to cope with such a situation can be detrimental to success for these students.[5]

The academic success and well-being of an individual are well governed by the balance between academic and personal experiences. The results of one of the studies showed that there is a positive correlation between effective stress management with quality performance.[6] In Medical and Dental Institutions, patients' outcomes can be improved by students with higher emotional intelligence scores.

Therefore, the institution should make a selection of dental and medical students based on the criterion of emotional intelligence. However, psychometric studies pertaining to EI scales used for health care professionals (dentist, dental auxiliaries etc.) in the institution are rarely conducted which decides the individual level of coping and handling stress in their workplace. More commonly, in developing countries, individual assessment is solely done based on their academic excellence.[5]

These studies provide a basis to decide whether there is a need to expand the research pertaining to emotional intelligence in healthcare settings and healthcare education. This would further enhance the external validity of the study based on the

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ORIGINAL RESEARCH

Biodistribution, Clearance And Morphological Alterations Of Intravenously Administered Iron Oxide Nanoparticles In Male Wistar Rats

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International Journal of Nanomedicine

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Introduction: Nanoparticles are used worldwide because of their unique properties, with large-scale application in various fields, such as medicine, cosmetics and industries. In view of their widespread use, the potential adverse effects of nanoparticles have become a significant cause for concern, in terms of not only human health and safety but also the environment. The present investigation focused on establishing the bioaccumulation patterns and ultrastructural changes induced by retained iron oxide nanoparticles (IONPs) in various target organs of rats.

Methods: Twenty-four male Wistar rats were randomly divided into four groups. Experimental animals were intravenously administered different doses of IONPs (7.5 mg/kg, 15 mg/kg and 30 mg/kg) once in a week for 4 weeks. Urine and feces samples were collected on a daily basis to assess nanoparticle clearance and analyzed via atomic absorption spectroscopy (AAS). At the end of the experiment, rats were euthanized and different organs, including spleen, liver, kidney, lung, heart, testis and brain, were dissected. Bioaccumulation of iron in organs and ultrastructural changes induced by IONPs were determined.

Results: The maximal concentration of iron was detected in spleen and minimal concentration in the brain. The level of iron accumulation in organs was as follows: spleen>blood>liver>kidney>lung>heart>testis>brain. The excretion profile in urine revealed maximum excretion on the day following administration that was maintained until day 28, whereas the iron content in feces remained high during the first three days after injection. A similar pattern was observed throughout the duration of the experiment. Ultrastructural alterations were detected in spleen, kidney, lung, heart, testis, brain and liver, indicative of cellular damage induced by accumulating nanoparticles in these organs.

Conclusion: Intravenous administration of IONPs results in ultrastructural changes and dose-dependent bioaccumulation in different organs of rats.

Keywords: metal oxide nanoparticles, bioaccumulation, ultrastructural changes, toxicity, metabolic cages

Introduction

Over the past few decades, metal oxide nanomaterials (NMs) have been used in sunscreens, cosmetics, paints, electrical appliances, textile and food products, along with medical fields, such as disease diagnosis, therapeutic agents, drug delivery systems and antimicrobial agents. Wider scope of application of NMs due to their extraordinary physiochemical characteristics has resulted in increased human exposure. These particles may be introduced daily in human life through diverse means, such as water, food, medicines and other commercial products.[1] Nanoparticles (NPs) incorporated through different modes of administration enter the blood circulation and are distributed to various organs including

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REVIEW ARTICLE

Recent updates on drug resistance in *Mycobacterium tuberculosis*

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Keywords
anti-tubercular drugs, drug resistance, multidrug drug-resistant tuberculosis, *Mycobacterium tuberculosis*, tuberculosis.

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Summary

Tuberculosis (TB) along with acquired immune deficiency syndrome and malaria rank among the top three fatal infectious diseases which pose threat to global public health, especially in middle and low income countries. TB caused by *Mycobacterium tuberculosis* (*Mtb*) is an airborne infectious disease and one-third of the world's population gets infected with TB leading to nearly 1·6 million deaths annually. TB drugs are administered in different combinations of four first-line drugs (rifampicin, isoniazid, pyrazinamide and ethambutol) which form the core of treatment regimens in the initial treatment phase of 6–9 months. Several reasons account for the failure of TB therapy such as (i) late diagnosis, (ii) lack of timely and proper administration of effective drugs, (iii) lower availability of less toxic, inexpensive and effective drugs, (iv) long treatment duration, (v) nonadherence to drug regimen and (vi) evolution of drug-resistant TB strains. Drug-resistant TB poses a significant challenge to TB therapy and control programs. In the background of worldwide emergence of 558 000 new TB cases with resistance to rifampicin in the year 2017 and of them, 82% becoming multidrug-resistant TB (MDR-TB), it is essential to continuously update the knowledge on the mechanisms and molecular basis for evolution of *Mtb* drug resistance. This narrative and traditional review summarizes the progress on the anti-tubercular agents, their mode of action and drug resistance mechanisms in *Mtb*. The aim of this review is to provide recent updates on drug resistance mechanisms, newly developed/repurposed anti-TB agents in pipeline and international recommendations to manage MDR-TB. It is based on recent literature and WHO guidelines and aims to facilitate better understanding of drug resistance for effective TB therapy and clinical management.

Introduction

Tuberculosis (TB) is a highly infectious disease caused by *Mycobacterium tuberculosis (Mtb)*, which primarily affects the lungs to cause pulmonary TB and affects other body parts to cause extra pulmonary TB (Lee and Yeo 2015; Pai *et al.* 2016; Ravimohan *et al.* 2018; WHO 2018). It is the leading cause of death from single infectious agent, ranking above HIV/acquired immune deficiency syndrome (AIDS) (WHO 2018). Prevention of new *Mtb* infections and their progression to TB disease is critical to reduce the burden of disease and death caused by TB. To address this global need, all 194 Member States of World Health Organization (WHO) and the United Nations (UN) unanimously agreed to progress towards the goal of ending TB epidemic by 2030 and endorsed WHO's END TB Strategy at the World Health Assembly in May 2014. The END TB strategy of WHO aims to achieve a world free of TB with zero deaths and suffering due to TB. This strategy sets interim milestones for 2020, 2025 and 2030 and targets to have 95% reduction in TB deaths and 90% reduction in new incidence of TB cases (new cases per 100 000 population per year) between the baseline year 2015 and 2035, ensuring that zero families

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Boron nitride (^{10}BN) a prospective material for treatment of cancer by boron neutron capture therapy (BNCT)

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Identification, Quantification and *In-Vitro* Genotoxicity of Major Polyaromatic Hydrocarbons Produced by Sugarcane Fly Ash Emitted from Sugarmill

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Abstract

Sugarcane burning during harvest and non-harvest season emits various pollutants like volatile organic compounds (VOCs), alkanes, and PAHs (Polyaromatic hydrocarbons) in the surrounding environment. Among these pollutants, PAHs are of uttermost concern due to their high level of toxicity. Burning of sugarcane bagase in sugar mill results in the production of fly ash. Fly ash is produced as a result of sugarcane bagasse burning in sugar mills. In present study, fly ash that comes out from the sugar mill chimney was collected from Western Uttar Pradesh, India and used for further analysis. High temperature and incomplete combustion inside chimney lead to the formation of PAHs. Extraction of PAHs present in fly ash samples was done by ultrasonication method and was identified with GC-FID (gas chromatography-flame ionization detector). Results exhibit the presence of eight PAHs in fly ash samples where the Benzo(a)pyrene and Naphthalene were found to be in high concentration. Furthermore, we have evaluated toxic effects of fly ash and Polyaromatic hydrocarbons (Standard of BaP & Nap) through different methods *i.e.* MTT, ROS and comet assay. Significant reduction ($p < 0.001$) in cell viability was noted in cells treated with fly ash as compared to control. Fly ash samples were also found to induce significant oxidative stress in HeLa cells, which ultimately causes DNA damage. Therefore, it may be concluded that the fly ash samples are toxic to the environment due to the presence of PAHs. Hence, the present study plays an important role in determining the harmful effects of PAHs and their source of occurrence.

Keywords

Sugarcane Fly Ash, Polyaromatic Hydrocarbons, Reactive Oxygen Species

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In Vitro and *In Silico* Evaluation of Betulin on Calcium Oxalate Crystal Formation

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ABSTRACT

Objective: The medicinal plant *Betula alba* has been used for prevention and treatment of kidney stones. Betulin is one of the main phytochemicals of *Betula alba*. The aim of this study is to investigate the antioxidant and antiurolithiatic activity of betulin in *vitro* and *in silico*. For antioxidant activity, 2, 2-diphenyl-1-picrylhydrazyl (DPPH), total reducing capacity, nitric oxide (NO) radical scavenging assay, and superoxide radical scavenging assay were studied.

Method: In order to study antiurolithiatic activity, three assays such as crystallization, nucleation, and aggregation of oxalate crystal in urine were performed. *In silico* experiments were performed by using AutoDock 4.2 tools in order to establish affinity of phytochemicals toward antioxidant enzyme and matrix metalloproteinase (MMP-2 and 9).

Results: The results obtained clearly demonstrate the significant scavenging activity of betulin and cystone against DPPH, NO, and superoxide radicals in comparison to standard antioxidant L-ascorbate (L-AA). It has also been observed that betulin has the capacity to inhibit the crystallization, nucleation, and aggregation in comparison to cystone. On the other hand, betulin and L-AA showed strong affinity toward antioxidant enzymes and matrix metalloproteinase as determined by *in silico* experiments.

Conclusions: From this, it may be concluded that the antiurolithiatic activity of betulin is, at least in part, mediated by its antioxidant property.

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Antioxidant; antiurolithiatic; betulin and cystone

Introduction

Urolithiasis or kidney stone formation is a well-known disease of the urinary tract that affects around 10% to 12% of the world population at a certain period of their lives (1). According to the National Health and Nutrition Examination Survey in the United States between 1976 and 1980, 1988 and 1994, and 2007 and 2010, the average lifetime prevalence of kidney stone disease was 3.2% (4.8% male and 1.6% female), 7.0% (8.5% male and 5.6% female) and 8.8% (10.6% in male and 7.6% in women), respectively. The U.S. Census Bureau estimated that total lifetime prevalence of urolithiasis will be 9.2% in U.S. males and females by 2030 (2,3). A kidney stone is an aggregation of solute materials from urine such as calcium, oxalate, phosphate, and uric acid. Frequency of urinary calculi occurrence are 80% calcium oxalate, 15% to 20% calcium phosphate, 10% to 15% mixed stone, 15% to 20% straiten, 6% to 10% cystine, and 2% to 10% uric acid (4,5). Calcium oxalate (CaOx) crystals are of two types, viz, calcium oxalate monohydrate (COM) or whewellite and calcium oxalate dihydrate (COD) or weddellite. COM is a thermodynamically more stable form than COD. COM is more common in clinical stones and has a greater affinity for renal tubular cells due to chemical nature of the crystal formed; thus, it is responsible for the formation of stones in the kidney (6). The pathogenesis of calcium oxalate stone formation is a multistep process which includes nucleation, crystal growth, crystal aggregation, and crystal retention. Supersaturated urine is required for the stone formation. The causes of supersaturation are urinary pH, ionic strength, solute concentration, and complexations. There is no satisfactory drug in the treatment of urolithiasis in spite of vast knowledge in the pathophysiology. Methods like endoscopic stone removal and extracorporeal shock wave lithotripsy are available but are costly, and recurrence is often observed in 70% to 80% of males and in 47% to 60% females (7). Therefore, a drug for the prevention of this disease or its recurrence would be of great interest (6). Ethnobotany has provided knowledge for treatment of kidney stone without any side effects (8). An ayurvedic drug, cystone—which contains extracts of *Didymocarpus pedicellata* = 65 mg; *Saxifraga ligulata* = 49 mg; *Rubia cordifolia* = 16 mg; *Cyperus scariosus* = 16 mg; *Achyranthes aspera* = 16 mg; *Onosma bracteatum* = 16 mg; *Veronica*

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Color versions of one or more of the figures in the article can be found online at www.tandfonline.com/uacn.

Review Article

Molecular Biomarkers for Early Detection and Prevention of Ovarian Cancer—A Gateway for Good Prognosis: A Narrative Review

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Abstract

Gynecological cancers are one of the most lethal and deadliest cancers in the world. In India, the prevalence of ovarian cancer accounts for 2.5% to 3%. Despite the availability of improved treatment option along with improved technology, the survival rate of ovarian cancer in the early-stage and the advanced stage is poor. Therefore, due to the heterogeneity of ovarian cancer, to detect it at an early stage and to prevent further mortality turns out to be a big challenge. Researchers are still in the process to identify any single biomarker with good sensitivity and specificity. Various traditional and serum approaches to identify ovarian cancer have been successful in the early stages. The invention of molecular biomarkers such as the use of genomic profiling, DNA methylation, and other approaches have proven to be of higher sensitivity and specificity, which overall affects the prognosis of ovarian cancer. With the use of whole-genome analysis, the detection of possible location of critical tumor suppressor gene (TSGs) in the paired region of chromosomes has been identified, which are associated with *BRCA1* and *BRCA2* which further makes these novel molecular biomarkers as potential biomarkers. Moreover, studies are required to assess the combined use of traditional, molecular biomarkers that might be useful for enhanced sensitivity and specificity for early detection and prevention of ovarian cancer in early stages which will lead to reduced mortality and good prognosis

Keywords: *Molecular biomarkers, ovarian cancer, preventive medicine*

Introduction

Woman reproductive organs constitute five main types of cancer (cervical, ovarian, uterine, vaginal, and vulva) collectively termed as gynecological cancers. Among these, ovarian cancer is the most lethal cancer which if not detected at the earliest stage leads to death. In 2017, more than half of the women died in the U.S due to these diseases and 14,080 out of 22,440 women were diagnosed with ovarian cancer. It is one of the deadliest and fifth most widespread cancer-related death among all gynecological cancer among women in the world. In India, the prevalence of ovarian cancer accounts for 2.5%. The mortality rate of ovarian cancer is up to some extent higher for Caucasoid women than for African-American women.[1]

Ovarian cancer is defined as an abnormal growth of cells that arises from the cells of ovaries. There are different kinds of ovarian cancer but most commonly it arises from the epithelial lining cells of ovaries. Ovarian carcinoma includes cancer of ovaries, fallopian tube, and primary peritoneal (lining tissues of the pelvis and abdomen) cancer, less commonly it includes germ cell tumors and sex cord-stromal tumors.[2]

Histologically, ovarian cancer is further classified as serous, mucinous, endometroid, clear cell, and mixed undifferentiated.[2] Cancer staging is a fundamental principle and one of the first and most important steps used to predict the patient outcome as well as to plan the most appropriate treatment. The most commonly used staging system for the ovarian cancer is FIGO (International Federation of Gynecology and Obstetrics) which provides more accurate prognostic information and better guidance on the management of ovarian cancer. The epithelial ovarian cancer does not present with earlier signs and symptoms and there are no specific efficient biomarkers to detect it which eventually leads it to be diagnosed at advanced FIGO staging. Despite improved treatment option, the survival rates of ovarian cancer with

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Collectivistic Culture Orientation across Age and Gender in a Mizo Society

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Abstract

This study investigated the role of age and gender and their interactions in differentiating Mizo people in terms of their perceived collectivistic cultural orientation by highlighting the discrepancy between normative cultural orientation and perceived evaluation of culture exists among the Mizos. The Cultural Orientation Scale (COS) developed by Brierbrauer, Meyer & Wolfradt (1994) was used and individually administered. 412 Samples were collected from 20 localities in Aizawl City using a multistage random sampling technique with an equal proportion of age and gender. Results of two ways ANOVA revealed significant main effects of age that Young Mizos reported greater normative culture than old Mizos who were higher in their self-evaluation of collectivistic values; no significant gender effect on all dependent variables; and the interaction of age and gender did not significantly affect cultural orientations of the Mizos. The great magnitude of discrepancy between the normative and evaluative perception of culture exists among old adults. Gender comparison of Mizo young adults showed significantly greater discrepancy among young male than young female. Implications for differing culture view between age groups are discussed with the scope of large scale studies comparing rural and urban areas to further explore and enrich the findings.

Keywords*: Collectivistic Culture, Age, Gender, Normative and Evaluative Orientation, Mizo Society.*

Cultures broadly exist in two dimensions of individualism and collectivism (Hofstede, 1980). Hui and Triandis (1986) defined collectivism as " a cluster of attitudes, belief and behaviours toward a wide variety of people". Within each cultural constructs, normative and evaluative assessments of one's culture exist (Hofstede, 1980; Triandis; 1989). Brierbrauer

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Analysis of configuration interaction and convergence with energy levels and radiative data in W XXXIX

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ABSTRACT

Fine structure energies and radiative data namely, transition wavelength, transitions rates, oscillator strength and line strength have been presented for lowest 123 levels of Kr-like W (WXXXIX) by using Multi-Configuration Dirac-Fock (MCDF) method. We have systematically analysed configuration interaction (CI) and convergence in radiative data and Dirac-Coulomb as well as Breit and Quantum electrodynamics (QED) effects of excitation energies. We demonstrate that inclusion of CI and convergence in excitation energies are crucial to attain the accuracy in atomic data. We have also discussed the evaluation of results from two independent codes GRASP and FAC based on MCDF and Distorted Wave (DW). We show that magnetic multipole transitions (M1, M2) are dominant in the contribution of lifetime of $4\,s^2(^1S_0)\,4p^5(^2P_1)\,4f^1(^2F_1)^3D_1$ and $4\,s^1(^2S_1)\,4p^5(^2P_1)\,4d^2(^3F_2)^3\,D_2^o$. The present results are complete, extensive and in good agreement with other results.

1. Introduction

The theoretical and experimental study of highly charged ions has played a substantial role throughout the history of experimental plasma physics. As an example, it has been very crucial to have an accurate knowledge of atomic properties, to understand the plasma energy balance and for diagnostic development. Interest in the extreme ultraviolet (EUV) and Soft X-ray (SXR) spectroscopy of highly charged, high Z ions with open 4p subshell electrons has recently grown in terms of practical applications as well as basic atomic physics. Since tungsten has been adopted as a plasma-facing material or component in the future fusion devices such as International Thermonuclear Experimental Reactor (ITER), the behavior of tungsten ions injected into the plasma has become recent topic of fusion plasma research because the penetration power or ability of tungsten ions within core of plasma possibly leads to significant power loss due to strong emissivity [1,2]. This may be due to the exhaust of energy through emission of high energy radiations [3–5]. The importance of tungsten ions in the diagnosis and investigation of fusion as well as astrophysical plasmas [6–8] due to unique physical properties of metallic tungsten, empowers the application and use of tungsten in high temperature devices [9,10]. The identification and interpretation of spectral lines within EUV and X-range from various fusion sources such ITER, EBIT, etc, require complete atomic data for neutral and different ionization stages of tungsten. In past few decades, several experimental and theoretical methods or techniques have been employed for determination of atomic data for several ionization states of tungsten [11–15], but still there is demand of complete atomic data [16,17]. Therefore, sudden rise in the development and modification of theoretical methods and experimental machines, and techniques etc. can bee seen for determining spectroscopic properties of tungsten ions properties [18,19].

Since in many electron systems, several points have crucial importance in accurate calculations: (1) how the configurations are interacting with each other. (2) Which configurations are contributing more or dominant. (3) effect of configuration interaction on atomic data and (4) convergence in atomic parameters. Therefore, in the past few years, the detailed investigation and scrutiny of configuration interaction (CI) effect with convergence has been published in literature. Fishcer [20] has given a detailed review of analysis and evaluation of configuration effect in different codes. Deprince etal [21]. have also examined effect of configuration through different physical models in W VIII using pseudo-relativistic Hartree-Fock (HFR) method. Gorczyca etal [22]. have demonstrated the importance of CI in fluorescence yields of Li-like ions using autostructure. Therefore, in the present work, we have studied CI effect and achieved convergence in our calculations.

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Equation of state of a PNJL model with chemically equilibrium QGP

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We study the equation of state (EOS) of PNJL model with chemically equilibrium QGP. By the effect of the chemical potential, the phase structure of QGP appears at lower critical temperature Tc. The result with the chemical potential found the phase structure of QCD is in agreement with the earlier result and almost matching with lattice data.

Keywords: QCD, Quark-Gluon Plasma

1 Introduction

Quantum-chromodynamics (QCD) is the theory of the strong interactions[1]. The theory predicts that there is a phase transition at high temperature and at very high chemical potential which exhibit a separation of these two matters[2]. In this transition phenomenon, there is a complete separation between these two matters, *viz.* the confined phase of hadronic matter and the deconfined phase of QGP matter at much lower temperature and there is mixed phase where the temperatures is around (150 - 170) MeV. It is also believed that the transition took place during the early phase of universe evolution and the evolution of universe can also be reproduced in contemporary heavy-ion collision experiments as colliding heavy-ions of Pb-Pb/Au-Au nuclei producing a state of matter as mini universe called quark-gluon plasma. So there are a number of experiments around the globe that these experiments are trying to prove the existence of quark-gluon-plasma formation. The study has proved the existence of QGP at RHIC at BNL and SPS at CERN. From these proofs the curiosity on the study of QGP formation has been increased from the last one decade and the proof can be signified from the different angles of signatures *viz.* photon/dilepton production, strange enhancements, hydrodynamical studies and QCD phase structure like equation of state (EOS). It indicates that the hot strongly interacting matter behave much like a nearly ideal relativistic fluid and this phenomenon of transition can be described by the models of relativistic hydrodynamics[3]. To describe such a complicated and crucial aspect is found as a description relating between local thermodynamic quantities, the equation of state (EoS). The calculation of the EoS is based on the parameters such as the temperature T and the chemical potential μ of the phenomenologically created matter of free quarks and gluons[4]. Most studies of the finite chemical potential EOSs were performed using monte carlo simulation work and through the high computer facility like lattice QCD[5,6]. In this paper, we follow the thermodynamic potential through the grand canonical ensemble and the potential is carried out to the leading order expansion of thermodynamic observables[7–11]. Then, we focus to find the equation of state using thermal quark mass in the PNJL model at finite temperature and chemical potential[12,13].

2 Gibbs Free Energy of PNJL Model

In this section we briefly describe the formalism of PNJL model with the introduction of thermal quark mass incorporating in the potential with the finite chemical potential. By the presence of thermal quark mass and chemical potential the early characteristic features of PNJL model is re-examined. The thermo dynamical potential for the two flavor quark in presence of chemical potential and thermal mass term in PNJL model[14] is written as:

$$\Omega(\varphi^*,\varphi,m;T) = U(\varphi,\varphi^*,T) + \frac{\sigma^2}{2G} - 2N_f qB\int d^3p E_p \frac{2}{\pi^3} - 2N_f qB\int d^3p \frac{2}{\pi^3}\left(Trln\left(1+L^{\dagger}e^{\frac{E_p-\mu}{T}}\right) + Trln\left(1+Le^{\frac{-E_p-\mu}{T}}\right)\right)$$

Where, $U(\varphi,\varphi^*,T) = \frac{-1}{2}b_2(T)\varphi^*\varphi + b_4(T)ln(1-6\varphi*\varphi-3\varphi*\varphi2+4\varphi3+\varphi*3$

with

$b_2(T)=a_0+a_1\left(\frac{T_0}{T}\right)+a_2\left(\frac{T_0}{T}\right)^2$ & $b_4(T)=b_4\left(\frac{T_0}{T}\right)^3$

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Analysis of discrepancy in previously published excitation energies of Ne-like ions from two independent codes and atomic data of Rb XXVIII and Ba XLVII

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ABSTRACT

Fine structure energies and radiative data namely, transition wavelength, transitions rates, oscillator strength and line strength have been presented for lowest 75 levels of highly ionized Ne-like Rb^{27+} (Rb XXVIII) and Ne-like Ba^{46+} (Ba XLVII) by using Multi-Configuration Dirac-Fock (MCDF) method. Our presented transition X-ray wavelengths of Ne-like Rb match well with Ne-like Rb experimentally determined laser wavelengths from different laser techniques. We have analyzed inconsistencies and uncertainties in previous Ne-like ions results by the evaluation of results from two independent codes general purpose relativistic atomic structure package (GRASP) and flexible atomic code (FAC). Our excitation energies for Rb XXVIII and Ba XLVII match well with NIST and other available results. We demonstrate that inclusion of configuration interaction (CI) is crucial to attain the accuracy in atomic data calculations. The present results are complete, extensive and in good agreement with other results and believe that presented results will be effective and helpful in detection of other X-ray spectral lines of Ne-like Rb laser from different sources.

1. Introduction

The diagnosis and investigation of fusion and astrophysical plasmas requires accurate, precise and large amount of atomic data such as excitation energies, radiative data, photoionization and excitation cross-sections for all charge state of atoms. To fulfill this demand, various experimental techniques and instruments have been developed and under process. The compiled and assessed energy levels, transitions rates, transition wavelengths etc, for few levels are freely available on several databases such as NIST and CHIANTI database. But due to insufficiency of experimental results and atomic data on databases, several theoretical methods and codes have been developed for the calculation of required atomic data. Most of the codes are freely available on CPC (Computer Physics Communication) program library website www.cpc.cs.qub.ac.uk/and IAEA (International Atomic Energy Agency) Atomic Molecular Data Services by Nuclear Data Section provides databases on atomic and molecular data for fusion such as OPEN ADAS (Atomic Data and Analysis Structure), GENIE (A General Internet Search Engine for Atomic Data), ALADDIN, etc. on website https://www-amdis.iaea.org/. This also offers user friendly platforms, namely, LANL (LOS ALMOS NATIONAL LABORATORY) for online calculation of atomic structure as well as excitation and ionization cross-sections and FLYCHK for modeling of atomic processes in plasmas. Such availability of free codes and online computing platforms have made easy the calculations of energy levels, radiative rates, etc. for comparison and production of atomic data. But still there are discrepancies in excitation energies and radiative rates calculated from two or more different codes or methods due to several reasons. These discrepancies create insecurities in the mind of researchers to use this data further in plasma physics and other fields. To highlight and removing these discrepancies, several workshops and research schools have been organized in the past. Chung et al. [1] have review atomic and molecular data and discussed quantification of uncertainties in different stages of extensive calculations. USA national research council has also submitted its survey report on uncertainty quantification for complex systems [2,3] in meeting with SIAM activity group.

Since the lines emitted from Ne-like ions with nuclear charge up to 36 have been detected in astrophysical plasmas which will be useful in diagnosis and plasma modeling [4–7]. Highly charged Ne-like ions for example, W LXV has applications in fusion plasmas [8], due to which accurate atomic data such as excitation energies, transition rates, etc. are required. Therefore, the goal of this work is to provide accurate

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Accommodating succinonitrile rotators in micro-pores of 3D nano-structured cactus carbon for assisting micro-crystallite organization, ion transport and surplus pseudo-capacitance: An extreme temperature supercapacitor behavior

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ABSTRACT

The 3D nano-structured cactus activated carbon, AC and its composites containing 0 to 10 wt % succinonitrile, SN rotators are prepared and investigated in PVdF-HFP/Na-TFSI/EC-PC gel polymer electrolyte. Against AC, the modified porosity, micro-structure and surface chemistry for 5 wt % SN rotators in optimized AC/SN-5 electrodes leads to ~5 times faster diffusion of ions inside pores, D ~1.25 × 10^{-4} vs. 2.50 × 10^{-5} cm^2/s, enhanced electrical conductivity, σ ~2.36 vs. 0.76 S cm^{-1}, meso-pores, S_{MESO}/S_{MICRO} = 0.192 vs. 0.148 and surplus pseudo-capacitance. Compared with AC, the AC/SN-5 electrodes offer higher specific energy, E ~34 vs. 20 Wh kg^{-1}, specific power, P ~200 vs. 40 kW kg^{-1}, knee frequency, f_k ~25 vs. 2 Hz and specific capacitance, C_s ~244–250 vs. 145–150 F g^{-1} with higher retention ~ (90 vs. 64%) at 10 A g^{-1}. Further, at 100 °C, contrary to AC, the AC/SN-5 electrodes can deliver a maximum power, P ~333 vs. 66 kW kg^{-1} with f_k ~30 vs. 3 Hz. However, at −50 °C, reduced values of P ~3 vs. 7 kW kg^{-1} and f_k ~0.5 vs. 1 Hz are observed due to death of SN rotators below − 40 °C.

1. Introduction

The increasing development of world's economy and industry, limited availability of fossil fuels and the increasing environmental pollution, led to discover efficient, clean, low cost and sustainable sources of energy, as well as new technologies associated with energy conversion and storage [1–4]. Devices for electrochemical energy conversion and storage include batteries, fuel cells and supercapacitors [1–4]. Particularly, the supercapacitors, are the energy storage devices exhibiting higher power density than batteries/fuel cells and higher energy density than conventional capacitors [1–7]. Electrical double layer capacitors (EDLCs) are a class of supercapacitors where the energy storage is caused by rapid electrostatic accumulation of charges to form electric double-layers at the high surface area carbonaceous electrode/electrolyte interfaces [1–7]. Electrode properties e.g., micro-structure, relative sizes of pores and ions, degree of straightness of pores (tortuosity), ion diffusion distances, interconnectivity of pores, electrolyte-carbon interfacial energy; and orientation, morphology and curvature of the accessible surfaces, surface chemistry, etc. have a key role in determining the rate capability/power performance of supercapacitors [8–17]. As opposed to the traditional activated micro-porous carbons which have non-uniform pore structure; recently, several novel carbonaceous electrode materials like graphene, carbide derived carbons, CDC, templated carbons, onion like carbons, transition metal dichalcogenide nanosheets, black phosphorus, vanadium dioxide anchored porous carbon nanofibers, etc., have been designed which can retain substantially higher values of specific capacitance even at higher charge discharge rates [17–23]. In addition to power performance, the energy density of supercapacitors is also an important feature which can be improved by increasing the active surface area of carbonaceous materials, use of

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Relativistic nonlinear frequency shift of laser pulse on reflection from critical layer in inhomogeneous plasma

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ABSTRACT

An analytical formalism is developed for the nonlinear frequency shift of intense laser pulse, due to relativistic mass nonlinearity (in the sub-relativistic regime), on reflection from the critical layer in an inhomogeneous plasma. As a higher and higher intensity front of the pulse approaches the critical layer, the reflection layer moves forward to higher densities, due to the relativistic increase in the electron mass, causing a red shift in the reflected wave frequency. The frequency shift increases with shortening laser pulse duration and laser intensity. For the rear portion of the pulse, the critical layer moves backward, causing a blue shift. The effect is more pronounced for shorter pulses and longer density scale lengths, consistent with recent experiments.

I. INTRODUCTION

The interaction of high power laser pulses with plasmas has been an important area of research both for studies of the fundamental aspects of the relativistic laser–plasma interaction physics and for physical applications in particle acceleration, novel radiation sources, and fast ignition inertial confinement fusion.[1–7] In these studies, the plasma density profile is a crucial parameter that controls much of the light coupling. However, the plasma density profile continuously changes throughout the interaction. The plasma in the interaction region moves on ultrafast timescales. Mostly, light coupling in short pulse laser interactions occurs at the critical surface where strong plasma oscillations can be excited.

For sub-picosecond laser pulse obliquely incident on a sharp edged plasma, the collisionless absorption takes place through the mechanism of electron vacuum heating, if the oscillation amplitude is larger than the typical nonuniformity scale length.[8] The theoretical model of the frequency shift in expanding plasma, however, has been developed when the characteristic scale lengths are larger compared to the light wavelength.[9] The frequency shift occurs when light propagates in a plasma of changing density. Coherent radiation emissions at high harmonics have also been observed in the interaction of long laser pulses with overdense plasma.[10] A train of zeptosecond pulses is produced by the reflection of a relativistically intense femtosecond laser pulse from the oscillating boundary of a overdense plasma due to the Doppler effect.[11]

Self-phase modulation and supercontinuum generation are important nonlinear effects in the intense short pulse laser plasma interaction. The phase of the laser, $\varphi = \omega t - kz$, of frequency ω (propagating along $\hat{z}$) depends on electron density n_0 and relativistic electron mass $m\gamma$ through the propagation constant $k = (\omega/c)(1 - n_0 e^2/m\varepsilon_0\gamma\omega^2)^{1/2}$, where $\gamma = (1 + a^2/2)^{1/2}$, with $a = e|A|/m\omega c$, in which A is the amplitude of the linearly polarized laser, –e and m are the electronic charge and rest mass, ε_0 is the free space permittivity, and c is the speed of light in vacuum. For a pulsed laser, γ is a function of time; hence, k becomes a function of time. The laser may also cause temporal variation of electron density by raising the ionization level of atoms or by exerting ponderomotive force and pushing electrons from a high intensity region to a low intensity region. As a consequence, the frequency of the wave becomes $\omega^{!} = \partial\varphi/\partial t = \omega - (\partial k/\partial t)z$.[12]

The frequency shift $(\omega^{!} - \omega)$ is a valuable diagnostic for the evolution of laser produced plasma and also a source of broadband radiation generation, and hence has been studied extensively in transparent optical medium and other media.[13–19] In a liquid or a gaseous

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PM_{10} carbonaceous aerosols and their real-time wet scavenging during monsoon and non-monsoon seasons at Delhi, India

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Abstract
Real-time simultaneous measurements of rainwater and PM_{10} chemistry were carried out at Delhi during the year 2016–17 in order to assess the levels of carbonaceous species and their wet scavenging during monsoon and non-monsoon seasons at Delhi. The PM_{10} samples were collected Before Rain (BR), During Rain (DR) and After Rain (AR) events, while rainwater samples collected on an event basis. The ambient OC levels were always higher than the levels of EC during both monsoon and non-monsoon seasons in ambient aerosol as well as in rainwater. On an average, during rain (DR) 30% of OC aerosols and 28.2% of EC aerosols removed via wet scavenging process. In after rain (AR), 26.2% OC and 1.8% EC aerosols further decreased in comparison to DR samples due to the presence of OC and EC free air parcel. Overall it observed that the OC concentration significantly lowered from BR to DR and AR. However, EC concentrations in AR were found to be higher than DR samples indicating their build-up after the rains. The Scavenging Ratios (SRs) of OC and rain intensity had a significant positive correlation, whereas the SRs of EC showed a weak correlation with rain intensity. The SRs of EC were significantly higher during non-monsoon as compared to monsoon season. Such characteristics can be explained based on the particles size, source and the hygroscopicity of both types of carbonaceous aerosol.

Keywords Organic carbon · Elemental carbon · Wet scavenging ratio · Rainwater

1 Introduction

Precipitation is a crucial component of the water cycle (Trenberth et al., 2003) and one of the most important components involve in the atmospheric circulation and weather studies (Kidd

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An investigation into corporate trust and its linkages

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ABSTRACT

We use a second order model of corporate trust to empirically investigate trust-commitment and loyalty building mechanisms in the Indian context. The development of corporate trust is found contingent on both organizational practices and employee behaviour, which are conceptualised as first-order dimensions of the second-order construct of corporate trust. The conceptualization of corporate trust is shown to be valid irrespective of the exchange situation involving durable, non-durable or service products. Results of a survey conducted with 835 Indian consumers show that the higher order construct of corporate trust predicts affective, normative and continuance commitment to the organisation behind the brand. Affective commitment is found to be the highest driver of customer loyalty (word-of-mouth and share-of-wallet) in the Indian context. The results vary slightly across different exchange situations and provide various implications to theory and practice with an aim at building long term customer relationships in the Indian context.

1. Introduction

Trust interfaces between customer and company embodying brand loyalty.Relational exchanges with long-term orientation are based on customer *trust* - the cornerstone of effective relationship management and one of the most significant attributes a brand can own for relationship initiation, formation, and maintenance (Ebert, 2009; Verhoef, Philip, & Janny, 2002; Palmatier, Dant, Grewal, & Evans, 2006). Trust has been shown to play a pivotal role in enhancing loyalty (Chaudhuri & Holbrook, 2002), corporate reputation (Walsh, Mitchell, Jackson, & Beatty, 2009) and commitment (Aurier & N'Goala, 2010; Morgan & Hunt, 1994), in business-to-consumer, business-to-business and not-for-profit contexts (MacMillan, Money, Money, & Downing, 2005).

Customers' trust in a brand is primarily based on their consumption experience and the evaluation and perceptions of direct and indirect contact with the brand (Delgado-Ballester & Munuera-Alemán, 2001). Brand trust, which develops from series of discreet encounters during consumption, indicates that a brand will behave in a customer's best interest (Hess & Story, 2005), showing reliability and integrity in its interactions (Garbarino & Johnson, 1999). Although the product/service consumption experience is a very relevant and important source of trust (Delgado-Ballester & Munuera-Alemán, 2000), research shows that customers evaluate both *product elements* and *company elements* when deciding to trust or distrust a brand (Mal, Davies, & Diers-Lawson, 2018; Sichtmann, 2007). The latter element is captured by Sichtmann (2007) findings demonstrating that the competence of a brand is also characterised by the leadership, the depth of experience and the qualifications the providing company has achieved in the relevant market. Consistent with Sirdeshmukh, Singh, and Sabol (2002) position employee behaviour and management practices as the independent nodes around which customers make evaluations/judgements about brands trustworthy behaviours and practices during an exchange. These findings further warrant that it is therefore important to not only understand the trust building mechanisms from an individual brand (Delgado-Ballester & Munuera-Alemán, 2000; Delgado-Ballester, 2004) or product/service perspective (Aurier & N'Goala, 2010; Johnson & Grayson, 2005; Sirdeshmukh et al., 2002), but also from a company (corporate brand, synonymously understood as the firm supplying the products and/or services) perspective, which has received considerably less attention from the trust literature.

We address these limitations in the extant literature by providing an intensive review of the existing conceptualizations of trust and its measurement to propose trust at the company level, termed as *corporate trust,* as a central mechanism with implications for effective customer-brand relationships (commitment and loyalty). In doing so, we also

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Interlinkages and Causal Relationships : An Empirical Study of BRICS and SAARC

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SHOEBA****

Abstract

This paper analyzes dynamics of stock indices inter-linkages between two regional integrations namely, BRICS and SAARC. These regional integrations are taken mainly as India is a member in these Regional Integrations. For analysis purpose, time series data of stock indices for a period ranging from April 2011 to March 2019 were taken. Johnson Co-integration test exhibits no long-run relationships between regional integrations resulting in non-existent of price discovery. To understand the short-term dynamics between these Regional Integrations VAR has been employed. Long-term equilibrium relationship is not confirmed between regional integrations. VAR results clearly indicates the dominance of BRICS over SAARC in the short-run. Further, Granger Causality results display uni-directional linkages flowing from BRICS to SAARC, due to the existence of more influential member countries in BRICS.

I. Introduction

IN REGIONAL INTEGRATIONS, two or more countries or nations reach an agreement to work closely and co-operate with each other to achieve stability, peace, and wealth. Regional economic integration is one of the forms of regional integrations. Under these agreements, member countries located in same geographic region agrees to reduce and gradually remove non-tariff and tariff restrictions to facilitate unrestricted flow of services, goods, and factors of production among them. The different stages of regional economic integration from the slightest integrated to the utmost integrated form are, custom unions, free-trade agreements, common market, political union and economic union.

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EMERGENCE OF PAYMENT BANKS: IMPLICATIONS IN INDIAN SCENARIO

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Abstract

Payment Bank in India is a type of bank which is a non-full service niche bank. A bank licensed as a Payments Bank can only receive deposits and provide remittances. It cannot carry out lending activities. Thus, Payment Banks can issue ATM/debit cards, but cannot issue credit cards as they are not empowered to carry out lending activities. Till now, four payments banks have started operations in India. Airtel Payments Bank was the first such bank to start its commercial operation in November 2016 on a pilot basis covering only Rajasthan initially and extending nationwide later in January 2017.

Payments banks can strategically use technology and smart segmentation as disruption tools and tactically leverage their existing customer base and distribution channels to quickly acquire critical mass.

Payment banks are supposed to serve as supporters of existing banking mechanism, instead of competing with them. In fact top-notch banks will not be affected much as payment banks will operate in specific areas only. As a strategy, the major banks in India could take advantage of these banks (as business correspondents) to improve their reach in remote parts of the country.

The paper, besides outlining the emergence of payment banks in India, highlights its potential role, and challenges in Indian context.

Keywords: *Payment banks, Indian Payment system, Challenges, Oppurtunities.*

27

REPRESENTATION OF RACE AND HISTORY IN *INVISIBLE MAN*

Komal Yadav, *JNU Research scholar, Centre for English Studies*

Abstract:

Set in the racial conflicts of the 1920s America, Ralph Ellison's Invisible Man (1952) is a bildungsroman and a protest song of a black man. The story chronicles the journey of a Nameless narrator from his subservience and disillusionment to self- realisation. The paper will attempt to delineate the politics of representation of History and race in the novel. It contends that by using the fictional space as a site of the protest, Ellison recuperates the subversive cultural history of blacks and debunks the illusion of equality, by exposing the racism prevalent in the guise of benevolent institutions. The paper engages closely with the narrative techniques of Ellison to understand his reformulation and problematisation of official documented history on blacks.

Key Words: *Subservience, disillusionment, fictional space, illusion of equality.*

What is History? Is it the neat sanitized figure given in the official recorded history written by the person in a position of power or an individual's recounting of what he has experienced? Ralph Ellison, through his masterful use of the narrative techniques, has posited history as an artefact which is in the process of making. Through the repeated use of the metaphor of loop, Ellison highlights the circularity of History with its interconnectedness with past, present and Future. It is his questioning of history through a first-person narrative, Ellison highlights the prevalent Racism in the country obfuscated under the guise of social equality. Let us try to probe the themes of Race and the problematisation of the dominant version of history as presented in *The Invisible Man*.

Benjamin pointed out that the past should be and can be retrieved because it is a pool of 'unrealised possibilities'. It is an amalgamation of crushed revolution, failed rebellion and much more. So, by playing with the 'gaze' of the readers, the nameless narrator acts as a post-colonial writer who is engaged and concerned about presenting history from below. It is evident from the fact that the novel is literally written from the basement. Two opposing versions of history are presented before us. One is the official documented history which is a delineation of glorified accounts of some heroes told in a linear and coherent pattern. But this version of history is problematised by our eloquent narrator, who mulls over the question of authorship of history. He ponders why only the survivors get the chance "to lie about it afterwards (237)?" However, the narrator makes explicit that human life is full of uncertainties and ups and downs, so it is not plausible to narrate history straight like 'an arrow; he wants it to resemble a 'boomerang' like a spiral and wants it to be discontinuous and formless like the actual living world. He wants the history of Blacks to sound like "a song with turgid, inadequate words (239)".

The repeated metaphor of 'invisible' is used for the Black community. Ellison goes to the extent of describing what he understands by invisibility in the novel. To him, it indicates the people who are either not taken into account or are 'plunged outside' it- since their mundane, monotonous everyday life is not considered worthy to be incorporated in the official version of history. The novel begins with the narrator asserting his existence 'I am invisible man…made of flesh and blood'. Ellison not only places the story of the invisible narrator as a part of fictional rewriting of history, but also allocates him all the power to recite it from the first-person account. The entire novel is a soul-searching mission of the nameless narrator to learn and unlearn the true depiction of history. It is at the end of his journey in the novel where he learns to

Chapter 4
A Genome-Wide Investigation on Symbiotic Nitrogen-Fixing Bacteria in Leguminous Plants

Lebin Thomas and Zeeshanur Rahman

Abstract The present article is focused on a wide genome investigation on nodule forming bacteria in 17 different genera. The genera included for the search were *Aminobacter*, *Azorhizobium*, *Bosea*, *Bradyrhizobium*, *Devosia*, *Ensifer/Sinorhizobium*, *Mesorhizobium*, *Methylobacterium*, *Microvirga*, *Neorhizobium*, *Ochrobactrum*, *Pararhizobium*, *Phyllobacterium*, *Rhizobium*, and *Shinella*, belonging to *Alphaproteobacteria*, and *Burkholderia* and *Cupriavidus* from *Betaproteobacteria*. All these genera (possessing full genomes) were scrutinized for the sequences with and without nodule forming capacity in the list of full genome sequences of NCBI. Approximately 1.83% of the total number of bacterial genome sequences were reported with nodule forming capacity. Maximum sequences for nodulation were available for *Burkholderia* followed by *Rhizobium* and *Bradyrhizobium*. Also, a great diversity of nodulation proteins were observed in most of the genera. Different nodulation proteins associated with different genera and their function were documented using genome mining in NCBI, UniProtKB, and literature survey. Different sequences of *Bradyrhizobium*, *Mesorhizobium*, *Rhizobium*, and *Ensifer* exhibited a great variety of nodulation proteins (nod, nol, noe, nfe, and nop). Overall, our investigation presents a molecular understanding about the nodule formation in legume plants and provides better future prospects for various biotechnological approaches to supply nitrogen in legume and nonlegume crops.

4.1 Introduction

Nitrogen is assimilated into plants from atmosphere by a wide diversity of nitrogen-fixing microorganisms. They are prokaryotic and are known as "diazotrophs." Both bacterial and archaebacterial genera can fix nitrogen (Young 1992). For the same, a wide variety of Gram-positive and Gram-negative bacteria and methanogenic

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Aptamer-Based Biosensors for Detection of Environmental Pollutants

10

Meenu Goyal, Ankush, Mukesh R. Jangra, Ritu Batra, and Pardeep Kumar

Abstract

Environmental pollutants monitoring is utmost importance for safety of living being of our ecosystem. Though the traditional detection techniques are capable of accurate analysis of environmental pollutants, there is need to develop fast, real-time and cost-efficient techniques for detecting and monitoring the environmental pollutants. Aptamer-based biosensors have shown promising performance in the detection of environmental contamination due to their high sensitivity, specificity and reusability. The aptasensor acts as an analytical device, which uses an aptamer as a ligand molecule. Aptamer is recently emerging as potential sensing elements that can replace other ligands due to its high temperature stability, low-immunogenicity, low-toxicity, high affinity and high specificity. This chapter explains the advances in development of aptasensor and its applications in the detection of various environmental contaminants.

Keywords

Aptamer · Biosensor · Detection · Environmental pollutants

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Chapter 12 - Enzyme Engineering

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What do these dates mean?

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Abstract

This chapter discusses the recent status of protein/enzyme engineering related to improvement activity, with an emphasis on the implications for industrial biotechnology. Different methods employed for enzyme engineering have been reviewed, such as directed evolution, rational design, site-directed mutagenesis, and semi-rational design. Information provided related to the mechanism for enhancement of enzyme activity is useful in industrial and environmental applications. Improvement in the yield of enzymes is difficult; however, increasing the activity of enzymes through various in silico approaches is useful. The high-throughput screening of various newly screened enzymes could further be tailored for use in prevalent industrial applications, with the help of

Aptasensor-Possible Design and Strategy for Aptamer Based Sensor

9

Jyoti Yadav, Ankush, Khushboo, Mony Thakur, Karuna Yadav, Manisha Sharma, and Kashyap Kumar Dubey

Abstract

Aptamers have procured immense attention as an evident identification element in biosensor design. Presently various electrochemical, optical, colorimetric, fluorescent, luminescent etc. are in trend because of their small size, flexibility to design, high sensitivity, high selectivity, chemical stability, temperature resistibility and cost effectiveness. The aptasensors have been classified in various groups depending on their configuration, confirmation and conductivity and four basic strategies have been used for designing the aptasensors i.e. target induced structure mode, sandwich mode, target induced dissociation mode and competitive replacement mode turning on the specific bidding process leading to signal variation however certain efforts have been made continuously in the design and operation of aptasensors. Nanotechnology, micromachines, quantum dot etc. have paved a new way in improvement of biosensors however in spite of rapid advancement aptasensors are still immature and need further amelioration.

Researchers are on way to take the tools further for significant advancement in the performance of aptasensors because of their unprecedented advantages. This chapter will give an overview of different types of aptasensors with their designing strategies and methods that have been implemented so far.

Keywords

Aptamer designing · Target induced modes · Aptamer types

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Chapter 4
Analysis of Atmospheric Pollutants During Fireworks Festival 'Diwali' at a Residential Site Delhi in India

Pallavi Saxena, Anju Srivastava, Shivangi Verma, Shweta, Lakhwinder Singh and Saurabh Sonwani

Abstract Globally, a number of firework events have been celebrated on a large scale in the names of different festivals. Diwali is one among the popular Indian festival held during October or November every year with huge fireworks. In the present study, various air pollutants like nitrogen oxides (NO_x), particulate matter ($PM_{2.5}$ and PM_{10}) and ozone (O_3) were analyzed in pre, during and post Diwali in two consecutive years i.e. October 2016 and October 2017 in capital city of India, Delhi. The results showed that the background values of particulate matter are exceeding 5–6 times in 2016 and 7–8 times in 2017 than permissible limits set by National Ambient Air Quality Standards (NAAQS), India. In Diwali-2016, the highest PM_{10} and $PM_{2.5}$ concentrations were about 8 times and 7 times higher than NAAQS limits respectively. For Diwali-2017, there was rapid increase in PM_{10} and $PM_{2.5}$ concentrations that were about 10 times and 13 times higher than NAAQS threshold value respectively. Moreover, PM_{10} and $PM_{2.5}$ concentrations in 2017, higher than 2016 were found to be 5–8 times more as compared to background concentrations. However, the concentrations of NO_x and O_3 look similar during background event, pre Diwali, Diwali and post Diwali periods in both the years of 2016 and 2017. The huge Diwali induced air pollution is influenced by transboundary air mass movements from nearby regions of Delhi and adjoining countries in both the selected years of 2016 and 2017 particularly in case of particulate matter in Diwali and Post Diwali. The study concludes that during background and in and around Diwali period receives the air masses containing the emissions from biomass burning which significantly increases the air pollution load.

Keywords Air pollution · Fireworks · Diwali · Delhi

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Criteria Air Pollutants and their Impact on Environmental Health

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Introduction

1

Abstract

The problem of air pollution is one of the greatest challenge worldwide and unfortunately it has not been solved even after the implementation of various technologies and policy actions. Drastic increase in urbanization and industrialization has resulted in elevated increase in primary as well as secondary air pollutants which ultimately affect the plant as well as human health. In particular, criteria air pollutants are some of the significant air pollutants that are more strongly supposed to be hazardous to human health and plant life. These air pollutants are showing drastic increase in their levels especially in developing countries and very few studies have been reported collectively to depict about their impacts and possible controls. Therefore, there is a stringent need for implementation of control policies and technologies to mitigate these kinds of air pollutants. Hence, this chapter focus on the overview of criteria air pollutants and also summarizes the brief introduction of different chapters highlighting about various aspects of criteria air pollutants.

Keywords

Air pollution · Plant and human health · Criteria air pollutants · Control policies

1.1 General Introduction

Air pollution is one of the major issues in today's world irrespective of developing or developed countries. Rapid increase in population and demand for energy have resulted in emission of toxic air pollutants that affect the surrounding environment as well as human health. According to the World Health Organization (WHO), about four million deaths along with numerous cases of respiratory illnesses annually result from air pollution in developing countries (WHO 2015, 2016). Human health, plant health, meteorological phenomena, agriculture yield, buildings and materials are immensely affected by various types of air pollutants emitted by various sectors

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Criteria Air Pollutants: Chemistry, Sources and Sinks

2

Abstract

Ambient air pollution is the foremost reason for global death and disease. An estimated premature death globally is related to ambient air pollution, mainly from emphysema, obstructive bronchiolitis, lung cancer, heart disease, stroke, and severe respiratory problems in children. The criteria air pollutants include particulate matter (PM), ozone (O_3), nitrogen dioxide (NO_2), sulphur dioxide (SO_2) and lead (Pb). The present chapter provides a summary of the types of criteria air pollutants, their National Ambient Air Quality Standards and their emission sources. This chapter also explains their level distribution and chemistry, and the sink in the earth's environment of these criteria pollutants is studied extensively. Description of global, regional emissions of criteria air pollutants, their contribution from different sectors, and efficiency of control strategies in developed and developing countries are also focused.

2.1 Introduction

Air pollution is one of the rapidly growing problems of today's world. The pollutant is emitted from different sources directly or indirectly to the ambient atmosphere. When one or several pollutants are present in the air in such a level for a long period of time, that can have some harmful effects on human, animal, plant and/or material properties which is called air pollution. It also affects the global economy, Earth Radiation Budget and climate change in the long-term perspective. Air pollution is now considered as the world's biggest threat to the environmental health and responsible for the seven million deaths over the world per year. It causes a number of deleterious effects and causes pulmonary illness, asthma and cardiovascular diseases after long-term exposure. Short-term exposure also creates problems like headache, mood alteration, dizziness, eye-irritation, nausea, coughing, etc. US Environmental Protection Agency (USEPA) has set up the National Ambient Air Quality Standards (NAAQS) for six pollutants, viz. particulate matter, carbon

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Primary Criteria Air Pollutants: Environmental Health Effects

3

Abstract

A polluted air is a harmful complex combination of primary and secondary pollutants in the atmosphere. The US Environmental Protection Agency (USEPA) listed the six most common air pollutants as criteria air pollutant under the Clean Air Act. The primary criteria air pollutants (CO, SO_2, NO_2, PM and Pb) are released into the atmosphere directly from their emission source. Due to their highly reactive nature, they get easily participated in a variety of reactions during atmospheric chemical transformation reactions. Due to the dry and wet deposition process, they may easily settle down onto ground/vegetation/ecosystems/water surfaces/building materials and show negative impact on their health/life/durability/beauty. The primary criteria air pollutants also produce adverse health effects to human being after their short-term/long-term exposure. Asthma, bronchitis, lung cancer and cardiopulmonary problems are the major noticed due to inhalation exposure of these pollutants. Mental disorder, kidney disorder and abortion are other harmful impacts. The WHO reported the level distribution and harmful effects of air pollutants several times in the past few decades. The direct and indirect effects of criteria air pollutants in changing climate are also discussed.

Keywords

Air pollution · Human health · Atmospheric processes · Impacts

3.1 Introduction

The Clean Air Act (CAA) of 1970 identified six common air pollutants of concern, called criteria air pollutants, viz. particulate matter, tropospheric ozone, carbon monoxide, nitrogen dioxide, sulphur dioxide and lead. The previous chapters of this book already discussed about the sources, level distributions, atmospheric chemistry and sinks of these criteria pollutants. As per the origin/emission, criteria

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Secondary Criteria Air Pollutants: Environmental Health Effects

4

Abstract

Air quality has become a serious concern in mostly urban areas and covering different parts of the world. Over the last few years, there have been tremendous studies reported so far related to harmful health effects due to bad air quality in urban areas across the globe. Among all air pollutants, criteria air pollutants are specifically highlighted for critically analysing about the environmental impacts in relation to plants species, materials, health, biosphere, etc. These air pollutants are in focus due to their toxicity, reactivities and the severity of their impacts. Among them very less information has been reported on secondary criteria air pollutant. Hence, the present chapter focuses on the nature and behaviour of secondary criteria air pollutants with respect to their impacts on environment. It will also highlight the mechanisms involved in examining their impacts, toxicity and overall assimilation plus fate of their chemical reactivities.

Keywords

Secondary criteria air pollutants · Health · Toxicity · Air quality and Biosphere

4.1 Introduction

Deleterious air quality is a main issue in both developed and developing countries. Rapid increase in motor vehicular emissions during peak traffic hours results in major air pollution episodes at selected hotspots (Nagpure et al. 2013; Mishra et al. 2015). The extreme air pollution episodes mostly occur during winter season, characterized by low winds, low mixing heights and temperature inversions (Nagpure et al. 2016; Martins et al. 2010). Many of the populous centres have large, major contribution by man-made pollutants in the atmosphere which is resulted into bad air quality not only at regional but at worldwide level. Among all the listed environmental issues, atmospheric pollution, and their impact on environmental health, is one of the most challenging issues (Chen et al. 2012). The impacts

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Policy Regulations and Future Recommendations

5

Abstract

Air quality has been worsened due to increase in urbanization and industrialization both nationally and internationally. This poor air quality has affected floral and faunal diversity severely. This will affect the whole ecosystem widely. The major factors including biomass burning, high vehicular emissions, increment in industrial emissions and increase in demand for energy are responsible for increase in air pollution. Therefore, both natural and anthropogenic activities are responsible for the alarming high concentrations of criteria air pollutants. Criteria air pollutants are hazardous categories of air pollutants under Clean Air Act, 1990, and urgent step has been needed by EPA to set permissible limits for them. Hence, it is an important agenda to control and mitigate these air pollutants which are affecting plants/vegetation, human health and other environmental concerns along with their sources. Hence, this chapter aims at various control strategies designed by national as well as international agencies to combat the deleterious concentrations of criteria air pollutants. Control strategies include various norms, implementation of clean air act policies, mitigation protocols and laws and legislations.

Keywords

Criteria air pollutants · Control policies · Clean Air Act · Air quality

5.1 Introduction

Air pollutants affect a quarter of the world's population, which resulted in a large scale from anthropogenic activities like biomass burning, industrialization and vehicular activities (WHO 2012). Air pollutants also damage buildings, crops, ecosystems and wildlife populations. Lack of control technologies and policies is responsible for worsening air quality and leads to increase in concentrations of air pollutants (Burney and Ramanathan 2014). The concentrations have increased and

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SWASTH BHARAT SAMRIDH BHARAT

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Abstract
'Swachh Bharat Abhiyan' or 'Swachh Bharat Campaign', is a 'Clean India' government run drive since 2014 to make the country clean and environment healthy. On the occasion of Mahatma Gandhi Jayanti, 2nd October 2014 our honourable Prime Minister Shri Narendra Modi launched this campaign . It is mailny aimed to make India not only clean but also "Open Defecation Free". The best part of this campaign is to make toilets available in all schools and colleges across the country.

Key Words: Swach, Swasth, Cleanliness, Enviornment.

Government of India launched Clean India campaign in the past as well themed as "Total Sanitation Campaign" which was later named as "Nirmal Bharat Abhiyan"(1999) by then prime minister Manmohan Singh. We witness dirt and unhygienic surroundings everywhere in the country but try to ignore and blame the system for it, as well as to the unavailability of infrastructure. PM Modi through this compaign urged the fellow citizens to participate in the cleaniliness of the country. He himself took centrestage and took the broom in hand to clean the road. A good marketing was undertaken by the government to broadcast and propagate this campaign. Through this compaign we hope that by 150th Jayanti of Mahatma Gandhi, 12 million toilets would be constructed in rural India. It has been a welcome move by the government and has been overwhelmingly supported by politicians, sports persons, celebrities,

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