



Research Article

PADDY CROP RESIDUE MANAGEMENT: AS A POTENTIAL SOURCE OF BIO-ETHANOL IN BARGARH, ODISHA

ANANYAA MOHANTY* AND V. SURESH BABU

North Eastern Regional Centre, National Institute of Rural Development & Panchayati Raj, Guwahati, 781028, Assam, India

*Corresponding Author: Email - anushreemohanty9994@gmail.com

Received: April 09, 2022; Revised: April 26, 2022; Accepted: April 27, 2022; Published: April 30, 2022

Abstract: Rice plays a significant role in the economy of Odisha farming community, covering 70 percent area under cereals. At present nearly 4mha of area is covered annually under this crop (3.7 m ha during *kharif* & 0.3 m ha during *Rabi*). About 2.5-3.0 tons per ha of dry rice straw is the average net production in Odisha (State Agriculture Plan of Odisha, 2014). This creates a huge canvas to use the rice straw in a more economically feasible way without hampering the environment. One of the key alternatives being its role as a feedstock in bioethanol production. But there are various factors that determine the management of paddy straw. The present study was conducted in Bhatli district of Bargarh, Odisha which is one of the highest producing areas of paddy. A total of 50 farmers were selected for the given study. Study was conducted to list out the amount of straw used for various purposes by the farmers. Also, awareness amongst the farmers about various alternative uses of paddy straw was assessed. It was revealed that none of the farmers were aware about the use of paddy straw as a feedstock for bioethanol production. Moreover, various problems encountered by the farmers in handling of paddy straw as ranked. Thus, the study revealed that management of paddy straw is determined by various socio-economic factors and thus these factors should be considered to devise a suitable regional model to put use of paddy straw in more suitable ways. Thus, to utilize paddy straw in an effective and ecological way there should be an integrated afford made by extension agent, farmers and farmers organizations in terms of changing Knowledge, Attitude and Practice (KAP).

Keywords: Feedstock, Paddy, Bio-ethanol, Extension, Kharif, KAP

Citation: Ananyaa Mohanty and V. Suresh Babu (2022) Paddy Crop Residue Management: As a potential source of Bio-ethanol in Bargarh, Odisha. International Journal of Agriculture Sciences, ISSN: 0975-3710 & E-ISSN: 0975-9107, Volume 14, Issue 4, pp.- 11278-11281.

Copyright: Copyright©2022 Ananyaa Mohanty and V. Suresh Babu, This is an open-access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution and reproduction in any medium, provided the original author and source are credited.

Academic Editor / Reviewer: S. M. Chavan, Dr M. Pandiyan, Dr Prashant Shrivastava, Navin Kumar Rajpal, Rajib Das, Dr R. S. Umakanth, Nisha Sharma

Introduction

India is an agro-ecological diverse country with a population of 1.27 billion in a geographical area of 328.7 million ha. It includes 200.2 and 139.4 m ha of gross cropped and net sown area, respectively [1]. The cultivation area is about 51% of total geographical area with an average cropping intensity of 136 %. India is the world's largest producer of milk, pulses and jute, and ranks as the second largest producer of rice, wheat, sugarcane, groundnut, vegetables, fruit and cotton. It is also one of the leading producers of spices, fish, poultry, and livestock and plantation crops. Agriculture, with its allied sectors, is the largest source of livelihoods in India.

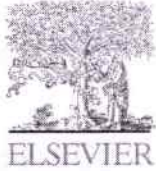
According to the Indian Ministry of New and Renewable Energy (MNRE), India generates on an average 500 million tons (Mt hereafter) of crop residue per year. The same report shows that a majority of this crop residue is in fact used as fodder, fuel for other domestic and industrial purposes. However, there is still a surplus of 140 Mt out of which 92 Mt is burned each year. It is also interesting to note that the portion burnt as agricultural waste in India, in volume, is much larger than the entire production of agricultural waste in other countries in the region.

Crop residues are materials left on cultivated land after the crop has been harvested. Retention of crop residues after harvesting is considered to be an effective anti-erosion measure. Crop residues can improve soil structure, cation exchange capacity, increase organic matter content in the soil facilitating transformation of primary and secondary plant nutrients and availability to plant, reduce soil erosion, improve water-holding capacity of the soil and reduce moisture evaporation, and help fix CO₂ in the soil. It incorporates a large number of nutrients in the soil for crop production and affects soil water movement, runoff and infiltration. Judicious crop residue management has a significant impact on the regulation of the soil microbial biomass. In a conservation agriculture system, successful management of crop residues is an integral part, and

the maximum benefit of conservation agriculture can only be achieved with in-situ management. However, decomposition of crop residues has both positive and negative impacts on crop production [2].

Good residue management practices on agricultural lands have many positive impacts on soil quality. Besides, crop residues can be used in biofuel production It is estimated that 500 mt of crop residues are generated annually. As per the available data cereals generate maximum residues of 352Mt, followed by fibres (66Mt) and pulses (18Mt). Amongst them rice residues comprise 34% of the total crop residues. Open field rice straw burning causes air pollution and GHGs emission (7300 kg CO₂-equivalent per hectare), soil nutrient and biodiversity losses and human health hazards. Huge amount (731 million tons (Mt)) of rice straw is produced globally in which India contributed around 126.6 MT, and 60% of them is burnt on the field. Once a wealth, the straw now became a waste subjected to burning due to technical, structural, institutional, and socioeconomic challenges [3].

Each year in late September and October, farmers from Punjab and Haryana in particular burn an estimated 35 million tons of crop residue from their paddy fields after harvesting. This practice serves as a low-cost method of getting rid of the straw and reduces the turnaround time between harvesting and sowing for the second (winter) crop. With labour being unavailable and the time window for preparing the field for wheat cultivation being limited, the options that the farmer has are either investing in expensive implements or burning the residues, the latter being an easy way out. [4]. It causes a reduction in the ambient air quality, as well as causes soil nutrient loss of organic carbon(3850 million kg), nitrogen (59 million kg), phosphorus (20 million kg), and potassium(34 million kg), and discharges large volumes of various air pollutants such as COX, CH₄,NOX, SOX, and particulate matters (PM10 and PM2.5) [5].



Contents lists available at ScienceDirect

Comparative Biochemistry and Physiology, Part C

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

Dehydration induced hypoxia and its role on mitochondrial respiratory enzymes and oxidative stress responses in liver of Asian stinging catfish *Heteropneustes fossilis*

Abhipsa Bal, Samar Gourav Pati, Falguni Panda, Biswaranjan Paital*

Redox Regulation Laboratory, Department of Zoology, College of Basic Science and Humanities, Odisha University of Agriculture and Technology, Bhubaneswar 751003, India

ARTICLE INFO

Keywords:

Antioxidants
Heteropneustes fossilis
 Cat fish, oxidative stress
 Reactive oxygen species
 Respiratory complex enzymes

ABSTRACT

In the present study, Water Deprived Condition (WPC, up to 18 h) induced hypoxia and altered oxidative stress (OS) physiology along with responses of respiratory chain enzyme in *Heteropneustes fossilis* are described. The body O₂ saturation level in the fish was declined with respect to air exposure. Higher levels of lipid peroxidation and protein carbonylation were recorded in the tissue of fish exposed to 6 h of WPC stress. The regulation of the mitochondrial complex and antioxidant enzymes, small antioxidant molecules indicated that the fish can moderately survive up to 6 h of air exposure. Probably with the onset of metabolic depression, it can critically resist the dehydration stress up to 18 h. Although the activities of glutathione peroxidase and reductase were elevated, activities of antioxidant enzymes such as superoxide dismutase and catalase were insufficient to combat WPC induced ROS and OS generated under hypoxia. The small antioxidant molecules played a key role in elimination of ROS. The elevated complex II activity was probably responsible for resisting the complex I, II and IV mediated electron leakage events in mitochondria of the fish under WPC. The total H₂O₂ removing capacity was less under WPC while the total units of all calculated antioxidants were alleviated signifying an interesting mechanism of WPC induced OS in the fish.

1. Introduction

The aquatic organisms are exposed to a variety of stress factors perennially, which involves both biotic and abiotic factors. Water quality and availability ensures a better survival prospect for the aquatic organisms as well as for humans (Karimi-Maleh et al., 2021). Despite 70% of the water cover on earth, several incidents of water scarcity especially less pure water availability have arisen and also the situation is predicted to be intensified in near future (Kulp and Strauss, 2019; Karimi-Maleh et al., 2021). Additionally, the global climate change and abnormality in annual rainfall have instated prolonged drought/dehydration conditions. Dehydration, de-oxygenation, oxygen level fluctuation, accelerated nutrient pollution leading to dead zones etc., deplete the optimum oxygen concentration in water bodies (Sokolova et al., 2019). Consequently, those adverse conditions provoke survival intimidation to aquatic species. The stress experienced by the species largely

influences its physiological pathways (Bal et al., 2021a; Choudhury and Saha, 2016). Nevertheless, the aquatic species also experience air exposure during commercialization purposes such as transport of species from farms to the markets, imports, exports etc. (Paital, 2013; Paital et al., 2016). Thus, in view of dehydration induced stress in aquatic organisms, assessing hypoxia and its toxic or abnormal biochemical effects such as Oxidative Stress (OS) has gained special attention.

Dehydration stress can undesirably affect the respiration rates and eventually, induces hypoxic conditions in aquatic organisms. Oxygen limitation can deregulate cellular respiration and subsequently may lead serious concerns in ATP generation in mitochondria (oxidative phosphorylation) (Hochachka, 1993). These oxygen limiting conditions further enhances the production of oxygen-derived free radicals, collectively known as Reactive Oxygen Species (ROS). In the process of internal respiration, oxygen is reduced to produce energy. Incomplete reduction of oxygen (1–5% of the total consumed oxygen under normal

Abbreviations: ROS, Reactive oxygen species; OS, Oxidative stress; TBARS, Thiobarbituric acid like reactive substances; PC, Protein carbonyls; SOD, Superoxide dismutase; CAT, Catalase; GPx, Glutathione peroxidase; GR, Glutathione reductase; LPO, Lipid peroxidation; SH, Non-protein sulfhydryl groups.

* Corresponding author.

E-mail address: biswaranjanpaital@gmail.com (B. Paital).

<https://doi.org/10.1016/j.cbpc.2022.109300>

Received 27 October 2021; Received in revised form 30 January 2022; Accepted 12 February 2022

Available online 17 February 2022

1532-0456/© 2022 Elsevier Inc. All rights reserved.

प्राचार्य, PRINCIPAL

 क्षेत्रीय शिक्षा संस्थान

 Regional Institute of Education

 Bhubaneswar-751022

COMPUTATION OF STRUCTURE AND ELECTRICAL RESISTIVITY OF LIQUID Na-Rb ALLOYS[†]

R.R. Koireng^{a,b,*}, P.C. Agarwal^c, Alpana Gokhroo^a

^aSamrat Prithviraj Chauhan Government College, Ajmer-305001, Rajasthan, India

^bNational Institute of Education (NCERT), New Delhi-110016, India

^cRegional Institute of Education (NCERT), Bhubaneswar-751022, Odisha, India

*Corresponding author: karenkrr@gmail.com

Received December 15, 2021; revised March 15, 2022; accepted March 16, 2022

The structure and electrical resistivity of $\text{Na}_{1-x}\text{Rb}_x$ binary alloys (where $x = 0, 0.1, 0.2, \dots, 1$) are computed using Percus-Yevick (PY) equation, hard-sphere model and Faber-Ziman formula respectively. The partial structure factors and total structure factor are computed using hard-sphere model for $\text{Na}_{1-x}\text{Rb}_x$. In the calculation of resistivity using Faber-Ziman formula, we have employed Ashcroft empty-core pseudo-potential and Hartree dielectric screening. Calculated values of resistivity are compared with the experimental results and other theoretical values reported in literature. It is found that the electrical resistivity calculated using Faber-Ziman formula for binary alloy $\text{Na}_{1-x}\text{Rb}_x$ is in good agreement with the values reported experimentally.

Keywords: Structure factor, electrical resistivity, pseudo-potential, dielectric screening, liquid metal

PACS: 61.20.Ne; 61.25.Mv; 72.15.Cz

The study of structural and electron transport properties of liquid metals have attracted many researchers [1-2]. The studies related to liquid structure have been a concern for condensed matter physics and material science. The knowledge of the structural information and electron transport properties of liquid alloys are essential for understanding the alloys. Recently, the applicability of alkali-liquid metal alloys (such as Na-Rb, Na-K) in developing futuristic electrochemical devices makes it inevitable to study the electronic and chemical properties of such alloys [3-7]. The electrical resistivity of liquid binary alkali alloys has been computed theoretically by pairing Faber-Ziman formula [8] with a suitable pseudo-potential [9-10]. Islam et.al [9] has computed the electrical resistivity of $\text{Na}_{1-x}\text{Rb}_x$ binary alloys using Faber-Ziman formula employing Bretonnet and Silbert (BS) pseudo-potential [10] with two different local field corrections viz. Ichimaru-Utsumi (IU) and Vashishta-Singhwi (VS). It is important that a suitable potential associated with electron-ion interaction is chosen for the computation of the electrical resistivity as the choice of electron-ion pair potential plays a crucial role in the study of electrical resistivity.

In this paper, we compute the partial structure factors of $\text{Na}_{1-x}\text{Rb}_x$ binary alloys (where $x=0, 0.1, 0.2, \dots, 1$) employing the solution of Percus-Yevick (PY) equation for a multi-component hard-sphere model given by Hoshino [11] and the electrical resistivity of $\text{Na}_{1-x}\text{Rb}_x$ binary alloy is computed using the method given by Faber-Ziman [8]. In the computation of electrical resistivity, we employ Ashcroft empty-core pseudo-potential [12] and the dielectric screening function due to Hartree [13-14]. The results obtained are compared with experimental results available in literature.

THEORY Resistivity

The electrical resistivity of a liquid metal binary alloy is given by Faber and Ziman [8] as

$$\rho = \frac{3\pi m^2 \Omega_0}{4Ze^2 h^3 k_f^3} \int_0^{2k_f} \{c_1 S_{11}(q) V_1(q)^2 + c_2 S_{22}(q) V_2(q)^2 + 2\sqrt{c_1 c_2} S_{12}(q) V_1(q) V_2(q)\} q^3 dq. \quad (1)$$

Here Z is the valence of the liquid alloy and $Z = c_1 Z_1 + c_2 Z_2$, where c_1 and c_2 are the concentration of elements, $\Omega_0 = c_1 \Omega_1 + c_2 \Omega_2$ is the atomic volume of the alloy system, $V(q)$ is the form factor, $S(q)$ is the structure factor and k_f is the Fermi wave vector define by $k_f = \left(\frac{3\pi^2 Z}{\Omega_0}\right)^{1/3}$.

For the computation of electrical resistivity, we have considered Ashcroft's empty core potential [12] given by

$$V(r) = \begin{cases} 0, & r \leq R_c \\ -\frac{ze^2}{r}, & r > R_c \end{cases} \quad (2)$$

where R_c is the core radius. The values of R_c for the constituent elements Na and Rb is taken from the values given in [12]. The form factor with dielectric screening effect is given by

[†] Cite as: R.R. Koireng, P.C. Agarwal, and A. Gokhroo, East. Eur. J. Phys. 1, 66 (2022), <https://doi.org/10.26565/2312-4334-2022-1-09>
©R.R. Koireng, P.C. Agarwal, A. Gokhroo, 2022



Hydrogen bonding structure and dynamics of *cis*- and *trans*- conformers of N-methylformamide in water, DMSO and water-DMSO mixtures at varying compositions



Apramita Chand, Pragin Chettiyankandy, Rajesh Ghosh, Chinmay Parida, Snehasis Chowdhuri*

School of Basic Sciences, Indian Institute of Technology, Bhubaneswar, India

ARTICLE INFO

Article history:

Received 29 August 2021
Revised 5 April 2022
Accepted 11 June 2022
Available online 15 June 2022

Keywords:

Cis/trans-N-Methylformamide
Water-DMSO
Self-diffusion coefficients
Orientational relaxation times
Hydrogen bond lifetime

ABSTRACT

The local hydrogen bonding structure and dynamics of *cis*- and *trans*- N-methylformamide (NMF) in water, DMSO and in water-DMSO mixture is investigated by classical molecular dynamics simulations. We have considered five different concentrations of NMF in water as well as in DMSO at 298 K. In the case of NMF ($X_{\text{NMF}} = 0.20$) in water-DMSO mixtures, we have considered six different concentrations, varying from NMF in pure water to DMSO. It is observed that the donating ability of amide-hydrogen of NMF to the oxygen of DMSO is higher compared to the oxygen of water. The variation of DMSO shows negligible effects on the $H_{\text{NMF}} \dots O_{\text{DMSO}}$ radial distribution function (RDF), whereas the $H_{\text{NMF}} \dots O_{\text{WAT}}$ decreases with the addition of water to the solution. In the case of NMF in water-DMSO mixtures, the addition of DMSO strengthens the $H_{\text{NMF}} \dots O_{\text{DMSO}}$ as well as $H_{\text{NMF}} \dots O_{\text{WAT}}$ correlation, but it differently affects for *cis*- and *trans*- NMF in the solution. DMSO prefers *cis*- conformer, whereas water prefers *trans*- NMF. In NMF-water-DMSO mixtures, the addition of DMSO strengthens $H_{\text{WAT}} \dots O_{\text{NMF}}$ up to intermediate DMSO concentration, but at very high DMSO concentration, it decreases due to preferable $H_{\text{NMF}} \dots O_{\text{DMSO}}$ interaction. The probability of hydrogen bonding between NMF-NMF is higher in NMF-DMSO solution compared to NMF-water. The dynamical slowdown is observed for all the species in water-NMF mixtures at intermediate concentration, whereas in the case of NMF-DMSO solution, faster dynamics are observed with the addition of DMSO. For NMF in water-DMSO mixtures, the dynamical slowdown is observed as DMSO is added to the NMF-water solution. Our calculated hydrogen-bond lifetime suggested that the DMSO forms a stronger hydrogen bond with *cis*-NMF whereas water generally prefers *trans*-NMF.

© 2022 Elsevier B.V. All rights reserved.

1. Introduction

The complete knowledge of the solvation structure of several biologically relevant molecules often hinges on the conformational preferences of these molecules in protic/aprotic environments. When the discussion involves for larger molecules such as proteins, several complexities arise on account of interference from different sites of the protein coupled with limitations of the techniques used. This hinders efficient de-convolution in experiments of *cis*- and *trans*- peptide bonds of a protein in solution. Usually, simple amides having both *cis/trans* conformers, like N-methylformamide, can be used to scrutinize the interactions of both the conformations of the peptide bond with their environment at a microscopic scale. The *cis* and *trans* isomers of NMF

are different not only in geometry, stability, force constants, normal vibrations but also have electronic state disparities [1–7]. The structure of NMF, though widely studied in the liquid, aqueous, and the gaseous phase through diverse experimental methods [8–10] as well as by theoretical calculations [11,12], has been a subject of intense debate in terms of the ordering patterns of *cis/trans* NMF molecules. These studies suggested a variation in linear chain patterns of *trans*-NMF [13] to a cyclic *cis*-NMF trimer which dominates in short-range order [14]. It is also proposed that isolated *cis*-NMF molecules may be interspersed amongst the self-associated *trans*-NMF polymeric formations [15]. A mixture of *cis* and *trans* conformers of liquid NMF (94% *trans*-NMF) was simulated by Skamoutsos and Samios [16], where hydrogen bonding preference and dynamics were discussed. These properties have also been probed at various thermodynamic conditions through several other theoretical and experimental studies [11,17–20]. Recently, we examined the effects of temperature and pressure

* Corresponding author.

E-mail address: snehasis@iitbbs.ac.in (S. Chowdhuri).

Self Attested
Apramita Chand
26/10/22

Pragin

प्रचार्य/PRINCIPAL
क्षेत्रीय शिक्षा संस्थान
Regional Institute of Education
भुवनेश्वर / Bhubaneswar-751022

Review

Influence of Anthropogenic Activities on Redox Regulation and Oxidative Stress Responses in Different Phyla of Animals in Coastal Water via Changes in Salinity

Abhipsa Bal ^{1,2}, Falguni Panda ^{1,3}, Samar Gourav Pati ^{1,3}, Taslima Nasim Anwar ¹, Kajari Das ⁴ and Biswaranjan Paital ^{1,*}

¹ Redox Regulation Laboratory, Department of Zoology, College of Basic Science and Humanities, Odisha University of Agriculture and Technology, Bhubaneswar 751003, India

² Zoology Section, Regional Institute of Education, Sachivalaya Marg, Bhubaneswar 751022, India

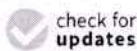
³ Department of Zoology, School of Life Sciences, Ravenshaw University, Cuttack 753003, India

⁴ Department of Biotechnology, College of Basic Science and Humanities, Odisha University of Agriculture and Technology, Bhubaneswar 751003, India

* Correspondence: biswaranjanpaital@gmail.com; Tel.: +91-674-2397029; Fax: +91-0674-2397970

Abstract: Salinity is a decisive abiotic factor that modulates the physiology of aquatic organisms. Salinity itself is modulated by various factors—most notably by anthropogenic factors. In coastal regions, increasing salinity is observed mostly due to the elevated rate of evaporation under high temperatures, especially under global warming. In addition, many other anthropogenic factors, climatic factors, chemicals, etc., also contribute to the changes in salinity in coastal water. Some of these include rainfall, regional warming, precipitation, moisture, thermohaline circulation, gaseous pollutants, dissolved chemicals, wind flow, and biocrusts. Salinity has been found to regulate the osmotic balance and, thus, can directly or indirectly influence the biomarkers of oxidative stress (OS) in aquatic organisms. Imbalances in OS potentially affect the growth, production, and reproduction of organisms; therefore, they are being studied in organisms of economic or aquacultural importance. Salinity-modulated OS and redox regulation as a function of phylum are covered in this review. The literature from 1960 to 2021 indicates that the altered OS physiology under changing salinity or in combination with other (anthropogenic) factors is species-specific, even within a particular phylum. Thus, knowing the response mechanisms of such organisms to salinity may be useful for the management of specific aquatic animals or their habitats.

Keywords: anthropogenic activities; aquatic animals; antioxidant enzymes; oxidative stress; phylum-specific; redox regulation; salinity stress



Citation: Bal, A.; Panda, F.; Pati, S.G.; Anwar, T.N.; Das, K.; Paital, B. Influence of Anthropogenic Activities on Redox Regulation and Oxidative Stress Responses in Different Phyla of Animals in Coastal Water via Changes in Salinity. *Water* **2022**, *14*, 4026. <https://doi.org/10.3390/w14244026>

Academic Editor: Dongmei Han

Received: 11 October 2022

Accepted: 7 December 2022

Published: 9 December 2022

Publisher's Note: MDPI stays neutral with regard to jurisdictional claims in published maps and institutional affiliations.



Copyright: © 2022 by the authors. Licensee MDPI, Basel, Switzerland. This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC BY) license (<https://creativecommons.org/licenses/by/4.0/>).

1. Introduction

Salinity is one of the most important abiotic factors and is known to impart substantial effects on the physiology of aquatic animals. The variation in habitats' salinity is influenced by many anthropogenic factors in coastal regions [1]. Increasing salinity in coastal and other water bodies is notably modulated by the rate of evaporation under high temperatures and/or global warming [2]. Many other anthropogenic-induced climatic factors, chemicals, ions, etc., also modulate the salinity of coastal water; for example, variations in rainfall, regional warming, precipitation rates, thermohaline circulation, biocrusts, and pollutant loads—including gases, various dissolved substances, and chemicals/ions such as sulfate, sulfuric acid, nitrate, nitric acid, Ca^{2+} , Mg^{2+} , SO_4^{2-} , HCO_3^- , Na^+ , and Cl^- . Exploring the source(s), mode(s), mechanism(s), and pattern(s) of the changing salinity in water bodies—especially in coastal belts—is always useful for maintenance of the habitat and management of the inhabitants. This is because the salinity of water significantly influences the physiology of its inhabitants [1–3]. Salinity is a major influential abiotic parameter in



Contents lists available at ScienceDirect

Children and Youth Services Review

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

Armed conflicts and girl child marriages: A global evidence

Risha Singh^{a,*}, Srinivas Goli^{b,c}, Abhra Singh^d^a Centre for the Study of Regional Development, School of Social Sciences, Jawaharlal Nehru University (JNU), New Delhi 110067, India^b Australia India Institute (AII) AIN Research Fellow, DWA Public Policy Institute, University of Western Australia (UWA), 35 Stirling Highway, Perth, WA 6009, Australia^c Population Studies, Centre for the Study of Regional Development, School of Social Sciences, Jawaharlal Nehru University (JNU), New Delhi 110067, India^d Department of Geography, Faculty of Natural Sciences, Jamia Millia Islamia (JMI), New Delhi 110025, India

ARTICLE INFO

Keywords:

Child marriage
Armed conflicts
Battle deaths
Developmental impacts
Gender-based violence

ABSTRACT

Armed conflicts have profound socio-economic and developmental impacts on populations, far beyond direct deaths and injuries. Women and girls more often bear the indirect consequences of conflicts. During conflicts, marriage has been used as a 'coping or protective mechanism' to save young girls from physical and sexual exploitation, and also for consumption smoothing to sustain the household economy in difficult times. Previous studies on the relationship between 'conflicts and girl child marriages' are mostly localised and qualitative. For the first time, we provide global level empirical evidence of the association between 'conflict events and girl child marriage rates' using robust macro-level econometric analysis of multi-country panel data. The study uses data from multiple sources: Uppsala Conflict Data Program, Demographic Health Surveys, Multiple Indicator Cluster Surveys and World Development Indicators for 217 countries for the period, 1989 to 2018. Our findings based on multiple econometric models demonstrate a consistent significant positive relationship between conflict events and girl child marriage rates. Our results showed an increase of 0.03 to 0.08 percent points in girl child marriage rates for each battle-related death per thousand. In conclusion, we advance that humanitarian actions in conflict settings must consider preventing child (or forced) marriages of girls, with pro-active policy priorities.

1. Introduction

Armed conflict is a development concern. The impacts of conflicts last far beyond direct killings and deaths. Besides loss of lives, conflicts inevitably create precarious socio-economic and political situations, leading to capital flight, forced migrations, and deepening of poverty, inequalities and insecurities. Indeed, the indirect impacts of conflicts hold much more reasons for concern and importance than the direct casualties. It is important to note that women and girls more often bear the indirect consequences of conflicts on their health and survival (Bendauid et al., 2021; Plimpen & Neumayer, 2006) compared to men who are predominantly killed directly during conflicts (Ornhaug et al., 2009). Further, women and girls experience increased risks of physical and sexual violence (Stark & Landis, 2016), along with increased impunity and underreporting of the violence during conflicts (United Nations General Assembly, 2017). Child marriage has been used as a coping or 'protective mechanism' in such situations to save the girl child (Myers et al., 2013).

United Nations Conventions and Resolutions consider child marriage

a fundamental violation of human rights (United Nations General Assembly, 2014). United Nations Human Rights Council Resolution in 2017, on child marriages in humanitarian settings, which includes situations of armed conflict, recognised child marriages as an "impediment not only to the economic, legal, health and social status of women and girls but also to the development of society as a whole" (p. 2). Further, the Sustainable development goals (SDGs) in 2015 placed eliminating the harmful practice of child marriage as one of the targets to achieve gender equality and empowerment by 2030 (United Nations Department of Economic and Social Affairs [UNDESA], 2021).

Despite the growing research on the adverse effects of child marriage on human capital accumulation, "most aspects of child marriage in conflict settings are significantly under-studied" (Mucunusi et al., p. 600). Further, most of the work on child marriages in conflict settings has been localised and often qualitative in nature. Though a contextual approach and qualitative narrative of the issue are important to understand the nuances and insights into the complex dynamics that drive the gender-based violence, quantitative empirical evidence is equally necessary for policy formulations and its monitoring and evaluations.

* Corresponding author.

E-mail address: rishasingh51@gmail.com (R. Singh).<https://doi.org/10.1016/j.childyouth.2022.106458>

Received 21 July 2022; Received in revised form 27 January 2022; Accepted 9 March 2022

Available online 14 March 2022

0190-7409/© 2022 Elsevier Ltd. All rights reserved.

Self attested
Abhra Singh

Principal
Regional Institute of Education
भुवनेश्वर / Bhubaneswar-751022



Computation of phonon dispersion curves and thermodynamic properties of Pd₈₀P₂₀ metallic glass

RR Koireng^{a,b,*}, PC Agarwal^c, Alpana Gokhroo^a

^aSamrat Prithviraj Chauhan Government College, Ajmer-305001, Rajasthan, India

^bNational Institute of Education (NCERT), New Delhi-110016, India

^cRegional Institute of Education (NCERT), Bhubaneswar-751022, Odisha, India

ARTICLE INFO

Article history:
Available online xxx

Keywords:
Metallic glass
Phonon frequency
Sound velocity
Dielectric screening

ABSTRACT

In this paper, the theoretical computation of phonon frequencies for Pd₈₀P₂₀ metallic glass is presented both for the longitudinal and transverse modes. For computing the phonon frequencies, we follow Bhatia and Singh approach. The elastic constants of the Pd₈₀P₂₀ metallic glass are used for determining the force constants for computing the phonon frequencies. The theoretically obtained phonon frequencies of Pd₈₀P₂₀ show relevant behaviour in the low momentum region for both the modes (longitudinal and transverse). Further, we have estimated transverse sound velocity from the computed phonon frequencies in the low momentum region. Similarly, in the low momentum region of the phonon frequency curves, we have computed longitudinal sound velocity and Debye temperature employing different types of dielectric screenings. The theoretical results obtained from the dispersion curves are in good agreement with the available data on Pd₈₀P₂₀ metallic glass.

© 2022 Elsevier Ltd. All rights reserved.

Selection and peer-review under responsibility of the scientific committee of the International Conference on Condensed Matter and Device Physics.

1. Introduction

Metallic glasses show promising engineering and technological applications for their unique mechanical and thermal properties [1–2]. Studies have reported that information regarding the phonon dynamics and configuration of metallic glasses at micro-structural level are crucial for understanding the mechanical and thermal properties [2–4]. The dispersion curves of metallic glasses are studied experimentally by neutron scattering technique [5–6]. Computer simulation and recursion techniques are widely used for studying phonon dispersion curves of metallic glasses theoretically [5–9]. Bhatia and Singh [3] has proposed a simple theoretical approach to compute the dispersion curves of metallic glasses, whereas other noteworthy theoretical approaches for computing dispersion curves of metallic glasses are due to Hubbard and Beeby [10] and Takeno and Goda [11]. In the recent past, many theoretical studies on phonon dispersion curves of metallic glasses have mainly followed these three approaches [7–12].

Recently, the importance of Pd-based alloys has been recognised from the application point of view. Some of the studies on the electrochemical behaviour of Pd-P alloys demonstrate a good

electrocatalytic performance and identifies as potential material for a cheaper alternative of electrocatalyst in the fuel cells [13–14]. Unfortunately, for a complex alloy such as Pd-P, there are very rare sources of experimental information on the structure of the Pd-P alloys and very few studies on the properties of the Pd-P alloys are available [13–15].

In this paper, we follow Bhatia and Singh method [3] to obtain the phonon frequencies of Pd₈₀P₂₀ for both the modes (longitudinal and transverse). As suggested in Bhatia and Singh method [3], for obtaining the phonon frequencies, we use the calculated value of the force constant κ_e and then fixed the other force constants (δ and β) using κ_e along with bulk (B) and shear (G) modulus of the Pd₈₀P₂₀ metallic glass. Further, we have also considered the effect of different dielectric screening functions [8–9] on the longitudinal dispersion curves of Pd₈₀P₂₀. The values of sound velocity for longitudinal (V_L) and transverse (V_T) are estimated along with corresponding Debye temperature (θ_D) in the low momentum region of the phonon frequency curves.

2. Theory

The expressions for phonon frequencies viz. longitudinal (ω_L) and transverse (ω_T) modes according to Bhatia and Singh are given as [3].

* Corresponding author.

E-mail address: karenkr@gmail.com (RR Koireng).

<https://doi.org/10.1016/j.matpr.2022.07.321>

2214-7853/© 2022 Elsevier Ltd. All rights reserved.

Selection and peer-review under responsibility of the scientific committee of the International Conference on Condensed Matter and Device Physics.



Synthesis of nanosized Sm and Co oxides by liquid–liquid extraction scheme and investigation into separation chemistry employing tri-alkyl phosphine oxide as an extractant

Nilam Swain¹ · Sujata Mishra¹

Received: 14 May 2021 / Accepted: 2 October 2021 / Published online: 11 October 2021
© Institute of Chemistry, Slovak Academy of Sciences 2021

Abstract

Rare earth and transition metal-based permanent magnets are the “jewels of smart and emerging technologies”. Due to the increase in their demand in the industrial market, these metals will be at supply risk in near future. Spent Sm-Co magnets are the potential sources of Sm and Co, and recycling of these magnets is an alternative goal to sustain their resources. This present extraction investigation has been designed with an aim to avoid the use of high concentration of acids to reduce pollution and also to maintain sustainability. The solvent extraction process is executed with an organic solvent tri-alkyl phosphine oxide. This extractant has pronounced selectivity towards samarium resulting in complete separation of Sm/Co. By using 0.1 mol/L TAPO, Sm³⁺ was selectively extracted from the mother liquor containing Co²⁺, 3 mol/L NaNO₃ at pH 3 and 1:1 organic-to-aqueous phase volume ratio. The extraction equilibrium was spontaneous and adversely affected by temperature. Cent per cent recovery of samarium was achieved with 0.2 mol/L HCl. From the stripped liquor, samarium oxide was recovered and cobalt oxide was reclaimed from the raffinate. With an increase in calcination time, the crystalline size of Sm₂O₃ and Co₃O₄ becomes finer. Regeneration studies revealed that tri-alkyl phosphine oxide could be reused for several cycles with an insignificant change in the extraction efficiency.

Keywords TAPO · Separation · Sm · Co · Simulated waste

Introduction

Rare earth and transition metal-based permanent magnets are known as the “armory of infrastructure networks” in developed and developing countries due to their vast applications including electric motors in automobiles, computer peripherals, magneto-electronic, electromechanical devices, storage devices, etc. (Sellmyer and Skomski 2008). The permanent magnets like Nd-Fe-B, Sm-Co and Sm-Fe-N featuring excellent magnetic performance embarked into the market of renewable energy technologies and are receiving growing attention in producing infrastructures which would meet the sustainable and green objectives (Chen et al. 2015). The 4f-electrons of rare earth metal ions are shielded by

the electrons of 5 s and 5p subshell, which protect them from interacting with their environment. As a consequence, the electronic properties of the rare earth metal complexes remain unaffected by the neighbouring environment and show supreme magnetic behaviour (Zucchi and Goff 2012). The interaction between the partially filled 3d-orbitals of transition metals and 4f-orbitals of rare earths offers them high intrinsic coercivity (H_c) and thus exhibit outstanding magnetic properties at elevated temperature (Dent 2012).

The demand for permanent magnets in the period 2005–2010 was found to increase proportionately with a compound rate of 9% per annum as reported by IMARC (International Market Analysis Research and Consulting). In 2013, their consumption was accounted as above 106,100 metric tons with an approximated cost of 11 billion dollars (IMARC 2014). By 2020, the global demand of these magnets was prognosticated as 5,400 metric tons for Sm-Co magnets and 137,200 metric tons for Nd-Fe-B magnets (Kumar 2016). Though the current share of Sm-Co magnets is only 2% as compared to Nd-Fe-B magnets, their excellent performance at high temperature makes them superior

✉ Sujata Mishra
drsujatamishra97@gmail.com; sujatamishra@soa.ac.in

¹ Department of Chemistry, Institute of Technical Education and Research (FET), Siksha 'O' Anusandhan Deemed To Be University, Khandagiri Square, Bhubaneswar, Odessa 751030, India

Nilam Swain
Relational
Sharma/Sharma

Quadrature Rules for Approximate Evaluation of Cauchy Type Integrals With Periodic Weight Functions

^aArup Kumar Saha, ^bManoj Kumar Hota and ^cPrasanta Kumar Mohanty

^aDepartment of Education in Science and Mathematics

Regional Institute of Education (NCERT), Bhubaneswar, Odisha, India

^b Department of Mathematics, Nayagarh Autonomous College, Nayagarh, Odisha, India

^cDepartment of Mathematics, School of Applied Sciences

KIIT Deemed to be University, Bhubaneswar, Odisha, India

Abstract

The numerical scheme for specific oscillatory integrals of the Cauchy type is presented in this study. The quadrature rules for the Cauchy type non-oscillatory integral $\int_{-1}^1 \frac{u(x)}{x} dx$, where $u(x)$ is analytic in $[-1, 1]$, cubic spline interpolation and the well known Simpson's $(1/3)^{rd}$ rule are used to build the scheme. Further, a quasi-exact method for the evaluation of the oscillatory integral is proposed and considered as a frame of reference to measure the relative accuracy. Error bound is given and the scheme is verified with the help of some numerical experiments.

Keywords: *Cauchy principal value integral; spline interpolation; quasi-exact method, analytic function.*

AMS 2010 Classification: 65D30, 65D32

1 Introduction

The Cauchy principal value integral of either kind

$$\mathfrak{J}(u) = P \int_{-1}^1 \frac{u(x)}{x} dx; \quad (1.1)$$

and

$$\mathfrak{J}(u; \omega) = P \int_{-1}^1 \frac{u(x)}{x} e^{i\omega x} dx; \quad (1.2)$$

where $u(x)$ is analytic in $[-1, 1]$ frequently appears in mathematical physics in a natural way and as such they play important role in various fields of science and engineering. If u meets the Holder's condition in $[-1, 1]$, then these two improper integrals exist. However, the classical quadrature rules intended for the numerical approximations of integrals of the type (1.1), diverge significantly with increasing values of $|\omega|$ due to the oscillation of the integrand function of the integral (1.2), which

Prasanta

Arup
 REGIONAL PRINCIPAL
 क्षेत्रीय शिक्षा संस्थान
 Regional Institute of Education
 Bhubaneswar / Bhubaneswar-751022



Non-Classical Quadrature Schemes for the Approximation of Cauchy Type Oscillatory and Singular Integrals in Complex Plane

Saha, A. K.^{*1}, Hota, M. K.², and Mohanty, P. K.³

¹Department of Education in Science and Mathematics, Regional Institute of Education (NCERT), India

²Department of Mathematics, Nayagarh Autonomous College, India

³Department of Mathematics, School of Applied Sciences, KIIT Deemed to be University, India

E-mail: saha.ganit@gmail.com

*Corresponding author



Received: 23 June 2021

Accepted: 19 September 2021

Abstract

In this paper, non-classical numerical schemes are proposed for the approximation of Cauchy type oscillatory and strongly singular integrals in complex plane. The schemes are developed by incorporating classical quadrature rule meant for the Cauchy type complex singular integrals over a line segment in complex plane with a quasi exact quadrature method meant for the numerical integration of complex definite integrals with an oscillatory weight function. The error bounds are established and the schemes are numerically validated using a set of standard test integrals. Numerical results show that these schemes are efficient.

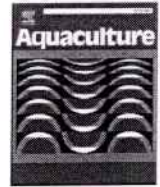
Keywords: analytic function; asymptotic error estimate; Cauchy principal value; error bound; Hardamad finite part integral.



प्रचार्य/ PRINCIPAL
क्षेत्रीय शिक्षा संस्थान
Regional Institute of Education
भुवनेश्वर/ Bhubaneswar-751022



Contents lists available at ScienceDirect

Aquaculture

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

Low salinity induced challenges in the hardy fish *Heteropneustes fossilis*; future prospective of aquaculture in near coastal zones

Abhipsa Bal^a, Samar Gourav Pati^a, Falguni Panda^a, Leema Mohanty^b, Biswaranjan Paital^{a,*}

^a Redox Regulation Laboratory, Department of Zoology, College of Basic Science and Humanities, Odisha University of Agriculture and Technology, Bhubaneswar 751003, India

^b Department of Pathology, College of Veterinary Sciences and Animal Husbandry, Odisha University of Agriculture and Technology, Bhubaneswar 751003, India

ARTICLE INFO

Keywords:

Coastal abiding zone aquaculture
Global climate change
Groundwater salinity
Growth
Heteropneustes fossilis
Sea water level rise

ABSTRACT

The groundwater in coastal and abiding zones is experiencing alarmingly growing levels of salinity that might be small in absolute terms. Several reasons may contribute for retrogression of groundwater quality and the most concerning issue is they can critically distress the inhabitants. This notion encouraged us to comprehensively investigate the salinity tolerance range and effects of sub-lethal salinity on various attributes such as the growth pattern (morphometric and feed intake), haematology, histo-architecture and generation of oxidative stress in different tissues of *Heteropneustes fossilis*, a coastal zone hardy fish that has high market demand. The fish were exposed to sub-lethal salinity i.e. 3, 6 and 9 ppt for 45 days against a control set (tap water, ~0 ppt) under constantly monitored pH, temperature, dissolved oxygen and alkalinity. The fish can tolerate a narrow salinity range although correlation and discriminant function analyses among the computed parameters indicate that sub-lethal low salinity strongly modulates the fish physiology. Decline in the body weight, feed intake, specific growth rate and changes in morphometry coupled with histological alterations in different tissues were observed with the increase in level of sub-lethal salinity. The significant alterations in the measured parameters substantiated an overall decline in growth of the fish at 9 ppt. Significant loss in haemoglobin content, RBC and eosinophil counts accompanied by a rise in neutrophil count was also observed at higher salinities. The lipid peroxide level under higher salinities was comparatively higher than the control. Disruption in the typical histo-architecture in its muscle, gill and liver tissues was observed at higher salinities, possibly due to the generation of oxidative stress and/or osmotic imbalances in the respective tissues. In conclusion, the *H. fossilis* can satisfactorily grow in low salinities up to 6 ppt and critically beyond the range till 9 ppt. Therefore, the study of compromised physiology due to the toxic effects of altered salinity under changing climatic conditions and anthropogenic activities in the inhabitants especially in lower vertebrate hardy fish models is a major concern in aquaculture prospect. The development of this study on the transcriptional and translational level could provide access to unsolved problems related to aquaculture. Further it also suggests that a) it is indispensable to maintain optimal freshwater quality in coastal and allied zone globally in coming decades, b) introduction of saline tolerant hardy fish species and development of appropriate aquaculture practices based upon the altered physiology in the concerned regions.

1. Introduction

Aquaculture is one of the important industrial sectors that serve as the connecting link between the people, environment and the life under

water (Bal et al., 2021a). The economies of the countries which possess long coastlines depend on the revenues collected from this sector to a larger extent (Prakash et al., 2020). Moreover, it also contributes as rich source of proteinaceous food, support system for livelihoods of

Abbreviations: DFA, Discriminant function analysis; HAI, Histological Alteration Index; LC-50, 50% Lethal Concentration; LPx, Lipid Peroxide; OS, Oxidative stress; OSP, Oxidative Stress Parameters; ppt, parts per thousand; RBC, Red Blood Cell; ROS, Reactive Oxygen Species; SCCV, Standardized Coefficient for Canonical Variables; SGR, Specific Growth Rate; FCR, Feed Conversion Ratio; TBARS, Thiobarbituric Acid Reactive Substances.

* Corresponding author at: Redox Regulation Laboratory, Department of Zoology, Odisha University of Agriculture and Technology, College of Basic Science and Humanities, Bhubaneswar 751003, India.

E-mail address: biswaranjanpaital@gmail.com (B. Paital).

<https://doi.org/10.1016/j.aquaculture.2021.737007>

Received 12 January 2021; Received in revised form 28 May 2021; Accepted 30 May 2021

Available online 1 June 2021

0044-8486/© 2021 Elsevier B.V. All rights reserved.


 प्राचार्य/Principal
 क्षेत्रीय शिक्षा विभाग
 Regional Institute of Education
 भुवनेश्वर / Bhubaneswar-751022


 Abhipsa Bal



Modification of the time of incubation in colorimetric method for accurate determination of the total antioxidants capacity using 2,2-diphenyl-1-picrylhydrazyl stable free radical

Abhipsa Bal, Samar Gourav Pati, Falguni Panda, Biswaranjan Paital*

Redox Regulation Laboratory, Department of Zoology, College of Basic Science and Humanities, Odisha University of Agriculture and Technology, Bhubaneswar, Odisha, India.

ARTICLE INFO

Article history:
Received on: January 25, 2021
Accepted on: March 04, 2021
Available online: July 10, 2021

Key words:
2,2-diphenyl-1-picrylhydrazyl radical oxidation,
Heteropneustes fossilis,
Radical scavenging activity,
Time of incubation,
Total antioxidant capacity

ABSTRACT

2,2-diphenyl-1-picrylhydrazyl (DPPH)-based spectrophotometric detection of total antioxidant capacity (TAC) in samples is a common method. However, controversy exists for applying multiple absorption maximum wavelength and final concentration of DPPH used in the reaction mixture to measure TAC in terms of % of inhibition of DPPH (PID). Further, inconsistent spectrophotometric absorption values obtained during the incubation of sample with DPPH are also another drawback of this method. We tried to fix above issues by estimating the TAC in the tissue homogenate of *Heteropneustes fossilis*. Ascorbic acid was used as standard antioxidant in this study, and depending on tissues, the time of incubation of tissue extracts with DPPH (1.35 μM optimum concentration) to obtain optimal consistent result was found to be 20–30 min. The absorption maximum of DPPH was found to be 516 nm as compared to the used wavelength ranging from 515 to 546 nm. The order of TAC in tissues of the fish was muscle (76% PID, 20–60 min incubation), gill (71% PID, 30 min incubation), and liver (49.9% PID, 30 min incubation). This report suggests that the incubation time of tissue extracts with DPPH is important and needs to be determined accurately to get consistent results.

1. INTRODUCTION

The major cytotoxic by-products in organisms during the oxidative metabolism are the free radicals. The reactive oxygen species (ROS) such as superoxide radical, hydroxyl ion radical, and hydrogen peroxide are some of the examples of the oxidants or free radicals produced in cells. They have deleterious effects as they oxidize all biomolecules present in their vicinity and cause oxidative stress (OS). In general, ROS oxidize lipids, proteins, and nucleic acids to lipid peroxides, protein carbonyls, and nucleic acid adduct, respectively. When the levels of the above compounds are elevated, it leads to cellular disturbances under OS condition. Elevated OS leads to tissue damage, protein misfolding, diseases susceptibility, and aging [1]. As a result of oxidation of the above biomolecules, the reduced efficiency of enzymatic and other functions of proteins, loss of membrane fluidity, unwanted modulation in gene expression, and complete or partial arrest in several anabolic processes occur in cells [2]. To counteract OS, antioxidants can donate an electron to ROS to make them chemically stable and inert. Antioxidants may be enzymatic

(superoxide dismutase, catalase, glutathione peroxidase, etc.) or non-enzymatic (Vitamins C and A, flavonoids, carotene, etc.) in nature [1]. Thus, the activities of the antioxidants along with OS parameters serve as biomarkers of OS physiology.

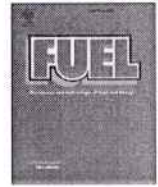
The total free radicals or the ROS scavenging activity by the antioxidant defense system are considered as a measure of the total antioxidant capacity (TAC) of tissues. Various analytical methods are employed to estimate the TAC potency and are classified into two categories: (i) Hydrogen atom transfer-based assays and (ii) single electron transfer-based assays [Table 1]. [3-7] In addition to the above assays, fluorimetric, electrochemical techniques, and chromatography techniques are also employed to estimate the TAC level. Molecules or probes such as 2', 7'-dichlorodihydrofluorescein diacetate, 1, 3-diphenylisobenzofuran, and dihydroethidium are used to estimate total ROS scavenging activity or TAC in cells [8]. However, the simplest, economic, and rapid result providing method among above is the 2,2-diphenyl-1-picrylhydrazyl (DPPH, C₁₈H₁₂N₅O₆, 394.33 g mol⁻¹) scavenging assay which was first developed by Blois in 1958. To determine the TAC, the stable free radical DPPH is used. Its paramagnetic structure enables it to accept an unpaired electron or a free radical to become a stable diamagnetic structure. DPPH shows a strong absorption band at 517 nm due to its odd electron and the solution in alcohol appears a deep violet color but the absorption vanishes as the electron pairs off. The resulting decolorization is stoichiometric based on the number of electrons taken

*Corresponding Author:
Biswaranjan Paital, Redox Regulation Laboratory, Department of Zoology,
College of Basic Science and Humanities, Odisha University of Agriculture
and Technology, Bhubaneswar, Odisha, India.
E-mail: biswaranjanpaital@gmail.com

Regional Institute of Education
Bhubaneswar-751022
(Handwritten signatures and stamps)



ELSEVIER



Facile integration of core-shell catalyst and Pd-Ag membrane for hydrogen production from low-temperature dry reforming of methane

Subhasis Pati^{a,b}, Sonali Das^a, Nikita Dewangan^a, Ashok Jangam^a, Sibudjing Kawi^{a,*}

^a Department of Chemical and Bio-Molecular Engineering, National University of Singapore, Engineering Drive-4, Singapore 117585, Singapore

^b Dept. of Chemistry, Regional Institute of Education, NCERT, Bhubaneswar, Odisha 751024, India

ARTICLE INFO

Keywords:

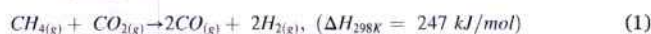
Pd-Ag membrane
DRM reaction
RWGS suppression
GCMS analysis
Core shell catalyst

ABSTRACT

Dry reforming of methane (DRM) is an important way of conversion of CH₄ and CO₂, two greenhouse gases, for the production of hydrogen. In this study, a catalytic membrane reactor combining an ultra-thin Pd-Ag alloy membrane with a coke-resistant Ni-SiO₂@CeO₂ core-shell catalyst was developed for high yield hydrogen production from DRM. The performance of membrane in the presence of gases such as CO, CO₂ and CH₄ was evaluated, and very little reduction in H₂ flux (~2.5 %) was observed in the presence of these gases at the relevant reaction conditions. The catalyst was tested for DRM reaction in both fixed bed reactor (FBR) and catalytic membrane reactor (CMR) to evaluate its performance at different reaction conditions. In a catalytic membrane reactor, the removal of hydrogen resulted in 1.5 times higher methane conversion compared to the calculated conversion at thermodynamic equilibrium at the used reaction conditions when hydrogen is not removed from the reaction mixture. Around 70 % of the produced H₂ was recovered from the reaction stream, by virtue of the high H₂ flux through the ultra-thin Pd-Ag membrane. Further, the competing reverse water gas shift reaction, that consumes the produced H₂, was drastically suppressed by using membrane reactor. The suppression of reverse water gas shift reaction (RWGS) in CMR was confirmed by analyzing downstream gases using gas chromatography mass spectrometer, the result showed significantly lower H₂O content for CMR than FBR. Thus, the coupling of ultra-thin membrane with a core shell catalyst synergistically improved the performance of the dry reforming of methane.

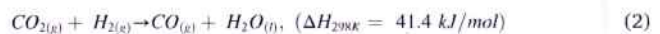
1. Introduction

Incessant increase in green-house gas emissions from the use of fossil fuels has a detrimental effect on global climatic conditions and is creating a threat to the human civilization. This has encouraged the contemporary scientific community to investigate alternate solutions for CO₂ utilization and the production of hydrogen as an alternate fuel [1,2]. Dry reforming of methane (Eq. (1)) is one potential and significant pathway of converting CO₂ and CH₄ – two greenhouse gases – to produce hydrogen [3].



Potential applications of H₂ produced from this reaction include its use in fuel cells to provide power with low greenhouse gas emissions. High purity hydrogen is necessary for such applications, and this necessitates downstream separation of high-purity H₂ from the DRM product. High purity H₂ can be produced in a single step process by

conducting DRM in a catalytic membrane reactor. The integration of chemical reaction and separation in a catalytic membrane reactor can have a synergetic effect on the overall performance [4,5]. For example, the simultaneous removal of the produced hydrogen from the reaction mixture may facilitate the operation of DRM at low temperatures. DRM is an endothermic reaction and is thermodynamically favorable at high temperatures. Hence, low temperature operation of DRM is unattractive because of limited reactant conversion dictated by the thermodynamic equilibrium. At the same time, competing side reactions such as reverse water gas shift reaction (Eq. (2)) consume part of the produced H₂, thereby decreasing the overall H₂ yield from the reactor [1,6].



The extraction and removal H₂ from the reaction mixture by the membrane in a CMR can help to bypass the equilibrium limitation on reactant conversion in DRM, because it can favor the forward DRM reaction as per Le Chatelier's principle. Therefore, higher conversions may

* Corresponding author.

E-mail address: chekawis@nus.edu.sg (S. Kawi).

<https://doi.org/10.1016/j.fuel.2022.126433>

Received 25 August 2022; Received in revised form 7 October 2022; Accepted 18 October 2022

Available online 3 November 2022

0016-2361/© 2022 Elsevier Ltd. All rights reserved.

2021 Af. S. K. Dash

PACS: 71.20. Rv, 73.20.-r, 72.80.-r

INVESTIGATION ON ELECTRICAL PROPERTIES OF SOLID POLYMER SHEETS (HDPE AND LDPE) AT AUDIO FREQUENCY RANGE

Sarat K. Dash^{a,*}, Hari S. Mohanty^b, Biswajit Dalai^{b,†}

^aDepartment of Physics, Regional Institute of Education (NCERT), Bhubaneswar, Odisha, 751022, India

^bDepartment of Physics, School of Sciences, GIET University, Gunupur 765022, Odisha, India

*Corresponding author: skdash59@yahoo.com, †biswajit@giet.edu

Received February 15, 2021; revised March 31, 2021; accepted April 12, 2021

Two different groups of solid polymer sheets: low density polyethylene (LDPE) sample of thickness 0.006 cm and 0.007 cm along with high density polyethylene (HDPE) sample of the thickness of 0.009 cm, 0.010 cm were taken in this work. The measurement of electrical properties such as dielectric constant, ϵ' and dielectric loss, ϵ'' for LDPE and HDPE polymer sheets have been measured using a dielectric cell. The dielectric cell has been fabricated which consists of two circular parallel plates of pure stainless steel each of 5 cm diameter and 2 mm thickness. An impedance bridge (GRA 650A) was used for measurement of capacitance, C , and dissipation factor, D in the audio frequency (AF) range, 100 Hz to 10 kHz. Different samples were loaded in between the two plates of the cell and the capacitance as well as the dissipation factor were estimated from the dial readings of the bridge. Effect of frequency variation on ϵ' , ϵ'' , relaxation time, τ , dissipation factor, $\tan \delta$ and ac conductivity, σ were also discussed at audio frequency range. The complex permittivity, ϵ^* , related to free dipole oscillating in an alternating field and loss tangent, $\tan \delta$ were calculated. The frequency-dependent conductivity, dielectric behavior, and electrical modulus, both real (M') and imaginary (M'') parts of LDPE and HDPE have been studied in this work. The values of the real part of the electrical modulus (M') did not equal to zero at low frequencies and it is expected that the electrode polarization may develop in both sheets. These findings reveal an increased coupling among the local dipolar motions in a short-range order localized motion. The analysis of real (ϵ') and imaginary (ϵ'') parts of dielectric permittivity and that electrical modulus real (M') and imaginary (M'') parts signify poly dispersive nature of relaxation time as observed in Cole-Cole plots.

KEY WORDS: LDPE, HDPE, dielectric constant, dielectric loss, AC conductivity

In continuation of our earlier analysis on characterization and dielectric properties of barium zirconium titanate prepared by solid state reaction and high energy ball milling processes [1], the electrical properties of solid polymer sheet have been studied in this work which enable the industry to elicit the characteristic information as regards to its use as insulator having high dielectric breakdown strength, low dielectric loss and the ability to be easily processed and also recycled when cross linked [2, 3]. The measurement of dielectric constant is recognized as one of the important tool for understanding the molecular behavior of associating molecules [4]. Gradual evolution of dielectric theories based on such measurements has helped in this study further. The physico-chemical behavior of macromolecules could be ascertained from the study of the frequency and temperature variation of relative permittivity ϵ' and dielectric loss ϵ'' [5, 6]. Surface composition of the polymers primarily influences many industrial applications such as wetting, weathering, permeation friction, electrostatic charging and dye adsorption [7]. However, lack of precise information regarding functional groups and the surface region-a problem having no counterpart in polymer science, is an important impediment in this sphere. High density polyethylene (HDPE) and low density polyethylene (LDPE) are low cost, high tensile strength and percent elongation, has penetrated into the markets like stretching film, merchandizing bags and also non-packing application like industrial sheeting and agricultural film [8, 9]. Attempt are being made to determine the size of surface micro-cracks of irradiated polythene terephthalate (PET) with X-Rays and nonmonotonous dependence of dissociation rate of polymer on alkali solution [10]. The physico-chemical properties of LDPE with wood fiber, induced by ion-bombardment are being extensively studied [11, 12]. The physical and chemical nature of the macromolecules and the molecular mobility of the sub-molecules can be deduced from the study of the variation of dielectric constant as well as dielectric loss with temperature and frequency and the position of the loss peak [13].

The dielectric properties of solid polyethylene have been investigated in audio frequency (AF) range because of large size of the molecules. In the present report, an attempt has been made to determine the values of dielectric constant (ϵ') and dielectric loss (ϵ'') of the solid polymers such as high density polyethylene (HDPE) and low density polyethylene (LDPE) by using an impedance bridge over a frequency range of 100 Hz to 10 kHz at 303.16 K. The cost of the design is relatively less compared to any other versatile system and can be inducted as standard experiment at an appropriate level.

THEORY

The most generally used methods for measuring dielectric constant (ϵ') and loss (ϵ'') consists of the measurement of the capacitance of an empty capacitor and the capacitance of the capacitor filled with the dielectric material. The capacitance C of a capacitor is defined as the ratio of the charge on its plates to the potential difference between them. For a parallel plate capacitor, the capacitance C can be calculated from the geometry of the system [14]

© S. K. Dash, H. S. Mohanty, B. Dalai, 2021

प्राचार्य/ PRINCIPAL
क्षेत्रीय शिक्षा संस्थान
Regional Institute of Education
भुवनेश्वर / Bhubaneswar-751022

Agard

Dash
21.04.23



Heavy metal and organic load in Haripur creek of Gopalpur along the Bay of Bengal, east coast of India

Sasmita Rath¹ · Abhipsa Bal² · Biswaranjan Paital²

Received: 9 April 2020 / Accepted: 18 January 2021

© The Author(s), under exclusive licence to Springer-Verlag GmbH, DE part of Springer Nature 2021

Abstract

Accumulation of heavy metals in zooplanktons is used as an essential tool for the evaluation of health of an ecosystem. Such data are used to set further monitoring strategies especially in (coastal) water bodies. In the present study, seasonal bioaccumulation of heavy metals such as Cu, Zn, Pb, Cd and Hg, organic loads such as nitrite and phosphate, contents loads and physicochemical parameters in Haripur creek along the Bay of Bengal in east coast of India is measured in zooplanktons. Coastal organisms are considered an integral part of marine ecosystems and their frequent massive die-off events along the coast of the Bay of Bengal are correlated with the obtained pollutant data. The levels of heavy metals were also correlated with several extrinsic environmental factors such as water transparency, dissolved oxygen, salinity, pH and temperature. Discriminant function analyses and standardised coefficients for canonical variables for the obtained data indicate that the studied environmental factors and organic loads varied as a function of season. Bioaccumulation of the studied heavy metals in zooplanktons was seasonal and infrequently noticed above the standard limit. The computed bioaccumulation factor of the five metals showed that accumulation of Zn was higher in zooplanktons as compared to that of the other studied metals. So, the entry of heavy metals through the food chains or via direct exposure (to organic loads also) to the other inhabiting organisms including fish may be assumed. This could be one of the possible reasons for the observed frequent (fish) die-off events at Gopalpur Coast along the Bay of Bengal and may be considered a clue for future investigations.

Keywords Phytoplankton · Bay of Bengal · Bioaccumulation · Environmental monitoring · Heavy metals · Organic load · Frequent die-off event

Introduction

Heavy metal and organic load in aquatic environments are intricately associated with several cellular metabolic and regulatory processes in the inhabiting animals (Morcillo et al. 2015, 2016; Gupta et al. 2016; Samanta and Paital 2016). Recorded heavy metals such as As, Cd, Hg, Pb, Cu, Zn and Se and their deleterious effects in tissues of commercial fish from central Adriatic Sea, Italy (Perugini et al. 2014),

scleractinian coral tissues in Bocas del Toro Archipelago, Panama (Berry et al. 2013), macrophytes in River Nile (Fawzy et al. 2012), different fish such as *Dicentrarchus labrax*, *Sparus aurata* and *Mugil cephalus* in the Çamlık Lagoon of the Eastern Coast of Mediterranean, Turkey (Dural et al. 2006) and in the planktons in Singapore coastal marine inlets (Calbet et al. 2016) are few of the examples. Accumulation of the organic herbicide Primextra Gold TZ in planktons (Filimonova et al. 2016; Ciszewski et al. 2013) noticed the deleterious effects of Zn in aquatic organisms. Owing to the importance of environmental protection, metal pollution in marine environments is considered a serious threat over the past few years (see reports: GESAMP 1991; 2001; 2009).

Specific studies in the last two decades indicate that heavy metal accumulation in aquatic environments is frequently observed (Morselli et al. 2003; Tabari et al. 2010; Bashir et al. 2013; Zhuang and Gao 2014; Paital et al. 2015; Paital 2016; Paital and Rivera-Ingraham 2016; Lueder et al. 2020). The

Responsible Editor: V. V.S.S. Sarma

✉ Biswaranjan Paital
biswaranjanpaial@gmail.com

¹ Department of Marine Sciences, Berhampur University, Berhampur, Odisha 760007, India

² Redox Regulation Laboratory, Department of Zoology, College of Basic Science and Humanities, Odisha University of Agriculture and Technology, Bhubaneswar, Odisha 751003, India

BISWARANJAN PAITAL
ବିସ୍ୱଜନ ପାଟିଆ
Regional Institute of Education
Bhubaneswar, Odisha, India



Global assessment of tropospheric and ground air pollutants and its correlation with COVID-19

H.R. Naqvi^{a,*}, G. Mutreja^b, M. Hashim^a, A. Singh^a, M. Nawazuzzoha^a, D.F. Naqvi^c, M. A. Siddiqui^a, A. Shakeel^a, A.A. Chaudhary^d, A.R. Naqvi^e

^a Department of Geography, Faculty of Natural Sciences, Jamia Millia Islamia, New Delhi, India

^b Environmental Systems Research Institute, R & D Center, New Delhi, India

^c ZMetrics Technologies Pvt. Ltd., Pune, India

^d Department of Biology, College of Science, Imam Mohammad Bin Saud Islamic University, Riyadh, 13317-7544, Saudi Arabia

^e Department of Periodontics, College of Dentistry, University of Illinois at Chicago, Chicago, IL, USA

ARTICLE INFO

Keywords:

COVID-19
Pandemic lockdown
Tropospheric pollutants
Air quality
Mortality

ABSTRACT

The declaration of COVID-19 pandemic by the WHO initiated a series of lockdowns globally that varied in stringency and duration; however, the spatiotemporal effects of these lockdowns on air quality remain understudied. This study evaluates the global impact of lockdowns on air pollutants using tropospheric and ground-level indicators over a five-month period. Moreover, the relationship between air pollution and COVID-19 cases and mortalities was examined. Changes in the global tropospheric (NO₂, aerosols, and O₃) and ground-level (PM_{2.5}, PM₁₀, NO₂, and O₃) pollutants were observed, and the maximum air quality improvement was observed immediately after lockdown. Except for a few countries, a decline in air pollutants correlated with a reduction in Land Surface Temperature (LST). Notably, regions with higher tropospheric NO₂ and aerosol concentrations were also COVID-19 hotspots. Our analysis showed moderate positive correlation for NO₂ with COVID-19 cases ($R^2 = 0.33$; $r = 0.57$, $P = 0.006$) and mortalities ($R^2 = 0.40$; $r = 0.63$, $P = 0.015$), while O₃ showed a weak-moderate positive correlation with COVID-19 cases ($R^2 = 0.22$; $r = 0.47$, $P = 0.003$) and mortalities ($R^2 = 0.12$; $r = 0.35$, $P = 0.012$). However, PM_{2.5} and PM₁₀ showed no significant correlation with either COVID-19 cases or mortality. This study reveals that humans living under adverse air pollution conditions are at higher risk of COVID-19 infection and mortality.

1. Introduction

In December 2019, Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) was identified in Wuhan, China, which was associated with a pneumonia-like illness termed Coronavirus Disease-19 (COVID-19). The virus spread rapidly worldwide, and by the end of January 2020, the World Health Organization (WHO) declared COVID-19 a pandemic (Huang et al., 2020; Cucinotta and Vanelli, 2020), which initiated a series of lockdowns in various countries commencing in Wuhan, China on January 23, 2020, and subsequently imposed by Italy (March 10), Spain (March 14), France (March 18), India (March 25), Iran (March 28), and globally by April (Sicard et al., 2020). Depending on the severity of transmission in different countries, lockdown required partial or complete containment of public interactions, leading to a halt

in anthropogenic activities.

Daily pollutant emissions from industries, traffic, and the energy production sectors significantly contribute to poor air quality and adversely affect human health and quality of life. According to a 2014 WHO report, one out of every eight deaths worldwide is attributed to air pollution amounting to 4.9 million deaths per year (WHO, 2014). According to a 2017 study, O₃ and PM_{2.5} caused 0.5 million and 3 million deaths, respectively, globally (State of Global Air, 2019). It was predicted that maintaining PM_{2.5} concentrations based on the WHO guidelines would likely increase the life expectancy in 11 of the most populated countries.

The evaluation of environmental pollutants during the COVID-19 lockdown revealed variations (increase or reduction) in the levels of NO₂, PM, CO, O₃, and other APs, indicating that a temporary pause in

Peer review under responsibility of Turkish National Committee for Air Pollution Research and Control.

* Corresponding author.

E-mail address: hnaqvi1@jmi.ac.in (H.R. Naqvi).

<https://doi.org/10.1016/j.apr.2021.101172>

Received 15 March 2021; Received in revised form 13 August 2021; Accepted 15 August 2021

Available online 17 August 2021

1309-1042/© 2021 Turkish National Committee for Air Pollution Research and Control. Production and hosting by Elsevier B.V. All rights reserved.

Self-Attended
Atisha Singh
[Signature]

प्रधान/PRINCIPAL

क्षेत्रीय शिक्षा संस्थान

Regional Institute of
[unclear]



Control of invasive apple snails and their use as pollutant ecotoxic indicators: a review

Falguni Panda^{1,3} · Samar Gourav Pati¹ · Abhipsa Bal¹ · Kajari Das² · Luna Samanta³ · Biswaranjan Paital¹

Received: 12 July 2021 / Accepted: 7 August 2021
© The Author(s), under exclusive licence to Springer Nature Switzerland AG 2021

Abstract

Apple snails are one of the most survived fresh water invasive species that causes massive economic loss to vegetations, especially to the rice fields. They survive against many environmental stressors and are considered as a major pest in water-logged cultivated area due to their intrusiveness, adaptation mechanisms and survivability. Therefore, there is a need for strategies to control their population. Snails can also be used as pollution bioindicators. Here we review apple snails for their ecotoxic management without compromising environment and co-inhabitants, and their use as semi-sessile invasive ecotoxic marker species. Snails have been found to accumulate 0.19–0.21% biphenyl ethers, 1.65% copper sulphate with 26.7% mortality, 1.53–29.7% ivermectin, 43% polybrominated biphenyl ethers, 59% triphenylphosphine oxide, 8–100% of various heavy metals and nanoparticles. Feed intake of apple snails can be enhanced up to 22% with copper supplements, while 17 and 100% mortality can be achieved with niclosamide monohydrate (0.13 mg/L) and tea seed derivatives (0.015 g/L) exposure, respectively. Snails respond to stress factors with up to 29.6% higher lipid peroxides and 1.06% protein carbonyls, along with up to 80, 240 and 127% higher activities of superoxide dismutase, catalase and glutathione peroxidase enzymes, respectively, after cypermethrin exposure. Oppositely, mercury (2–8 mg/L) and aldicarb can reduce their oxygen consumption and acetylcholinesterase activity of up to 88.1 and 96.08%, respectively.

Keywords Apple snails · Ecotoxic marker species · Environmental chemistry studies · Economic loss to crops · Invasiveness · Molluscicide

Introduction

Apple snails are one of the largest invasive hardy semi-sessile amphibious molluscs that cause massive loss up to 50% to crop fields. They invariably eat all cultivated vegetations along with other aquatic plants such as *Valisnaria*, *Pistia*; therefore, their control using appropriate (bio)chemicals and establishing use of apple snails for bioaccumulation of environmental toxic substances is needed. Accumulation studies

to control their population using plant extracts, nanoparticles, heavy metals, drugs and chemicals in the range of $10 \mu\text{g L}^{-1}$ to 8.3 mg L^{-1} even up to 0.01 g L^{-1} for biomedical chemistry and environmental biochemistry have been completed (Manusadžianas et al. 2014; Cristescu 2015; Pitarch et al. 2018). Not only studies on population control of apple snails using compatible (above) chemicals are needed but also their use as model ecotoxic markers based on their habitat, for example, aquatic, terrestrial or even arboreal life, or motiveless, or hardy adaptive nature or even having special molecular adaptations is required for social benefits (Potet et al. 2016; Szczybelski et al. 2019; Fig. 1). Special adaptations with adjustable genetic makeup against harsh environment, invasive and hardy nature under in situ and ex situ environmental conditions enables these snails to use them as models for environmental chemistry studies (Kunz et al. 2010; Manusadžianas et al. 2014; Schaffner et al. 2014; Cristescu 2015; Salinas et al. 2019). It is because already plants such as *Acer negundo* and native *Alnus glutinosa* (Manusadžianas et al. 2014), insects such as *Ae.*

✉ Biswaranjan Paital
biswaranjanpaital@gmail.com

¹ Redox Regulation Laboratory, Department of Zoology, College of Basic Science and Humanities, Odisha University of Agriculture and Technology, Bhubaneswar 751003, India

² Department of Biotechnology, College of Basic Science and Humanities, Odisha University of Agriculture and Technology, Bhubaneswar 751003, India

³ Redox Biology & proteomics Laboratory, Department of Zoology, Ravenshaw University, Cuttack 753003, India

माचार्य/ PRINCIPAL
क्षेत्रीय शिक्षण
Regin
Education



2021

RESEARCH

Open Access



Temporal morphometric analyses of *Pila globosa* in India for its use in aquaculture and food industry

Falguni Panda¹, Samar Gourav Pati¹, Abhipsa Bal¹, Shivangi Mathur², Ramalingam Nirmaladevi³ and Biswaranjan Paital^{1*}

Abstract

Background: Although the apple snail *Pila globosa* is used as indicator species for human consumption locally and as fish feed, research on it in general is very scanty. It is used in food industry, in aquaculture as fish bait and used as food in many regions of India and many other countries, but research on it has been started in the 1970s. Only 40 articles are available on this organism in PubMed indicating an urgent need of basic research on it especially work on its spatiotemporal morphometry. Therefore, sampling of *P. globosa* was done from different parts of India in different seasons (summer, winter and rainy), and different morphometric studies were performed on this organism to draw baseline information. Analysis was conducted to study morphometry, the relationship between shell length and the weight and relative condition factor of Indian apple snail *Pila globosa* collected from five zones (east, west, north, south and centre) of India during 2018–2019 year.

Results: The shell length (SL) (46.5 ± 13.33), shell width (SW) (40.22 ± 11.5 mm), spire length (SPL) (2.99 ± 0.15 mm), base length (BL) (12.53 ± 2.94 mm), aperture length (AL) (21.95 ± 4.36 mm), aperture width (AW) (2.74 ± 0.47 mm) and shell weight (WT) (31.08 ± 13.76 g) were observed to be varied among the individual sampled across India. Different relationships for SL/SW ($\text{Log SW} = 0.9889 \text{ Log SL} + 0.9444$), SL/SPL ($\text{Log SPL} = 0.1452 \text{ Log SL} + 0.3815$), SL/BL ($\text{Log BL} = 0.7789 \text{ Log SL} + 0.5814$), SL/AL ($\text{Log AL} = 0.6518 \text{ Log SL} + 0.9111$) and SL/AW ($\text{Log AW} = 0.4475 \text{ Log SL} + 0.1422$) were observed by considering shell length as basic index. The relationship between shell length and shell weight was found to be $\text{Log WT} = 2.0263 \text{ Log SL} + 0.1098$. The relative condition factor revealed uninterrupted and good environmental condition observed for apple snails. A negative allometric growth pattern was observed from the length–weight relationship.

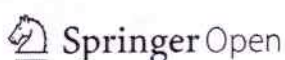
Conclusion: The environments of apple snail in India are not contaminated, and the results can be used as baseline data in aquaculture for model analysis and can be used as a reference for drawing relationship among different morphometric indices of *P. globosa* in India, as there is no such information available on it. The data can also be used for mass scale production of *P. globosa* for consumption by human and use in aquatic industries as fish feed.

Keywords: Allometric growth, Apple snail, Fisheries, Length–weight relationship, Morphometry, Mollusc shell, *Pila globosa*

* Correspondence: biswaranjanpaital@gmail.com

¹Redox Regulation Laboratory, Department of Zoology, College of Basic Science and Humanities, Odisha University of Agriculture and Technology, Bhubaneswar 751003, India

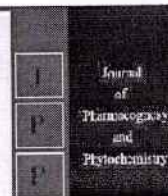
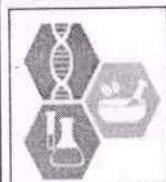
Full list of author information is available at the end of the article



© The Author(s). 2021 **Open Access** This article is licensed under a Creative Commons Attribution 4.0 International License, which permits use, sharing, adaptation, distribution and reproduction in any medium or format, as long as you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons licence, and indicate if changes were made. The images or other third party material in this article are included in the article's Creative Commons licence, unless indicated otherwise in a credit line to the material. If material is not included in the article's Creative Commons licence and your intended use is not permitted by statutory regulation or exceeds the permitted use, you will need to obtain permission directly from the copyright holder. To view a copy of this licence, visit <http://creativecommons.org/licenses/by/4.0/>.

Regional Incharge
Bhubaneswar

2021



E-ISSN: 2278-4136
P-ISSN: 2349-8234
www.phytojournal.com
JPP 2021; 10(4): 103-110
Received: 10-05-2021
Accepted: 16-06-2021

Priyamvada
Department of Education in
Science and Mathematics
(DESM) Regional Institute of
Education, Bhubaneswar,
Odisha, India

Preeti Mishra
Department of Education in
Science and Mathematics
(DESM) Regional Institute of
Education, Bhubaneswar,
Odisha, India

Anita Sha
Department of Education in
Science and Mathematics
(DESM) Regional Institute of
Education, Bhubaneswar,
Odisha, India

Animesh Kumar Mohapatra
Department of Education in
Science and Mathematics
(DESM) Regional Institute of
Education, Bhubaneswar,
Odisha, India

Corresponding Author:
Animesh Kumar Mohapatra
Department of Education in
Science and Mathematics
(DESM) Regional Institute of
Education, Bhubaneswar,
Odisha, India

Evaluation of antidiabetic and antioxidant activities of *Achyranthes aspera* leaf extracts: An *in vitro* study

Priyamvada, Preeti Mishra, Anita Sha and Animesh Kumar Mohapatra

Abstract

The present investigation aimed to screen the phytochemicals in the methanolic and petroleum ether leaf extracts of *Achyranthes aspera* and evaluate their antidiabetic and antioxidant activities by using an *in vitro* model. Phytochemical screening of the extracts revealed the presence of alkaloids, tannins, saponins, flavonoids, terpenoids, phenols and steroids. The results of α -amylase and α -glucosidase enzymes inhibition activities were found in a dose-dependent manner. The strongest activity was showed by methanolic fraction (55.0 \pm 0.50% for α -amylase and 53.06 \pm 0.23% for α -glucosidase inhibition at 160 μ g/ml) compared to petroleum ether extract (51.87 \pm 0.00% for α -amylase and 46.0 \pm 0.22% for α -glucosidase inhibition at 160 μ g/ml). The plant extracts were also examined for its antioxidant activities by using DPPH scavenging method. The DPPH assay exhibited significant antioxidant activity of isolated phytochemical compounds. The DPPH radical scavenging activity of the methanolic extract (68 \pm 0.44% at 250 μ g/ml) was higher than that of petroleum ether extract (63.06 \pm 0.56% at 250 μ g/ml). Thus, in conclusion this study can recommend this plant due to the presence of antioxidant components which have potential prospective for the control of diabetes and the related condition of oxidative stress. This knowledge will be helpful in exploring more potent antidiabetic principle from the natural resources for the clinical development of antidiabetic therapeutics.

Keywords: Diabetes mellitus, antidiabetic, antioxidant, hyperglycemia, postprandial blood glucose, insulin, α -amylase, α -glucosidase

Introduction

Diabetes mellitus is a leading cause of morbidity and mortality worldwide and a major economic burden. It is a chronic metabolic disorder manifested by hyperglycemia in which blood sugar levels are elevated either because of the insufficient production of insulin from the β -cells of pancreas or inactivity of body cells to respond the insulin properly [1]. About 90% of all cases of diabetes in developed and developing countries are non-insulin-dependent diabetes mellitus, also known as type-2 diabetes (T2D), or adult-onset diabetes [2, 3]. Persons with diabetes have lipid disorders and an increased risk of coronary heart disease, peripheral vascular disease and cerebrovascular disease.

In the process of digestion of food in the alimentary canal, α -amylase catalyses the hydrolysis of α -1,4-glycosidic linkages of starch and glycogen and α -glucosidase further breaks down the disaccharides into simple sugars making it available for intestinal absorption. The α -glucosidase enzyme catalyzes the cleavage of glycosidic bond and subsequently liberates glucose from the non-reducing end of the oligosaccharide chain [4]. The postprandial blood glucose levels have been found to play an important role in the onset and developing complications of T2D [5]. The postprandial rise in blood glucose level is associated with the activity of α -amylase and α -glucosidase enzymes in the small intestine [6]. The reduction of the activities of these two enzymes could play a role in managing postprandial hyperglycemia by slowing down the digestion of starch and extending intestinal carbohydrate holding time. This would result in decrease in the rate of glucose absorption and a subsequent reduction in the rate of increase of postprandial blood glucose. This could be a promising therapeutic strategy for the control of T2D, and forms the basis of many current clinical antidiabetic agents [7-9].

In diabetes, chronic hyperglycemia is associated with dyslipidemia, increased oxidative stress and consequently an alteration within the body's antioxidant defense system [10]. There is increasing proof that complications associated with diabetes are related to oxidative stress induced by the generation of free radicals. The antioxidant defense system protects the cells against free radicals. Once formation of free radicals overtakes the antioxidant defense system, the free radicals begin attacking the cells leading to several physiological disorders including diabetes.

Principal
Regional Institute of Education
Bhubaneswar, Odisha, India



Plant Community Analysis of Bhubaneswar Smart City, Odisha, India

M.K. Satapathy and S.K. Das^{*}

Department of Botany, Regional Institute of Education (NCERT)
Sachivalaya Marg, Bhubaneswar- 751 022, India
E-mail: Sanjeebdas75@yahoo.com

Abstract: Analysis of the plant community in four sites of each of Central and Transition zones of Bhubaneswar city showed that in the transition zone, *Mangifera indica* L., *Neolamarckia cadamba* (Roxb.) Bosser were the dominant trees. From the calculated values of relative frequency, relative density, relative dominance and importance value index, *Delonix regia* was quite dominant. In the Transition zone *M. indica* L. followed by *N. cadamba* (Roxb.) Bosser. were present in high population. Raunkiaer's frequency class, indicated that half of the sites in the central zone and three out of four sites in the transition zone were disturbed in terms plant community. Family Importance Value index, that Poaceae was the most dominant family followed by Cyperaceae and Fabaceae. The distribution pattern showed that in the central Zone, out of 276 species, 146 species showed contagious distribution, 90 species had random distribution and 40 species had regular distribution. In the transition zone, with 286 species recorded, 155, 84 and 47 species showed, contagious, random and regular distribution respectively. Because of more anthropogenic activities in the core areas, species richness was more in the transition zone than the central zone. The various above parameters showed marked differences among the study sites because of variations in soil conditions, local climate and biotic interferences.

Keywords: Community, Diversity index, relative dominance, Importance value Index, Family Index value

Cities provide ample opportunities to their citizens for economic development, better living standards, jobs and educational opportunities leading to migration of people from villages to cities. This continuous and unabated migration over the years has made cities densely populated and unsustainable. It has been predicted by UNO (Stanley 2008) that the number of people in Indian towns and cities will reach at 814 million by 2050. Under the smart city mission, announced by the Government of India, Bhubaneswar the capital of Odisha has been declared as one of the cities for comprehensive development of its physical, institutional, social and economic infrastructure. As such it attracts the attention of policy makers, and planners, and the government has been putting lots of stress to make it a model city for others. At the time of construction of new capital in 1948, Bhubaneswar and its surrounding areas supported a thick vegetation cover, mostly of deciduous type and the biodiversity was remarkably rich (Rout and Dash 1998). However with expansion of capital city, the rich flora of Bhubaneswar has largely been replaced by shrubs with stunted growth. Though some study has been conducted by botanists on the flora of Bhubaneswar, there is no comprehensive study that could throw light for the future planning and development of Bhubaneswar modern city from vegetational perspective. Under this background, the present study was conceptualized to make quantitative study

of vegetational patches and look for plant community analysis.

MATERIAL AND METHODS

Bhubaneswar is located in the Khurda district of Odisha, India between 20°12' N to 20 25' N latitude and 85 44' E to 85 55' E longitude on the Western fringe of the coastal plain across the main axis of the Eastern Ghats. The present study is confined to the Bhubaneswar city coming under Bhubaneswar Municipality Corporation (BMC) having an area of 146 Sq.km. with 67 wards. The present study was based on primary data collected through the survey from holistic and eco-systematic perceptiveness. The plants collected repeated field trips were identified in the Botany section of Regional Institute of Education, Bhubaneswar and documented following the "The Botany of Bihar and Orissa" (Haines 1925) and "Flora of Orissa" (Saxena and Brahman 1996). For plant community (vegetation) analysis, the central part of the Bhubaneswar city was taken as the Central zone (CZ). Samples were collected from randomly selected four wards such as WN-28, WN-17, WN-37 and WN-36. The area 10 km radius surrounding the Central Zone was considered as the Transition Zone (TZ). Sampling wards in this zone included WN-23, WN-02, WN-32 and WN-67.

Plant community was quantitatively analyzed following Quadrature method. From each (Central and Transition) zone,

Sanjeeb

Principal
Regional Institute of Education
Bhubaneswar

ORIGINAL ARTICLE

Dynamics of resonant self-focusing on second harmonic generation of Gaussian laser beam in a rippled density plasma

Nidhi Pathak¹ | Prakash Chandra Agarwal² | Tarsem S. Gill¹ | Sukhdeep Kaur¹

¹Department of Physics, Guru Nanak Dev University, Amritsar, India

²Department of Physics, Regional Institute of Education, Bhubaneswar, India

Correspondence

Sukhdeep Kaur, Department of Physics, Guru Nanak Dev University, Amritsar 143005, Punjab, India.
Email: sukhdeep.iitd@gmail.com

Abstract

Resonant second harmonic generation by a Gaussian laser beam in a rippled density plasma is studied using the moment theory approach. The nonlinearity arises through the relativistic mass effect and ponderomotive forces. The laser beam creates a plasma channel and gives rise to electron density perturbation at the laser frequency. The density perturbation beats with electron quiver velocity to produce second harmonics. The ripple provides phase matching and makes the process a resonant one. The second harmonic power efficiency is increased effectively with density ripple. Self-focusing causes enhancement in the efficiency of harmonic generation.

KEYWORDS

relativistic-ponderomotive non-linearity, second harmonic generation, self-focusing, self-trapping

1 | INTRODUCTION

Advancement of the extremely intense laser beams has ushered research in the field of laser plasma-based applications including Inertial confinement fusion,^[1,2] laser plasma-based accelerators,^[3,4] harmonic generation,^[5-8] X-ray lasers^[9,10] etc. One of the genuine nonlinear fundamental processes is self-focusing, which plays a crucial role in achieving appropriate conditions for the feasibility of the laser-induced fusion process. The combined influence of ponderomotive and relativistic nonlinearity is a useful and favourable strategy to enhance the focusing effects of the beam. Extensive theoretical as well as experimental research on the evolution of intense laser beam propagation through a plasma has been carried out by using the dual effect of relativistic and ponderomotive non-linearities.

Coherent extreme ultraviolet light^[11-13] is useful for the high harmonic generation, which are produced by focusing a femtosecond laser beam onto a gas. The chirped pulse amplification (CPA) technique^[14,15] is also useful to produce the high-gradient electric fields during the laser-plasma interaction thereby, generating high harmonics. At the relativistic intensities, the electron acquires figure eight orbit motion, which contains the basic nonlinearity for harmonics to occur.^[16] On that account, in the extremely intense laser fields, the harmonic generation acts as one of the pioneering tool to obtain information of plasma parameters such as local electron density, electrical conductivity, and opacity.^[17]

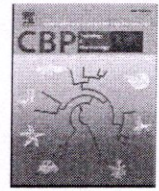
Phase matching is one of the most important issue in the harmonic generation. The efficiency of energy conversion is quite low until the wave number of the second harmonic k_2 does not match 2 times the laser i.e. $k_2 > 2k$, leaving it merely a non-resonant process. To make the process resonant, applications of the density ripple or magnetic wiggler have been suggested to provide the additional wave number in order to compensate this mismatch. The self-focusing has also been stimulated by the commencement of the concept of the rippled density profile in the laser plasma interaction. Milchberg et al.^[18] have proposed the use of extra degree of freedom available in the plasma fibre for the phase matching of non-linear conversion processes. Lin et al.^[19] have used the CPA technique in a spatial light modulator to produce the spatially



ELSEVIER

Contents lists available at ScienceDirect

Comparative Biochemistry and Physiology, Part C

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

Review

Modulation of physiological oxidative stress and antioxidant status by abiotic factors especially salinity in aquatic organisms

Abhipsa Bal^a, Falguni Panda^a, Samar Gourav Pati^a, Kajari Das^b, Pawan Kumar Agrawal^c, Biswaranjan Paital^{a,*}^a Redox Regulation Laboratory, Department of Zoology, College of Basic Science and Humanities, Odisha University of Agriculture and Technology, Bhubaneswar-751003, India^b Department of Biotechnology, College of Basic Science and Humanities, Odisha University of Agriculture and Technology, Bhubaneswar-751003, India^c Main Building, Odisha University of Agriculture and Technology, Bhubaneswar-751003, India

ARTICLE INFO

Keywords:

Salinity
Osmoregulation
Reactive oxygen species
Antioxidant enzymes
Mitochondrial energetic
Aquatic organisms

ABSTRACT

Exposure to a variety of environmental factors such as temperature, pH, oxygen and salinity may influence the oxidative status in aquatic organisms. The present review article focuses on the modulation of oxidative stress with reference to the generation of reactive oxygen species (ROS) in aquatic animals from different phyla. The focus of the review article is to explore the plausible mechanisms of physiological changes occurring in aquatic animals due to altered salinity in terms of oxidative stress. Apart from the seasonal variations in salinity, global warming and anthropogenic activities have also been found to influence oxidative health status of aquatic organisms. These effects are discussed with an objective to develop precautionary measures to protect the diversity of aquatic species with sustainable conservation. Comparative analyses among different aquatic species suggest that salinity alone or in combination with other abiotic factors are intricately associated with modulation in oxidative stress in a species-specific manner in aquatic animals. Osmoregulation under salinity stress in relation to energy demand and supply are also discussed. The literature survey of >50 years (1960–2020) indicates that oxidative stress status and comparative analysis of redox modulation have evolved from the analysis of various biotic and/or abiotic factors to the study of cellular signalling pathways in these aquatic organisms.

1. Introduction

Water covers around 71% of the total surface of our planet and 90% of water are in the form of oceans which harbour millions of species ranging from microbes to large mammals. The diversified species population is distributed in various ecological niches of oceans. In the scenario of the global climate change, the varying climatic patterns influence the abiotic factors in the coastal as well as marine ecosystems and thus eventually the physiology of the inhabitants. These disturbances in ecosystems can affect the physiology, reproduction, genomics, oxidative health, nutritional content, etc. of different species to a greater

extent.

Increase in the level of salinity is caused due to thermal stress that accelerates the evaporation rates, sea-level rise limiting the freshwater boundaries, etc. The varied salinity levels and associated environmental changes are found to modulate the oxidative stress physiology in aquatic aerobic animals. Oxidative stress is generated when imbalance in the production and neutralization of active oxygen species is moved in the favour of the former (Loro et al., 2012b). The active oxidants or free radicals such as superoxide radicals, hydroxyl radicals and H₂O₂ that are derived from oxygen are collectively called as the Reactive Oxygen Species (ROS). They are produced mainly in mitochondria due to

Abbreviations: ATP, Adenosine triphosphate; CAT, Catalase; ETC, Electron transport chain; FA, Fatty acid; GPx, Glutathione peroxidase; GR, Glutathione reductase; GSH, Reduced glutathione; GST, Glutathione-S-transferase; H₂O₂, Hydrogen peroxide; Keap 1, Kelch-like ECH-associated protein 1; LPO, Lipid peroxidation; MDA, Malondialdehyde; mRNA, Messenger RNA; NADPH, Reduced nicotinamide adenine dinucleotide phosphate; mRNA-messenger RNA Nrf2, Nuclear erythroid 2-related factor 2; NKA, Sodium potassium ATPase (Na⁺/K⁺-ATPase); OS, Oxidative stress; ppt or %, Parts per thousand; PRDX, Peroxiredoxin; PSU, Practical Salinity Unit; PUFA, Polyunsaturated fatty acids; ROS, Reactive oxygen species; SOD, Superoxide dismutase; SW, Sea water; TauT, Taurine transporter; TBARS, Thiobarbituric acid reactive substances.

* Corresponding author.

E-mail address: biswaranjanpaital@gmail.com (B. Paital).<https://doi.org/10.1016/j.cbpc.2020.108971>

Received 4 November 2020; Received in revised form 10 December 2020; Accepted 29 December 2020

Available online 6 January 2021

1532-0456/© 2021 Elsevier Inc. All rights reserved.

प्राचार्य/ Regional Institute of Education
भुवनेश्वर/ Bhubaneswar-751022



Vegetational study of the temple city of bhubaneswar (India): plant community analysis

Etude botanique de la ville temple de bhubaneswar (Inde): analyse de la communauté végétale

M.K. SATAPATHY¹ & S.K. DAS^{2*}

Résumé: L'analyse de la communauté végétale dans quatre sites de chacune des zones centrale et de transition de la ville de Bhubaneswar a montré que dans la zone de transition, *Mangifera indica* L., *Neolamarckia cadamba* (Roxb.) Bossier.etc. étaient les arbres dominants. Dans la zone centrale, les arbres dominants étaient *Delonix regia* (Boj. Ex Hook) Raf., *Anacardium occidentale* L. et *Mangifera indica* L. À partir des valeurs calculées de la fréquence relative (RF), de la densité relative (RD), de la dominance relative (RDo) et l'indice de valeur d'importance (IVI), *Delonix regia* s'est avéré assez dominant dans la population. *Anacardium occidentale* L., *Strychnos nux-vomica* L. avaient une population relativement pauvre. Dans la zone de transition *Mangifera indica* L. suivi de *Neolamarckia cadamba* (Roxb.) Bossier. était présent dans une population élevée. D'après l'analyse de l'indice de valeur d'importance de la famille, il a été observé que les Poacées étaient la famille la plus dominante, suivies par les Cypéracées et les Fabacées. En raison de davantage d'activités anthropiques dans les zones centrales, la richesse en espèces se situait davantage dans la zone de transition que dans la zone centrale. La régularité des espèces était plus pour les herbes, suivies des arbustes et des arbres dans les deux zones. Les différents paramètres ci-dessus ont montré des différences marquées entre les sites d'étude en raison des variations des conditions du sol, du climat local et des interférences biotiques.

Mots clés: Communauté, indice de diversité, dominance relative, indice de valeur d'importance, valeur d'indice familial

Abstract: Analysis of the plant community in four sites of each of Central and Transition zones of Bhubaneswar city showed that in the Transition zone, *Mangifera indica* L., *Neolamarckia cadamba* (Roxb.) Bossier.etc. were the dominant trees. In the Central zone, the dominant trees were *Delonix regia* (Boj. ex Hook) Raf., *Anacardium occidentale* L., and *Mangifera indica* L. From the calculated values of Relative Frequency (RF), Relative Density (RD), Relative Dominance (RDo) and Importance Value Index (IVI), *Delonix regia* was found to be quite dominant in the population. *Anacardium occidentale* L., *Strychnos nux-vomica* L. had relatively poor population. In the Transition zone *Mangifera indica* L. followed by *Neolamarckia cadamba* (Roxb.) Bossier. were present in high population.. From the analysis of Family Importance Value index, it was observed that Poaceae was the most dominant family followed by Cyperaceae and Fabaceae. Because of more anthropogenic activities in the core areas, species richness was more in the transition zone than the central zone. Species evenness was more for herbs, followed by shrubs and trees in both the zones. The various above parameters showed marked differences among the study sites because of variations in soil conditions, local climate and biotic interferences.

Key words: Community, Diversity index, relative dominance, Importance value Index, Family Index value

INTRODUCTION

Cities provide ample opportunities to their citizens for economic development, better living standards, jobs and educational opportunities leading to migration of people from villages to cities. This continuous and unabated migration over the years has made cities densely populated and unsustainable. It has been predicted by UNO (STANLEY, 2008) that the number of people in Indian towns and cities will reach at 814 million by 2050

Under the smart city mission, announced by the Government of India in 2015 (KULASHRESTHA, 2016), Bhubaneswar the capital of Odisha has been declared as one of the cities for comprehensive development of its physical, institutional, social and economic infrastructure. As such it attracts the attention of policy makers, and planners, and the government has been putting lots of stress to make it a model city for others.

At the time of construction of new capital in 1948, Bhubaneswar and its surrounding areas supported a thick vegetation cover, mostly of deciduous type and the biodiversity was remarkably rich (ROUT AND DASH, 1998). However with expansion of capital city, the rich flora of Bhubaneswar has largely been replaced by shrubs with stunted growth.

^{1,2} Department of Botany, Regional Institute of Education (NCERT)
Achrayavihar, Bhubaneswar, Odisha, India, 751 022

Sanjeeb
Principal
Regional Institute of Education
Bhubaneswar, Odisha

2021



Floristic evaluation and Phyto-sociological observation of Core Zone of Bhubaneswar Smart City, Odisha, India

Évaluation floristique et observation phyto-sociologique de la zone centrale de la Smart City de Bhubaneswar, Odisha, Inde

Sanjeeb Kumar DAS^{1*} & Pratikshya MOHANTY²

Résumé: Les attributs phytosociologiques ont été réalisés dans la zone centrale de la ville de Bhubaneswar, Odisha. Une tentative a été faite pour découvrir les caractéristiques de l'analyse qualitative de la ville urbaine. L'analyse de la végétation a été effectuée par la méthode Quadrat, largement acceptée pour de telles études. Un total de 130 espèces végétales pour 65 familles a été enregistré comprenant 32 espèces d'arbres, 36 espèces d'arbustes et 15 espèces d'herbes, 20 espèces de plantes grimpanes, 16 espèces d'hydrophytes, 01 épiphyte et 10 ptreidophytes. Cette étude fournit des informations de base pour toutes les études futures, car aucune évaluation écologique précédente n'a été réalisée dans la zone centrale d'une ville urbaine. En termes d'IVI, *Mangifera indica* (61,6), *Neolamarckia cadamba* (Roxb.) Bosser (39,0), *Butea monosperma* (Lam.) Taub. (23,6), *Ficus benghalensis* L. var. *bengalensis* (19,5) parmi les espèces d'arbres était dominante, suivie par *Ageratum conyzoides* L. (40,0) dans les arbustes et *Cynodon dactylon* L.Sp.Pi (65,7) dans les herbes. La présente étude montre que la plupart des espèces présentaient un type de distribution groupée. La ville a été soumise à diverses pressions anthropiques résultant de l'épuisement de la végétation. L'étude a révélé une intervention de gestion à long terme pour établir la valeur écologique et esthétique globale des espèces végétales et, par conséquent, leur valeur pour d'autres formes de vie.

Mots clés : *diversité des formes de vie, diversité floristique, indice de valeur importante, modèle de distribution, application stricte*

Abstract: Phyto-sociological attributes was carried out in the Core zone of Bhubaneswar city, Odisha. An attempt was made to find out the characteristics of Qualitative analysis of urban city. Analysis of vegetation was done by Quadrat method, widely accepted for such studies. A total of 130 plant species for 65 families were recorded comprising of 32 species of trees, 36 species of shrubs and 15 species of herbs, 20 species of climbers, 16 species of hydrophytes, 01 epiphyte and 10 ptreidophytes. This study gives baseline information for all future studies as no previous ecological assessment was done in the core zone of an urban city. In terms of IVI, *Mangifera indica* (61.6), *Neolamarckia cadamba* (Roxb.) Bosser (39.0), *Butea monosperma* (Lam.) Taub. (23.6), *Ficus benghalensis* L. var. *bengalensis* (19.5) among tree species was found as dominant followed by *Ageratum conyzoides* L. (40.0) in shrubs and *Cynodon dactylon* L.Sp.Pi (65.7) in herbs. The present study shows most of the species showed clumped type of distribution. The city has been under various anthropogenic pressures resulting depletion of vegetation. The study revealed a long term management intervention to setup overall ecological and aesthetic value of the plant species and consequently their value for other life forms.

Key Words: *Life form diversity, Floristic diversity, Important value Index, distribution pattern, Strict enforcement*

INTRODUCTION

Vegetation ecology is the study of structure vegetation and vegetation systematic. This includes the investigation of species composition and the sociological interaction of species in communities. (MULLER DOMBOIS & ELLENBERG, 1974). It lays emphasis on study of composition, development, geographic distribution and environmental relationship of plant communities. According to DANSEREAU (1960), floristic composition is one of the major anatomical characters of the plant community. Further, number of species of a community reflects the gene pool and adoption potential of the community. Quantitative floristic inventories provide necessary context for planning and interpreting long terms ecological research. (PHILLIPS *et al.*, 2003).

¹ Department of Botany, Regional Institute of Education (NCERT), Achrayavihar, Bhubaneswar, Odisha, India, 751 022

² Department of Botany, Centurion University of Technology and Management, Jatani, Bhubaneswar, Odisha, India

Corresponding author : *Email: sanjeebdas75@yahoo.com/ dassanjeebbotany75@gmail.com; Mo: 09437194035

Sanjeeb
प्राच्य विद्यापीठ (एन सी ई आर टी ई)
भूविज्ञान विभाग
Regional Institute of Education
भुवनेश्वर / Bhubaneswar-751022

Characteristics of spatiotemporal dynamics of a quadruple Gaussian laser beam in a relativistic ponderomotive magnetized plasma

NIDHI PATHAK,¹ P. C. AGARWAL,² T. S. GILL,¹ AND SUKHDEEP KAUR^{1,*}

¹Department of Physics, Guru Nanak Dev University (GNDU), Amritsar, Punjab 143005, India

²Regional Institute of Education, Bhubaneswar 751022, India

*Corresponding author: sukhdeep.iitd@gmail.com

Received 23 January 2020; revised 23 July 2020; accepted 3 August 2020; posted 3 August 2020 (Doc. ID 388470); published 8 September 2020

An investigation of the spatiotemporal dynamics of a quadruple Gaussian laser beam via plasma in the presence of an external magnetic field characterized by ponderomotive and relativistic nonlinearities is presented. The moment theory approach is used to study the second-order nonlinear differential equation analytically and numerically. The evolution of the beam width parameter determines the pulse dynamics, in both time and space. The spatial evolution at different pulse times of a quadruple Gaussian laser beam in a relativistic ponderomotive magnetized plasma is reported. The effects of initial laser parameters, such as lateral beam separation, laser intensity, external magnetic field, plasma density, and time factor on self-focusing, are studied. Strong periodic self-focusing is observed for a gradual increase in the magnetic field, plasma density, and time factor, whereas an increase in beam intensity shows reversal effects. The phenomenon of self-trapping is also observed for different values of lateral beam separation and magnetic field. A three-dimensional portrait of the normalized intensity as a function of the normalized radial co-ordinate and lateral beam separation is well illustrated. It is useful in studying inertial confinement fusion. © 2020 Optical Society of America

<https://doi.org/10.1364/JOSAB.388470>

1. INTRODUCTION

The advent of highly intense laser pulses has ushered in research in multivariate fields including inertial confinement fusion [1], harmonic generation [2], and laser-based plasma accelerators [3]. Self-focusing [4,5] is one of the nonlinear phenomena that has useful relevance in the plasma physics domain. Relativistic, ponderomotive, and ohmic nonlinearities put a great impact on the self-focusing phenomenon. When a high-power laser beam interacts with the plasma, it increases the refractive index on the axis, characterized by the transverse intensity gradient and least in the marginal regions. As a result, the axial portion of the beam travels with lower phase velocity than the outer portions, giving rise to curvature in the wavefront leading to self-focusing of the beam. Therefore, one requires the laser pulse to propagate over several Rayleigh lengths without any divergence/loss of energy. At low intensities, the sources of nonlinearity are ohmic heating and ponderomotive force. Ponderomotive effects dominate when electrons are expelled away from the focal spot. This decreases the plasma density on the axis of the beam and also increases the local dielectric function. At high laser intensities, the relativistic effects [6] become important because electrons start oscillating with the velocity of light. The combined effect

of both relativistic and ponderomotive nonlinearities [7] contributes to the focusing of a quadruple Gaussian laser beam on a femtosecond time scale.

Most of the theoretical research work on self-focusing pivots around the Gaussian [8] and cylindrically symmetric Gaussian intensity distribution [9], whereas non-Gaussian, including quadruple Gaussian beams [10], Hermite Gaussian beams [11], super Gaussian beams [12], and dark hollow Gaussian beams [13], are less explored and investigated. Super Gaussian laser beams are suitable for radiation pressure acceleration of protons and ions, as they suppress the Rayleigh Taylor instabilities.

Low-power laser beams recurrently suffer from low quality, less stability, and heat dissipation defects as compared to high-power laser beams. To make low-power laser beams advantageous, it is suggested to combine them coherently. The combined power, quality, and stability of coherently combined beams is extremely high as compared to single low-power beams. When adding two or more beams coherently (to attain constructive interference), researchers encounter two major issues of relative phase locking and controlling the phase between different laser beams. In order to surpass this limitation, several intracavity techniques based on planar interferometric couplers

Vegetational Study of The Temple City of Bhubaneswar (India) : Analysis of Floristic Diversity

S. K. Das, M. K. Satapathy

Received 24 January 2020; Accepted 14 March 2020; Published on 4 April 2020

ABSTRACT

The present study was carried out in the fast expanding temple city of Bhubaneswar in order to understand its floristic diversity after about 70 years of its inception. From selected sites, both from Central and Transitional/Peripheral zones, a total 572 plant species were recorded that included 138 herbs, 36 shrubs, 100 trees, 35 climbers, 93 grasses, 16 hydrophytes, 2 epiphytes, 3 parasites, 2 bryophytes and 18 peridophytes. From the study sites, 50 cultivars, 15 wild introduced and 12 weeds were recorded from the Central and Transition zones of the city besides 111 species of medicinal and 21 species poisonous/toxic plants. Ten plants species were found to be endangered, threatened and vulnerable. Further, 60 plant species were identified as invasive alien species with *Ageratum conyzoides* L., *Hyptis suaveolens* (L.) Poit., *Sida acuta* L., *Alternanthera paronychioides* St., *Cleome viscosa* L. and *Parthenium hysterophorus* L. being abundant. From the analysis of Family Impor-

tance Value index, it was observed that Poaceae with 56 species was the most dominant family followed by Cyperaceae, Fabaceae Asteraceae, Euphorbiaceae, Rubiaceae, Mimosaceae, Convolvulaceae and Lamiaceae with high species richness. A total of five species such as *Cassia alata* L., *Clerodrum incisum* Klotzsch., *Asparagus setaceus* (Kunth) Jessop., *Allamanda nerifolia* Hook. and *Portulaca umbraticola* Kunth were recorded for the first time from the study areas of Bhubaneswar.

Keywords Diversity, Family, Central zone, Transition zone, Poaceae.

INTRODUCTION

Globalization and industrialization have brought rapid urbanization and fast growth of cities that are considered as the engines of economic growth (Kumar and Chithra 2012). Cities provide ample opportunities to their citizens for economic development, better living standards, jobs and educational opportunities leading to migration of people from villages to cities. This continuous and unabated migration over the years has made cities densely populated and unsustainable. It is observed (Hayat 2016) that about 54% population of the world is confined to about 4.0% of the terrestrial

S. K. Das*, M. K. Satapathy
Department of Botany, Regional Institute of Education,
Bhubaneswar 751022, Orissa, India
Email : sanjeebdas75@yahoo.com
mksatapathy@rediffmail.com

*Corresponding author

Sanjeeb

Principal
Regional Institute of Education
Bhubaneswar-751022

PACS: 62.65.+k; 63.50.+x; 62.30.+d

INFLUENCE OF DIELECTRIC SCREENINGS ON PHONON FREQUENCIES AND ACOUSTIC PROPERTIES OF Pd-BASED BULK METALLIC GLASSES

R.R. Koireng^{a,b,*}, P.C. Agarwal^c, Alpana Gokhroo^a

^aSamrat Prithviraj Chauhan Government College, Ajmer-305001, Rajasthan, India

^bNational Institute of Education NCERT, New Delhi-110016, India

^cRegional Institute of Education NCERT, Bhubaneswar-751022, Odisha, India

*Corresponding Author: kavankrr@gmail.com

Received September 10, 2020; accepted October 15, 2020

The phonon dispersion curves for bulk metallic glasses (BMGs) Pd₄₀Ni₁₀Cu₃₀P₂₀ and Pd₆₄Ni₁₆P₂₀ are computed for the longitudinal and transverse phonon frequencies using the simple model given by Bhatia and Singh. Different dielectric screening functions are employed for the longitudinal mode. We obtain the values of the force constants β and δ calculated from the elastic constants of the material of the respective BMGs for computing the dispersion curves. The computed phonon dispersion curves show appropriate behaviour for both the longitudinal and transverse modes. The transverse sound velocity and the longitudinal sound velocities with various dielectric screenings are calculated in the long wavelength region from the computed dispersion curves for both the BMGs. The first peak position of the static structure factor is predicted from the dispersion curves. The values of sound velocities and the first peak of the static structure factor estimated from the computed dispersion curves show excellent agreement with the experimental values reported in literature for the BMGs under consideration and the results may be used for correlating other properties of the BMGs.

KEYWORDS: Bulk metallic glass, dispersion curves, dielectric screening, elastic properties

The advent of bulk metallic glasses (BMGs) has attracted a lot of interest due to its novel properties and applications in diverse technological areas [1–3]. Pd-based BMGs due to their unique mechanical and thermal properties have shown potential applications as electrode, jewelry and medical materials [4–5]. However, the understanding of phonon dynamics and atomic structure configuration are essential for understanding their mechanical and thermal properties [6–9]. The phonon dynamics of metallic glasses have been studied experimentally [10–11] using neutron scattering. Theoretically computed phonon frequencies have been investigated by many researchers [12–17] for correlating them with mechanical and thermal properties in a variety of metallic glasses. Three main theoretical approaches, namely Hubbard and Beeby [15], Takeno and Goda [16] and that of Bhatia and Singh [8] are widely used for computing phonon frequencies of metallic glasses.

In this paper, the phonon dispersion curves of Pd₄₀Ni₁₀Cu₃₀P₂₀ and Pd₆₄Ni₁₆P₂₀ BMGs are computed using the simple model given by Bhatia and Singh [8]. This model assumes a central force which is effective between the nearest neighbours and a volume dependent force. Bhatia and Singh [8] determine the values of force constants δ and β using the value of longitudinal and transverse sound velocities along with the calculated value of force constant κ_0 . However, in the approach adopted by us, we fix the values of force constants δ and β used in the computation of dispersion curves by using the value of bulk modulus (B) and shear modulus (G) of the respective BMGs along with the calculated value of κ_0 . This method of determining the values of δ and β from the elastic moduli of the BMGs for computing phonon frequencies using the simple model is applied for the first time for the Pd₄₀Ni₁₀Cu₃₀P₂₀ and Pd₆₄Ni₁₆P₂₀ BMGs. The dielectric screening due to conduction electrons in the long wavelength region of the phonon frequencies is quite significant. To study its effect on the phonon frequencies, various dielectric screening functions [13] namely, Bhatia and Singh (BS), Hartree (H), Hubbard (HB), Geldart and Vosko (GV), self-consistent screening due to Shaw (SCS) and Overhauser (OH) are employed for the longitudinal mode.

The longitudinal sound velocities (V_L) are computed for different dielectric screenings and the transverse sound velocity (V_T) is computed from the longitudinal and transverse dispersion curves respectively in the long wavelength region for both the Pd₄₀Ni₁₀Cu₃₀P₂₀ and Pd₆₄Ni₁₆P₂₀ BMGs. The first peak position of the static structure factor $S(q)$ denoted by q_p provides key structural information and elastic properties of amorphous materials [7]. The value of q_p is estimated from the dispersion curves, where it occurs around the first minimum of the longitudinal vibration mode [9].

THEORY

The details of this theory of the simple model employed are given by Bhatia and Singh [8] and others [12–13]. The equations for the longitudinal phonon frequencies (ω_L) and transverse phonon frequencies (ω_T) as given by Bhatia and Singh [8] can be written as

$$\omega_L^2 = \frac{2N}{\rho a^2} [\beta I_0 + \delta I_2] + \frac{\kappa_e \kappa_F^2 q^2 [G(q; \epsilon)]^2}{\rho [q^2 + \kappa_F^2 \epsilon(q)]} \quad (1)$$

and



ETHNOBOTANICAL STUDY OF WILD EDIBLE FOOD PLANTS USED BY THE TRIBALS AND RURAL POPULATIONS OF ODISHA, INDIA FOR FOOD AND LIVELIHOOD SECURITY

Samarendra Narayan Mallick^{1,2*}, Tirthabrata Sahoo¹, Soumendra Kumar Naik²
and Pratap Chandra Panda¹

¹Taxonomy and Conservation Division, Regional Plant Resource Centre, Bhubaneswar-751015 (Odisha), India.

²Department of Botany, Ravenshaw University, Cuttack-753003 (Odisha), India.

Abstract

The Wild Edible Food Plants (WEFPs) refer to those species which are neither cultivated nor domesticated but are important source of food in tribal areas of India. Uses of wild edible food as a coping mechanism in times of food shortage, provides an important safety net for the rural poor. In Odisha, there are 62 different tribes, of which the most numerous ones are Kondh, Gond, Santal, Saora, Kolha, Shabar, Munda, Paroja, Bathudi, Bhuiyan, Oraon, Gadabas, Mirdhas and Juang. The tribals of Odisha depend on forests for their food and other needs and regularly collect and consume fruits, leafy vegetables, tubers, flowers, mushrooms etc. from the nearby forests and have acquired vast knowledge about the wild edible food plants. The present study deals with the identification, documentation, ethnobotanical exploration and information on food value of wild edible plants (WEFPs) from different tribal dominated villages of Keonjhar, Mayurbhanj, Kalahandi, Bhitarkanika (Kendrapada), Rourkela (Sundargarh), Jeypore (Koraput), Rayagada, Ganjam, Gajapati, Nabarangapur, Phulbani district of Odisha. The ethnobotany and traditional uses of 193 wild edible plants have been dealt in this paper. Although the popularity of these wild forms of foods has declined, they are nutritionally rich and their usage need to be encouraged.

Key words : Odisha, Wild edible food Plants, Tribals, Traditional knowledge, Food security.

Introduction

Nutrition which is a fundamental biological process for self existence of living organisms. Food and nutritional security are key concerns the world over as low food intake and poor access to food in underdeveloped countries results in malnutrition and health hazards (Belcher *et al.*, 2005; Narendran *et al.*, 2001; Scherr *et al.*, 2004; Mahapatra & Panda, 2012). Food habits of human being have developed from the experience and through successive generations. Feeding in excess of 800 million undernourished people depend not only on increased productivity of domesticated crops but also the use of underutilized wild species. The wild plants and their products make significant contributions to the human and animal food web and are often a means of survival for millions of poor rural households. There is now greater recognition that products from the wild may support

household subsistence and income generation from their sale, either in raw or processed forms.

WEFPs are an important source of food in India and have a significant place in the dietary habits of small and marginal farmer's families and forest dwelling communities during the periods of food scarcity (Beluhan & Ranogajei, 2010). The food habits of tribals are generally developed according to the seasonal availability of food and their nutritional value and hence, food supply is traditionally based on their own collections.

India harbours 45,000 plant species and 550 tribal communities. The tribals belong to 227 linguistic groups and they inhabit varied geographic and climatic zones with diversified plant species, varied culture, rich traditional knowledge and wisdom. From the ethnobotanical studies of wild plants indicate that more than 7000 species have been used for human food at some stage in human history (Grivetti & Ogle,

*Author for correspondence: E-mail : samarendra.mallick1@gmail.com



प्राचार्य/ PRINCIPAL
क्षेत्रीय शिक्षा संस्थान
Regional Institute of Education
भुवनेश्वर / Bhubaneswar-751022


8/5/23



INDUCED-ANTIFUNGAL ACTIVITY IN *ORYZA SATIVA* L. CAUSED BY *PYRICULARIA ORYZAE* CAV. WITH A LOW DOSE OF NICKEL PRIMING

Diptimayee Jena¹, Srinivas Acharya¹, Deepak Kumar Patra², Shilpee Dhali¹
and Chinmay Pradhan^{1*}

¹Department of Botany, Utkal University, Vani Vihar, Bhubanesar-751004 (Odisha), India.

²Department of Botany, Nimapara Autonomous College, Nimapara, Puri-752106 (Odisha), India.

Abstract

Hydroponically grown rice seedlings were treated with a micronutrient Ni (II) and blast inducing fungus *Pyricularia oryzae* Cav. (MTCC 1477) under controlled condition to investigate the effect of Ni (II) on *Pyricularia oryzae* Cav. (MTCC 1477) in *Oryza sativa* L. (var. Naveen). Ten days old seedlings were treated with different Ni (II) (as NiCl₂) concentrations (40 μM) and after 3 days, spores of *P. oryzae* were sprayed on these treated seedlings each of 2 mL (contains 10⁵ CFU/mL). The morphological, biochemical and chlorophyll fluorescence parameters were studied in 10, 20 and 30d treated seedlings to evaluate the effect of Ni (II) on fungus in different gradations and effect of co-stress on *Oryza sativa* L. There was a significant decrease in growth and physio-chemical parameters in both the fungus (F) and Ni (II) treated rice seedlings when grown separately, whereas in co-stress of fungus with Ni (II) (40 μM) treated seedlings these parameters were restored. It indicates that Ni (II) inhibits the activity of fungal toxins in the rice seedlings. The JIP-test parameters and the anti-oxidative enzyme activity showed a growth-enhancing effect for 40 μM Ni (II) diseased rice plants. Under present experimental conditions, the study suggests that 40 μM Ni (II) concentration act as a nutritive supplement as well as induces antifungal activity against *P. oryzae* Cav. causing rice blast disease in *O. Sativa* L.

Key words : Antioxidative enzymes, Chlorophyll fluorescence parameters, Nickel (II), *Oryza sativa*, *Pyricularia oryzae*.

Introduction

Plants have developed different mechanisms for their survival sensing the external stress environment, get stimulated, and then create cellular responses accordingly to cope and combat abiotic or biotic stress. The signalling pathways have a vital role in sensing the environment stress and accordingly produce a distinct physiological and biochemical response (Zhu 2002). Plants under heavy metal stress are more prone to diseases by herbivores and/or microbial infections. Sometimes negative, positive or neutral effect between metal and pathogenic infection may experience by many plants (Hanson *et al.*, 2003; Jhee *et al.*, 2005). Heavy metal stress might save energy-demanding organic fortifications (Boyd and Martens 1998). But some heavy metals may induce resistance against biotic stress in plants. Metal ions may initiate biochemical reactions and rarely fight against pathogenic disease in non-hyper-accumulator plants (Walters *et al.*,

*Author for correspondence : E-mail: chinmay-pr@yahoo.com

2005). But, metal-induced ROS that can set off protection signals and as a result fabricates secondary metabolites (Jiang *et al.*, 2005).

Blast is one of the dominant airborne or seed-borne infections in rice across the globe. The pathogen *Pyricularia oryzae* Cav. usually causes leaf blast or neck blast (Bonman 1992). It was a reported fact that the productivity of rice significantly drops due to blast disease in 75% of the cases. Higher tolerance to excess metal of the plant than of the pathogen can lead to hermetic response where growth stimulation can be observed due to the efficient repression of the pathogen (Calabrese *et al.*, 2007).

Nickel being a micronutrient required by many plant in traces whereas in excess it induces heavy metal stress response. The present study aims to induce an optimal dose of Ni-stress which may trigger many genes encoding certain metabolites responsible to detoxify the fungal toxins by *P. oryzae* in rice seedlings. In metal

[Handwritten signature]
11/05/23.
(Diptimayee Jena)
Asst. Prof. (Botany) (cont.)

EFFECTIVENESS OF ICT INTEGRATED CONSTRUCTIVIST APPROACH ON ATTAINMENT OF CONCEPTS IN MATHEMATICS

Ajay Babu* and Prof(Dr). H. K Senapaty **

*Research Scholar .RIE,Bhubaneswar ,Utkal University

**Professor in Education,RIEBhubaneswar,NCERT

ABSTRACT

In the context of integration of information technology and communication in the Teaching / Learning of Mathematics, the present study examines the effectiveness of ICT integrated constructivist approach on the attainment of concepts in mathematics learning also it aims to ascertain the concept and gender independence of ICT integrated constructivist teaching model. The classroom samples in this study included 120 students of class VIII students. Students were divided into experimental group and control group, each having 60 students with the help of one to one matching based on their previous test marks. The true experimental design was used .To study the effectiveness data was collected with the help of self made exemplar materials using 5E constructivist teaching model integrated with ICT and concept based achievements.Pre-test and post-test were administered to compare the result. The results indicated that: Students of experimental group were significantly performed better than the students of control group .So ICT integrated has significant effect on the construction of concept in mathematics for class VIII student. It was concluded that there is no significant difference of concept 1 & concept 2 in experimental group . So ICT integrated has a significant effect on the construction of concepts in mathematics for class VII student.It was also concluded that there was no significant differences between the Mean gain score of Boys & Girls in experimental group . Hence it is concluded that ICT integrated constructivist approach is gender independence and concept independent.

Keywords: Information Communication Technologies, constructivist approach 5E constructivist teaching model

Background of study

The value of mathematics in daily life cannot be questioned. Mathematics finds its application in the fields of science, technology, economics , business, commerce and computer design and functioning"Students need to construct their own understanding of each mathematical concept, so that the primary role of teaching is not to lecture, explain, or otherwise attempt to 'transfer' mathematical knowledge, but to create situations for students that will foster their making the necessary mental constructions.Information Communication

Technology, or ICT, is changing everything about the modern classroom. Chris Abbott states that "schools as institutions are changing rapidly as technology alters the schooling paradigm" (Abbott, 2000, p.48). Incorporating ICTs into the curriculum to enhance learning is also a standard of the 2008 Smart classroom Professional Development Framework.

ICT is so much more than something we have to teach. It is a way of teaching. Technology is such an integral part of



Floristic Diversity Assessment of Dhauligiri Hill and its Adjoining Areas of Bhubaneswar City, Odisha, India

Sanjeeb Kumar Das, Padmini Bisoyi¹, Ashutosh Subudhi², Samarendranath Naik³
and Sourav Ranjan Pradhan⁴

Department of Botany, Regional Institute of Education (NCERT), Bhubaneswar-751 022, India

¹Department of Life Science, JawaharlalNehru University, New Delhi-110 067, India

^{2,4}Department of Botany, Utkal University, Vanivihar, Bhubaneswar- 751 004, India

³Departments of Botany, Odisha University of Agriculture and Technology, Bhubaneswar-751 022, India

E-mail: sanjeebdas75@yahoo.com

Abstract: The present paper aimed to study the floristic diversity of Dhauligiri hill and its adjoining areas of Bhubaneswar city. A total of 254 plant species, which are distributed in 174 genera and 73 families. Different life forms diversity in decreasing orders were herbs (82), shrubs (40), trees (43), grasses (45) and climbers (18). Euphorbiaceae is the dominant family among dicots and Poaceae in monocots. Ten plant species were found to be vulnerable, endangered while 40 plant species were Invasive Alien Plant species (IAPs). The 16 poisonous/toxic plant species were recorded. This is preliminary observation, however, it is recommended to initiate the activities such as inventory of useful species, habitat, characteristics, identification of species for various economic uses and formulation and implementation of plan of action taking consideration of the needs of people and sustainable management.

Keywords: Floristic diversity, Life form diversity, IAPs, Poisonous plant, Medicinal value

Floral diversity does influence the rates or nature of ecosystem processes, and a majority of studies concluded that a reduction in biodiversity does have a negative effect on ecosystem function. Floral diversity provides a useful measure of the quality of the environment and of the probability of sustainability. There are other several plants which have a strong association with another and if one species is destroyed, then it may cause a threat to another species. There are associations like parasitism, symbiosis, saprophytism and epiphytism which are completely dependent on others. Floral diversity is the natural resources and wealth of a country and acquiring knowledge of it is of immense scientific and commercial importance. Plant community plays a vital role in the sustainable management by maintaining biodiversity and conserving the environment. Floristic studies are taxonomical studies of a flora of a given area. It helps us to assess the plant wealth and its potentiality of any given area (Vediya and Kharadi 2011). The present study was the first attempt to make an inventory and analysis of entire flora of Dhauligiri hill and its adjoining.

MATERIAL AND METHODS

Bhubaneswar is located in the Khorda district of Odisha, India between 20°12'N to 20°25'N latitude and 85°44'E to 85°55'E longitude on the western fringe of the coastal plain across the main axis of the Eastern Ghats. The city stands at the Western side of the "Mahanadi Delta" on the bank of river

Kuakhai, a distributary of Mahanadi river 30 km south-west of the city of Cuttack.

The present study has been carried out based on primary data collected through survey method and floristic study was based on holistic and eco-systematic perceptiveness. The floristic survey was undertaken in the Dhauligiri and its adjoining region (Fig. 1) to document floral diversity of the region. Voucher specimens were collected along with live photographs were taken with the help of camera. Details procedure of the collected plants in the field such as their preservation, collection of data, identification was carried out following methods described in the books such as vascular plant systematics (Radford et al 1974) and a 'Handbook of Field and Herbarium Method' (Jain and Rao 1977). The plants were identified in the Botany Section of Regional Institute of Education, Bhubaneswar and documented following the book "Flora of Orissa" by Saxena and Brahmam (1994). The names of the plant dealt herewith have been updated in pursuance with ICBN (Tokyo Code, Greuter et al 1974).

RESULTS AND DISCUSSION

254 species are recorded, out of which 82 herbs, 40 shrubs, 45 grasses, 43 trees, 18 climbers, 3 parasites, 13 hydrophytes, 1 gymnosperm, 5 pteridophytes, 2 bryophytes and 2 lichens were found and their percent wise distribution has been depicted in (Table 1). The details of plants recorded

Sanjeeb

Principal
Regional Institute of Education
Bhubaneswar / Odisha-751 022



CANOPY INFLUENCES IN CONTRAST TO AN ADJACENT OPEN AREA: A CASE STUDY

Sanjeeb Kumar Das^{1*}, Padmini Bisoyi², Ashutosh Subudhi³, Samarendranath Naik⁴
and Sourav Ranjan Pradhan⁵

¹Department of Botany, Regional Institute of Education (NCERT), Sachivayala Marg, Bhubaneswar-751022, (Odisha) India.

² Department of Life Science, J.N.U., New Delhi.

^{3,5}P.G. Department of Botany, Utkal University, Vanivihar, Bhubaneswar (Odisha) India.

⁴P.G. Departments of Botany, OUAT, Bhubaneswar (Odisha) India.

Abstract

Bhubaneswar is the capital and largest smart city of the Indian state of Odisha. Chandaka Reserve forest, situated in Khurdha and Cuttack district of Orissa lies between the new capital Bhubaneswar and old capital Cuttack, covering an area of 193.39 Sq.km. The objectives of the paper deals with an investigation of the conditions that developed in the canopy-influence-areas of different trees and forest stands in comparison to an adjoining open area in a nearby forest. Micro climatic conditions like soil, air temperature, relative humidity, light intensity were studied. Soil analysis, Important Value Indices (IVI), of ground flora species in three habitats in two different seasons, occurrence of fungi in soil were also studied. Two influence circles are pointed out forming two completely separated zones around the tree *i.e.*, Truck-Influenced-Spaces (TIS) and Canopy-Influenced-Spaces (CIS) along with the inter-canopy-influenced-space (ICIS). Almost all the important characteristic features support this trend.

Key Words: Canopy, Micro-climatic conditions, Open area, IVI, Soil analysis.

Introduction

The conditions that evolve under the canopy of a tree are so marked in comparison to an adjacent area that they can hardly be left unnoticed. The changes which gradually appear with the development and spread of the canopy can be seen in the soil characteristics, ground flora, soil organisms and microclimate. In a mixed forest each tree with its specific chemical composition may have a controlling influence over the soil properties in the trunk and canopy region.

At times, therefore, it will not be surprising to find a great heterogeneity in chemical contents of a forest soil, over a distance of only a few centimetres, as has been demonstrated by Frankland *et al.*, (1963). Sinke, (1962) based upon a study of temperature forest, has shown that the pattern of soil properties under a single isolated forest, tree is generally developed with radial symmetry (Plate I). Heatwole, (1961) has pointed out that in

*Author for correspondence : E-mail: Sanjeebdas75@yahoo.com

temperate regions generally the forest floor contains a rather uniform and continuous layer of single leaf-litter type. The present paper deals with an investigation of the conditions that developed in the canopy-influence-areas of different trees and forest stands in comparison to an adjoining open area in a nearby forest.

Materials and Method

Study Site: A mixed deciduous forest (Chandaka) at a distance of 15 km from the heart of the Bhubaneswar city was selected for this study. A clear felled area and reforested 'teak' stand were also available in this forest.

Location: Chandaka Reserve forest, situated in Khurdha and Cuttack district of Orissa lies between the new capital Bhubaneswar and old capital Cuttack, covering an area of 193.39 Sq.km. It lies between latitude 20°16'05" to 20°26'03" N and longitudes 85°34'42" to 85°49'30" E. It is very close (15 km North West) to the capital city of Bhubaneswar in Orissa and can be approached by road *via* Khandagiri. (Fig. 1).

Sanjeeb

Regional Institute of Education
Bhubaneswar

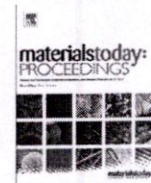
2020



Contents lists available at ScienceDirect

Materials Today: Proceedings

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



Role of extractants and diluents in recovery of rare earths from waste materials

Sanghamitra Pradhan, Nilam Swain, Susmita Prusty, Rakesh Kumar Sahu, Sujata Mishra *

Department of Chemistry, Institute of Technical Education and Research (FET), Siksha 'O' Anusandhan Deemed to be University, Khandagiri Square, Bhubaneswar 751030, Odisha, India

ARTICLE INFO

Article history:

Received 11 December 2019
Received in revised form 11 January 2020
Accepted 13 January 2020
Available online xxx

Keywords:

Solvent extraction
Rare earths
Extractants
Diluents
Sustainability

ABSTRACT

It is perceived that our society is heading towards an ultra-connected world with the help of emerging technologies. The swift frequency of technological development has been possible due to enhanced advances in IT, cheapness of raw materials that lead to industrial development. Rare earth elements are playing a key role in the economic progress having diverse applications in alloys, magnets, catalyst, phosphors and are utilized in equipments such as batteries, sensors, electric vehicles. The prominence of these elements has gone up due to high demand, limited supply and non-availability of appropriate substitutes. Considering the present scenario, recovery of rare earths from end of life products through economical technology have become top priorities in metallurgy. There are diverse routes to recover rare earths from secondary resources ranging from hydrometallurgical to pyrometallurgical processes. Hydrometallurgical technique such as solvent extraction has been proved beneficial in recovering rare earths from these secondary resources. This review has been framed to discuss the role of extracting agents and diluents in the extraction circuits used for rare earth extraction and separation studies taking into consideration the end of life products. The function of different extractants such as di-(2-ethylhexyl) phosphoric acid (D2EHPA), 2-ethylhexyl phosphonic acid mono-2-ethylhexylester (PC 88A), bis(2,4,4-trimethylpentyl) phosphinic acid (Cyanex 272), trialkyl phosphine oxides (Cyanex 923) and diluents like pentane, hexane, Solvent 70, dodecane, Octanol and cyclohexanone employed for the extraction of rare earths from the waste materials, particularly magnet scraps, spent batteries and lamp phosphors have been highlighted. The recent challenges concerning the development of cost effective, eco-friendly green extractants like tricaprylmethyl ammonium chloride (Aliquat 336), DEHPA, Alamine 336 IL have also been discussed.

© 2020 Elsevier Ltd. All rights reserved.

Selection and Peer-review under responsibility of the scientific committee of the National Conference on Trends in Minerals & Materials Technology.

1. Introduction

The on-going revolution of technology and industries emphasizes on the crusade towards low-carbon technology or green technology. In this transition, rare earth metals (REMs) play an essential role as major contributors in these emerging infrastructures and are recognized as the vitamins of modern technology [1]. These are a part of several devices starting from mobile phones to military appliances. Upgradation in technologies creates an increasing demand for REMs putting them at a stage of supply-risk. The limited supply and abruptly increasing demand of these

elements have led to the so called "balance problem" and hence, these are labeled as "critical" elements by European Union Commission [2]. Though the market share of REMs in economy of industries is unquestionable, the production of materials creates a lot of waste laying environment at risk which is of increased global concern. The anthropogenic inputs are the master sources of rare earth accumulation in soil, water, plant and air, which in turn enter into the food chain. The rare earth chain from mining to food is shown in Fig. 1 [3]. Based on this fact, it could be concluded that there is urgent need of sustainable recycling techniques with special attention to waste products containing substantial amount of rare earths.

The potential material streams of REMs are (1) pre-consumer products or scraps (2) post-consumer products or end-of-life products (EOLs) and (3) landfills rendered by pre-consumer and

* Corresponding author.

E-mail addresses: drsujatamishra97@gmail.com, sujatamishra@soa.ac.in (S. Mishra).

<https://doi.org/10.1016/j.matpr.2020.01.288>

2214-7853/© 2020 Elsevier Ltd. All rights reserved.

Selection and Peer-review under responsibility of the scientific committee of the National Conference on Trends in Minerals & Materials Technology.

Please cite this article as: S. Pradhan, N. Swain, S. Prusty et al., Role of extractants and diluents in recovery of rare earths from waste materials, Materials Today: Proceedings, <https://doi.org/10.1016/j.matpr.2020.01.288>

Regional
भुवनेश्वर
National
Nilam Swain



First report of *Aspergillus terreus* causing sunken leaf spot on *Dracaena alectrifomis* in India

Ashish Kumar Nayak^{1,2} · Samarendra Mallick³ · Bandamaravuri Kishore Babu^{1,2}

Received: 6 April 2019 / Accepted: 1 July 2019
© Australasian Plant Pathology Society Inc. 2019

Abstract

Large-leaved dragon tree (*Dracaena alectrifomis* L.) is an ornamental house plant of *Asparagaceae* family and native to tropical Africa. In summer 2017, dragon tree leaves showing sunken spots symptoms were observed in several grown on the premises of the CSIR-Central Institute of Medicinal and Aromatic Plants (CIMAP), Lucknow. The fungus was isolated from the lesions and its pathogenicity was confirmed. The fungus was identified based on morphological characteristics and confirmed through analysis of DNA sequences of internal transcribed spacer (ITS) regions of the ribosomal DNA. This is the first report on *Dracaena alectrifomis* sunken leaf spot disease caused by *Aspergillus terreus*.

Keywords *Dracaena alectrifomis* · Sunken leaf spot · Plant pathogenic fungi

Dracaena alectrifomis (family- Asparagaceae), commonly called large-leaved dragon tree, is a shrubby species of *Dracaena* which is a tropical plant native to Madagascar, Mauritius and other nearby islands of the Indian Ocean. It is widely grown as an ornamental plant and houseplant, valued for its richly colored, evergreen, thick and irregular stems (Banerjee et al. 2017). Traditional medicine practitioners of Madagascar and African countries have long believed that different species of *Dracaena* to cure diseases like dysentery, diarrhea, malarial symptoms, poisoning, dysmenorrhea and to be useful as an antipyretic and hemostatic agent (Randrianarivelosia et al. 2003). Different species of *Dracaena* genus have also the capacity to remove a considerable amount of indoor pollutants and significant antimicrobial activity against *Staphylococcus aureus*, *Pseudomonas aeruginosa*, and *Fusarium oxysporum* (MINH et al. 2009).

Diseases like anthracnose and leaf spot were previously reported in several species of *Dracaena* in different parts of the world. Leaf spot of *Dracaena hookeriana* species was reported from Chandigarh caused by *Gloeosporium polymorphism* (Sohi 1990). Serious damage by anthracnose (*Colletotrichum gloeosporioides*) on greenhouse crops of *Dracaena deremensis* was first time observed in Italy (Lenna and Montecchio 1995). Anthracnose of *Dracaena fragrans* by *Colletotrichum gloeosporioides* was recorded from China (Wang et al. 1997).

There has been no prior report of sunken leaf spot of *Dracaena alectrifomis* in India. The initial symptoms of this disease appear as very small yellow to rust brown zone that gradually increases from 7 to 10 mm in diameter, changing from circular to elliptical lesions on the leaves. Lesions enlarge and coalesce; causing diseased leaves to become blighted (Fig. 1a). The aim of the study was to determine the causative agent of the *D. alectrifomis* sunken leaf spot disease observed in CSIR-CIMAP, Lucknow, India.

Mature *D. alectrifomis* leaves showing typical symptoms of sunken leaf spot were collected from the premises of the CSIR-Central Institute of Medicinal and Aromatic Plants (CIMAP), Lucknow, India. Specimens were collected during May–June 2017. Five symptomatic leaves from five different plants were cut into small pieces, surface-sterilized with 1% sodium hypochlorite for 1 min, washed in sterile distilled water, placed on potato dextrose agar (PDA) plates and incubated

✉ Bandamaravuri Kishore Babu
kishorebanadam@cimap.res.in

¹ Department of Plant Pathology, Crop Protection Division, CSIR-Central Institute of Medicinal and Aromatic Plants (CIMAP), Lucknow 226015, India

² Microbial genomics and Diagnostic Lab, Regional Plant Resource Centre (RPRC), Bhubaneswar, Odisha 751015, India

³ Plant taxonomy and DNA fingerprinting Division, Regional Plant Resource Centre (RPRC), Bhubaneswar, Odisha 751015, India

Published online: 17 July 2019

Springer

प्रचारक/PRINCIPAL
क्षेत्रीय शिक्षा संस्थान
Regional Institute of Education
भुवनेश्वर / Bhubaneswar-751022

8/5/2019

Research Article

Antibacterial activity assessment of petroleum ether and methanolic extracts of *Achyranthes aspera* Linn (Amaranthaceae)

Preeti Mishra

TGT in Science, Middle School, Angardiha, West Singhbhum (Jharkhand), India

Anita Sha

PGT in Biology, KV, Chittaranjan (West Bengal), India

Poulami Bhakat

Department of Life Science Education (DESM), Regional Institute of Education, Bhubaneswar-751022 (Odisha), India

Sudipta Mondal

Department of Life Science Education (DESM), Regional Institute of Education, Bhubaneswar-751022 (Odisha), India

Animesh Kumar Mohapatra*

Department of Life Science Education (DESM), Regional Institute of Education, Bhubaneswar-751022 (Odisha), India

*Corresponding author. Email: akmcncert@gmail.com

Article Info

[https://doi.org/10.31018/](https://doi.org/10.31018/jans.v12i3.2319)

jans.v12i3.2319

Received: July 13, 2020

Revised: August 10, 2020

Accepted: August 17, 2020

How to Cite

Mishra, P. et al. (2020). Antibacterial activity assessment of petroleum ether and methanolic extracts of *Achyranthes aspera* Linn (Amaranthaceae). *Journal of Applied and Natural Science*, 12(3): 354 - 364. <https://doi.org/10.31018/jans.v12i3.2319>

Abstract

Achyranthus aspera is a common weed and known for various medicinal properties. The aim of the present study was to evaluate the antibacterial activities of different concentrations of methanolic and petroleum-ether leaf extracts of *A. aspera* against three gram-positive bacteria (*Micrococcus luteus*, *Bacillus subtilis*, *Streptococcus mitis*) and six gram-negative bacteria (*Escherichia coli*, *Pseudomonas aeruginosa*, *Klebsiella pneumonia*, *Salmonella typhi*, *Salmonella paratyphi A* (MTCC-3220), *Shigella flexneri*). The phytochemical screening of the leaf extract of the herb indicated the presence of flavonoides, tannins, saponins, polyphenolic compounds, alkaloids and glycosides. The methanolic extract at the highest concentration of 10 mg/ml showed prominent antibacterial activity in two gram-negative bacteria, i.e. *K. pneumoniae* and *E. coli* with 22 mm zone of inhibition and one gram-positive bacterium i.e. *M. luteus* with 19 mm zone of inhibition. The methanolic extract at 0.0781mg/ml concentration showed least antibacterial activity against all tested bacteria produced a zone of inhibition between 10 to 12 mm while petroleum ether extract of same concentration had moderate antibacterial activity against *S. flexneri* (15 mm zone of inhibition). It can be concluded that novel compounds like flavonoids, tannins, saponins, alkaloid, and polyphenolic compounds in *A. aspera* leaves have potent antimicrobial property.

Keywords: *Achyranthus aspera*, Antibacterial activity, Gram-negative, Gram-positive, Phytochemical

INTRODUCTION

The leading cause of World-wide deaths is due to infectious diseases. Though pharmaceutical industries have produced a wide range of antibiotics, resistance to these drugs by bacteria has increased as they have the genetic ability to acquire resistance. These drug-resistant bacteria are more pathogenic with high mortality rate and become a great challenge in the pharmaceutical and healthcare industry (Westh et al., 2004). To overcome these antibiotic-resistant bacteria, researchers are looking for alternative and novel

drugs. According to the World Health Organization (WHO), medicinal plants would be the best natural source to obtain a variety of compounds for the treatment of various infectious diseases (Vijayan et al., 2007). About 80% of the world's population relies on traditional medicines which has compounds derived from medicinal plants. In comparison to synthetic antibiotics, plant based drugs cause less or no side effects (Burt, 2004; Shariff et al., 2006; Dubey et al., 2011). Phytotherapy, the treatment of disease by the use of plants is a very old practice when a primitive man out of necessity and by intuition began to use plants to

This work is licensed under Attribution-Non Commercial 4.0 International (CC BY-NC 4.0). © : Author (s) Publishing rights @ ANSF.



प्रधान/PRINCIPAL
क्षेत्रीय शिक्षा संस्थान

Regional Institute of Education
भुवनेश्वर / Bhubaneswar-751022

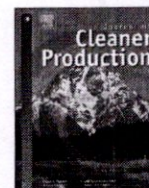
2019



Contents lists available at ScienceDirect

Journal of Cleaner Production

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



Review

A review on the recovery and separation of rare earths and transition metals from secondary resources



Nilam Swain, Sujata Mishra*

Department of Chemistry, Institute of Technical Education and Research (FET), Siksha 'O' Anusandhan Deemed to Be University, Khandagiri Square, Bhubaneswar, 751030, Odisha, India

ARTICLE INFO

Article history:

Received 10 November 2018
Received in revised form 6 February 2019
Accepted 9 February 2019
Available online 13 February 2019

Keywords:

Rare earth elements
EOL wastes
Leaching
Hydrometallurgical route
Solvent extraction

ABSTRACT

The continuous miniaturization of modern green and advanced technologies is increasing the demand of rare earth elements (REEs). Consequently, REEs are listed as the critical metals concerning their crucial role for a clean environment. However, their resources are limited which in turn disrupt their supply chain. To tackle the supply issue and to meet future demand, there is need to exploit recycling schemes for the recovery REEs from secondary resources. This review describes comprehensively various processes developed for the separation of REEs and transition metals from secondary resources. It focuses on the hydrometallurgical route, especially solvent extraction employed to separate REEs and transition metals from potential wastes originated from different industries. The use of different commercial extractants for the recycling purposes and mechanisms involved in the extraction has been discussed in detail.

© 2019 Elsevier Ltd. All rights reserved.

Contents

1. Introduction	884
2. Methodology	886
3. Results and discussion	886
3.1. Pretreatments of EOL wastes	886
3.2. Pyrometallurgical versus hydrometallurgical process	887
3.3. Leaching	887
3.4. Separation of rare earth and transition metals –different methodologies	887
3.4.1. Molten slag extraction	887
3.4.2. Supercritical fluid extraction	888
3.4.3. Liquid metal extraction	888
3.4.4. Liquid membrane extraction	888
3.5. Solvent extraction studies on separation of rare earth and transition metals	889
3.5.1. Acidic extractants	889
3.5.2. Basic extractants	889
3.5.3. Solvating extractants	894
3.5.4. Ionic liquids	895
4. Conclusions	896
Acknowledgements	896
References	896

1. Introduction

Rare earths in recent times have received much attention for

* Corresponding author.
E-mail address: drsjatamishra97@gmail.com (S. Mishra).

Nilam Swain
Assistant Professor
Department of Chemistry
FET, Siksha 'O' Anusandhan
Bhubaneswar, Odisha, India



Contents lists available at ScienceDirect

Journal of Alloys and Compounds

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

Hydrometallurgical route for recovery and separation of samarium (III) and cobalt (II) from simulated waste solution using tri-n-octyl phosphine oxide – A novel pathway for synthesis of samarium and cobalt oxides nanoparticles

Nilam Swain^a, Sujata Mishra^{a,*}, M.R. Acharya^b

^a Department of Chemistry, Institute of Technical Education and Research (FET), Siksha 'O' Anusandhan Deemed to be University, Khandagiri Square, Bhubaneswar, 751030, Odisha, India

^b Department of Physics, College of Basic Science and Humanities, OUAT, Bhubaneswar, 751003, Odisha, India



ARTICLE INFO

Article history:

Received 7 June 2019

Received in revised form

21 September 2019

Accepted 23 September 2019

Available online xxx

Keywords:

Hydrometallurgy

Recovery

Samarium (III)

Cobalt (II)

Synthesis

ABSTRACT

Samarium is a precious and expensive rare earth metal due to its potential service applications as samarium cobalt magnets at elevated temperature up to 500 °C. The untrammled demand of samarium and the supply risk of rare earth elements urge researchers to develop recycling processes. Distribution equilibrium of samarium (III) from nitrate medium with TOPO has been investigated taking into account variations in several extraction conditions. Extraction of samarium (III) was found quantitative (100%) using 0.05 M TOPO from 3 M NaNO₃ at aqueous pH 3. Based on slope analysis, the extracted species has been proposed as Sm (OH)₂ NO₃ .3TOPO which was very well supported by FTIR spectral studies. The influence of cobalt (II) on the extraction of samarium (III) has also been studied and in most of the cases there were no extraction of cobalt (II). Temperature had negative impact on the extraction of samarium (III) even in the presence of cobalt (II). Stripping of samarium (III) from loaded 0.05 M TOPO was 100% using 0.02 M HCl. Pure Sm₂O₃ was successfully recovered from stripped solution of samarium (III) and Co₃O₄ was recovered from raffinate following oxalate precipitation and calcination. The formation of samarium and cobalt oxide nanoparticles was confirmed from X-ray diffraction, FESEM and EDS studies.

© 2019 Elsevier B.V. All rights reserved.

1. Introduction

The meteoric growing exaction of REEs in diverse utilization for instance electronics, ceramic technology, electric vehicle batteries, magnetism, wind and solar energy conversion, catalysts in petroleum industries, phosphors, semiconductors, luminescence and laser materials is making them indispensable elements and is playing an important role in the transition toward low carbon, green economy [1,2]. These intensive demands of REEs have led the researchers to ascertain extraction and separation methods for obtaining high purity REEs. Excavation of REEs from primary resources and disposal of REEs based products to the environment have turned into environmental problems. To alleviate scarcity of REEs, the reprocessing of end-of-life products is required for

sustainable development. The end-of-life products from which REEs could be recycled are permanent magnets, NiMH batteries, lamp phosphors and FCC catalysts [3]. Permanent magnets based on rare earth and transition metals (RE-TM) e.g. Sm-Fe-N, Sm-Co and Nd-Fe-B are playing crucial role in modernization, particularly whenever there is matter of miniaturization and high efficiency. They have long range applications in electromechanical, electronic and magneto electronic devices, acoustics, motors in automobiles, storage devices, biomedical and many more [4–6]. Sm-Co magnets possess high curie temperature, high magnetic energy densities, resistant to corrosion and are thermally stable at elevated temperature [7]. Nd-Fe-B magnets show excellent magnetic properties at room temperature i.e. near about 200 °C but with increase in temperature their magnetic properties seem to dropdown. On the other hand, Sm-Co magnets could show excellent magnetic property near about 500 °C due to which they are used in aero-engine applications [8]. But the manufacture of Sm-Co magnets is expensive and requires energy consuming

* Corresponding author.

E-mail addresses: drsujatamishra97@gmail.com, sujatamishra@soa.ac.in (S. Mishra).

Nilam Swain

Principal
Regional Institute of Education
Bhubaneswar, Bhubaneswar

Materials Research Express



PAPER

Investigation of proton conductivity in Sc and Yb co-doped barium zirconate ceramics

RECEIVED
24 October 2018

REVISED
21 January 2019

ACCEPTED FOR PUBLICATION
12 February 2019

PUBLISHED
27 February 2019

Avishek Satapathy , Ela Sinha and S K Rout

Department of Physics, Birla Institute of Technology, Mesra, Ranchi-835215, India

E-mail: elasinha@gmail.com

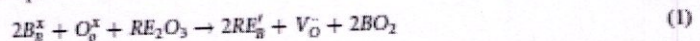
Keywords: ceramics, oxygen vacancies, proton conductivity, perovskites

Abstract

The oxygen deficient $\text{BaZr}_{0.85}\text{Sc}_{0.15-x}\text{Yb}_x\text{O}_{3-\delta}$ ($x = 0, 0.05, 0.10$) ceramics were synthesized via conventional solid state reaction route. The Rietveld analysis of the x-ray diffraction profile proved that all the prepared compositions presents single phase cubic perovskite symmetry and $Pm\bar{3}m$ space group. The actual oxygen occupancy of the materials has been derived from the Rietveld study. Thermo-gravimetric study of the pre-hydrated samples revealed a considerable mass loss, indicating more than 90% of the oxygen vacancies have been successfully filled by protonic defects upon hydration. FESEM images of the fractured surfaces of sintered ceramics showed dense microstructures with sub-micron sized grains and well resolved grain boundaries. The Nyquist plots differentiated the bulk, grain boundary and electrode response at lower temperatures ($\leq 300^\circ\text{C}$). The bulk conductivity of the Sc and Yb co-doped barium zirconate was higher compared to that of the respective Sc-doped perovskite oxide. The activation energy of bulk conductivity and total conductivity decreased with the increase in Yb content. The total conductivity of ($4.01 \times 10^{-3} \text{ Scm}^{-1}$) at 600°C has been achieved for $\text{BaZr}_{0.85}\text{Sc}_{0.10}\text{Yb}_{0.05}\text{O}_3$, suggesting the composition suitable for SOFC applications.

1. Introduction

High temperature ($\geq 800^\circ\text{C}$) solid oxide fuel cell (SOFC) qualifies to be the most promising renewable energy conversion technology for stationary power generation in future [1–4]. Developing highly efficient components of an SOFC such as the electrolyte, electrodes and simultaneously reducing its operating temperature ($\leq 600^\circ\text{C}$) is a major challenge. Perovskite structured materials with general formula $[\text{A}^{2+}\text{B}^{++}\text{O}_6]^{2-}$ are explored in a variety of ways for preparation of different SOFC components [5–8]. The perovskite-type oxides like barium zirconate (BaZrO_3) and barium cerate (BaCeO_3) when doped with trivalent rare earth elements shows exceptional protonic or oxide ion conduction at intermediate temperatures ($< 700^\circ\text{C}$). These acceptor-doped perovskites are therefore considered as suitable candidates for application as an electrolyte in SOFC, solid electrolytes for hydrogen production, hydrogen and oxygen sensors etc [4, 9–13]. The trivalent rare earth (RE) substitution on the B-site/tetavalent-site of the perovskites results in the creation of oxygen vacancies as per equation (1)



Where Kroger-Vink notation is used to represent different symbols, V_O^{2-} symbolizes the oxygen vacancy, 2RE_B^{3+} indicates the trivalent rare earth dopant at B-sites and O_O^{2-} represents the oxide ion at oxygen sites. The oxygen vacancies (OVs) are induced in the perovskite crystal structure to maintain charge neutrality on the substitution of lower valence ions at tetavalent B^{++} site. The creation of OV in the lattice is a pre-requisite condition for proton conduction when these materials are exposed to humid H_2O environment. The defect chemistry reactions that describes the H_2O absorption in a proton conducting electrolyte at intermediate temperatures is given as



Where, OH_O^- represents an oxide ion bonded to a proton (protonic defects) [14]. The hydroxide ions fill the oxygen vacancy sites as shown in equation (2), while the other proton of the water molecule forms a covalent

Avishek Satapathy

प्राचार्य / PRINCIPAL
 क्षेत्रीय शिक्षा संस्थान
 Regional Institute of Education
 भुवनेश्वर / Bhubaneswar-751022



Contents lists available at ScienceDirect

Journal of Alloys and Compounds

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



A comparative proton conductivity study on Yb-doped BaZrO₃ perovskite at intermediate temperatures under wet N₂ environment

Avishek Satapathy, Ela Sinha*

Department of Physics, Birla Institute of Technology, Mesra, Ranchi, 835215, India

ARTICLE INFO

Article history:
Received 30 May 2018
Received in revised form 28 August 2018
Accepted 31 August 2018
Available online 3 September 2018

Keywords:
Oxygen vacancies
Perovskite
Proton conductivity
Protonic defects

ABSTRACT

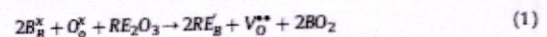
Conventional solid state reaction route was used for the synthesis of oxygen deficient BaZr_{1-x}Yb_xO₃ (x = 0.05, 0.10, 0.15, 0.20) oxide. Rietveld refinement of x-ray diffraction data confirmed the formation of mono-phasic cubic perovskite structure with space group Pm3m. The microstructure coupled with EDX analysis of the sintered ceramics reveals the formation of sub-micron sized grains, with no detection of impurity elements. Thermogravimetric analysis of the pre-hydrated sample shows a significant mass loss suggesting complete filling of oxygen vacancies by protonic defects. Impedance spectroscopy performed under wet N₂ environment show highest proton conductivity for the composition with x = 0.20. The total conductivity at 600 °C significantly increased from the order of 10⁻⁵ Scm⁻¹ for x = 0.05 to 10⁻³ Scm⁻¹ for x = 0.20 composition. The activation energy calculated from the Arrhenius dependence of total conductivity decreased with an increase in trivalent Yb³⁺ concentration, since the number of charge carriers in the form of protonic defects increases.

© 2018 Elsevier B.V. All rights reserved.

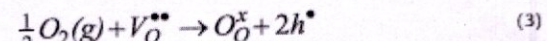
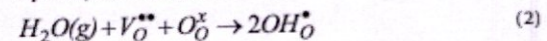
1. Introduction

Traditional oxide ionic conductors, such as yttria stabilized zirconia (YSZ), La_{0.9}Sr_{0.1}Ga_{0.8}Mg_{0.2}O_{2.85} (LSGM), La₂Mo₂O₉ etc. ceramics have been studied extensively for high temperature (>800 °C) solid electrolyte applications. However, several intrinsic constraints of these materials such as high conductivity values obtained at very high temperatures (>800 °C), structural instability over a wide temperature range (phase transition) and tendency to undergo interfacial reactions demanded the development of substitutes for these materials [1–3]. Overcoming these drawbacks pose a great challenge to material scientists to develop novel materials with high proton/ionic conductivity at intermediate temperatures (300 °C–600 °C) for application in solid oxide fuel cells (SOFC), hydrogen sensors, oxygen sensors, and solid oxide steam electrolyzers etc. Doping with trivalent rare earth (RE) elements or lanthanides have proven very much beneficial in altering the electronic, optical and other physical properties of a wide variety of materials [4–6]. Rare earth (RE) element doped perovskite-type ceramic oxides based on zirconates such as BaZrO₃ (BZO) and cerates such as BaCeO₃ attract an increasing attention in recent years

due to their excellent proton or oxide ion and/or mixed conductivity at intermediate temperatures [7–12]. In such perovskite-type oxides [A²⁺B⁴⁺O₃²⁻], substituting trivalent rare earth cation RE³⁺ into the B⁴⁺ site forms oxide ion vacancy as given in equation (1)



where the equation is written by using Kröger–Vink notation. Here 2RE_B^{*} represents the acceptor dopant at B-sites and O_O^x is the oxide ion at Oxygen sites, and V_O^{**} indicates the oxygen vacancy. The oxygen vacancies (OVs) are induced as a charge-compensating effect when lower valent ions are substituted at B⁴⁺ site in the perovskite structure. The introduction of oxygen vacancy in the lattice position plays an important role in oxide ion or proton conduction which appears in water vapour and oxygen containing atmosphere respectively. The defect chemistry reactions for H₂O or O₂ incorporation at intermediate temperature (300 °C–600 °C) for a proton/oxide ion conductor is given as



where, OH_O[•] is a proton bonded to an oxide ion (protonic defects)

* Corresponding author.
E-mail address: elasinha@gmail.com (E. Sinha).

Avishek Satapathy

Principal
Regional Institute of Education
Bhubaneswar / Bhubaneswar-751022



RESEARCH ARTICLE

Leaf photosynthesis and antioxidant response in selected traditional rice landraces of Jeypore tract of Odisha, India to submergence

Jijnasa Barik¹ · Debabrata Panda¹ · Sangram K. Mohanty² · Sangram K. Lenka³

Received: 10 December 2018 / Revised: 26 March 2019 / Accepted: 26 April 2019 / Published online: 18 May 2019
 © Prof. H.S. Srivastava Foundation for Science and Society 2019

Abstract Submergence tolerance in rice is important for improving yield under rain-fed lowland rice ecosystem. In this study, five traditional rice landraces having submergence tolerance phenotype were selected. These five rice landraces were chosen based on the submergence-tolerance screening of 88 rice landraces from various lowland areas of Jeypore tract of Odisha in our previous study. These five rice landraces were further used for detailed physiological assessment under control, submergence and subsequent re-aeration to judge their performance under different duration of submergence. Seedling survival was significantly decreased with the increase of plant height and significant varietal difference was observed after 14 days of complete submergence. Results showed that submergence progressively declined the leaf photosynthetic rate, stomatal conductance, instantaneous water use efficiency, carboxylation efficiency, photosystem II (PSII) activity and chlorophyll, with greater effect observed in susceptible check variety (IR 42). Notably, higher activities of antioxidative enzymes and ascorbate level were observed in traditional rice landraces and were found comparable with the tolerant check

variety (FR 13A). Taken together, three landraces such as *Samudrabali*, *Basnamundi* and *Gadaba* showed better photosynthetic activity than that of tolerant check variety (FR 13A) and showed superior antioxidant response to submergence and subsequent re-aeration. These landraces can be considered as potential donors for the future submergence tolerance breeding program.

Keywords Antioxidant · Gas exchange · Traditional rice · Photosynthesis · PSII activity · Submergence

Introduction

Complete submergence due to flash flooding is one of the foremost constraints for rice production, mainly in rainfed lowland areas of South and South-East Asia (Dar et al. 2017; Afrin et al. 2018). Out of ~ 20 million ha of rainfed lowland rice growing areas, 12–14 million ha in India are prone to flash flooding with average productivity of only 0.5–0.8 t ha⁻¹, which is far lower than that of national average productivity (Ismail et al. 2013; Bhowmick et al. 2014). The yield gap is substantially high because of the high yielding rice varieties grown in these areas are susceptible to submergence and perish within 7–14 days (d) of waterlogging (Sarkar et al. 2006; Ismail et al. 2013; Singh et al. 2017). Therefore breeding for submergence tolerance trait will be crucial for maintaining stable yields in these rainfed lowland rice ecosystems (Dar et al. 2017; Goswami et al. 2017). In the last decade, molecular mechanisms underlying flash flood tolerance have been revealed by the identification of major QTL, *Sub1* from FR 13A, a submergence tolerant rice cultivar of Odisha, India (Xu et al. 2006). This QTL has been successfully introgressed into several high yielding varieties and flash flood-tolerant

Electronic supplementary material The online version of this article (<https://doi.org/10.1007/s12298-019-00671-7>) contains supplementary material, which is available to authorized users.

✉ Debabrata Panda
 dpanda80@gmail.com

- ¹ Department of Biodiversity and Conservation of Natural Resources, Central University of Orissa, Koraput, Odisha 764021, India
- ² CNCB Academy of Science and Technology, Cuttack, Odisha 754159, India
- ³ TERI-Deakin NanoBiotechnology Centre, The Energy and Resources Institute, Gurugram, Haryana 122 001, India



Data Article

Data on genetic potentiality of folk rice (*Oryza sativa* L.) genotypes from Koraput, India in reference to drought tolerance traits



Debabrata Panda^{a, *}, Swati S. Mishra^a, Sangram K. Mohanty^b,
Prafulla K. Behera^a, Sangram K. Lenka^c

^a Department of Biodiversity and Conservation of Natural Resources, Central University of Orissa, Koraput, 764 021, Odisha, India

^b National Rice Research Institute (ICAR), Cuttack, 753 006, Odisha, India

^c TERI-Deakin NanoBiotechnology Centre, The Energy and Resources Institute, Gurugram, Haryana, 122 001, India

ARTICLE INFO

Article history:

Received 6 May 2019

Received in revised form 27 July 2019

Accepted 29 July 2019

Available online 12 August 2019

Keywords:

Drought tolerance

Indigenous rice

Simple sequence repeat

Microsatellite panel

ABSTRACT

Precise physiological and molecular marker-based assessment provides information about the extent of genetic diversity, which helps for effective breeding programmes. We have conducted detailed physiological and molecular marker-based assessment of selected eight indigenous rice landraces from Koraput, India along with tolerant (N22) and susceptible (IR64) check varieties under control and simulated drought stress using polyethylene glycol (PEG) 6000. After exposure to different levels of drought stress, relative germination performance (RGP), seedling vigour index (SVI) and relative growth index (RGI) were significantly declined in all the rice landraces compared to the control plants and significant varietal differences were observed. Genetic relationship among the studied rice landraces was assessed with 24 previously reported drought tolerance linked Simple Sequence Repeat (SSR) markers. A total of 53 alleles were detected at the loci of the 24 markers across the 10 rice accessions. The Nei's gene diversity (H_e) and the polymorphism information content (PIC) ranged from 0 to 0.665 and 0 to 0.687, respectively. Six SSR loci, RM276, RM411, RM3, RM263, RM216 and RM28199, provided the highest PIC values and are potential for exploring the genetic diversity of studied rice lines for drought tolerance. Four rice genotypes

* Corresponding author.

E-mail address: dpanda80@gmail.com (D. Panda).

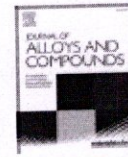
<https://doi.org/10.1016/j.dib.2019.104363>

2352-3409/© 2019 The Author(s). Published by Elsevier Inc. This is an open access article under the CC BY license (<http://creativecommons.org/licenses/by/4.0/>).

प्रधान/PRINCIPAL
क्षेत्रीय शिक्षा संस्थान
Regional Institute of Education
भुवनेश्वर/Bhubaneswar-751022



Contents lists available at ScienceDirect
Journal of Alloys and Compounds
journal homepage: <http://www.elsevier.com/locate/jalcom>



Conduction and relaxation phenomena in barium zirconate ceramic in wet N₂ environment



Avishek Satapathy, Ela Sinha*, Bibek K Sonu, S.K. Rout

Electroceramics Laboratory, Department of Physics, Birla Institute of Technology, Mesra, Ranchi, 835215, Jharkhand, India

ARTICLE INFO

Article history:
Received 30 June 2019
Received in revised form 26 August 2019
Accepted 26 August 2019
Available online 28 August 2019

Keywords:
Oxygen vacancies
Ceramics
Perovskite
Barium zirconate

ABSTRACT

Proton conducting barium zirconate perovskite was prepared by conventional mixed oxide reaction route. The x-ray diffraction patterns proved the single phase cubic perovskite structure of the synthesized ceramic. SEM analysis of the ceramic pellets sintered at 1600 °C reveals the formation of dense micro-structure with average grain size of 5–6 μm. Complex impedance spectroscopy study was performed over a wide range of frequency (10 Hz–5 MHz) under wet N₂ (pH₂O = 0.031 atm) and dry N₂ environment respectively varying the temperature from 300 °C to 600 °C. Two types of relaxation phenomena were evident from the impedance spectroscopic analysis, indicating the effect of grain and grain boundary to the overall resistance of the compositions. The conductivity due to grain and grain boundary contributions measured for the sample under wet N₂ environment was found fairly one order higher in magnitude than that measured in dry N₂ atmosphere respectively. The activation energy for conduction under wet N₂ condition is found lower than that measured in dry conditions. The comparison of conductivity under two different environments reveals that additional charge species take part in conduction process under wet condition. These are attributed to the protonic defects which are incorporated into barium zirconate through extrinsic oxygen vacancies generated due to sintering at higher temperature.
© 2019 Elsevier B.V. All rights reserved.

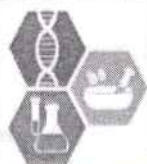
1. Introduction

The development of barium zirconate (BaZrO₃) ceramic has gained considerable interest for its versatile applications such as dielectrics for electronic systems, substrates for growth of high T_c superconductors, phosphors for different coloured light emission, field emission displays and green catalysts etc. [1–4]. BaZrO₃ (BZO) is a very promising material for its highly symmetric cubic perovskite structure which shows excellent structural stability (no phase transition) over a wide range of temperatures. The high melting point (>2600 °C), low thermal expansion coefficient (0.87 × 10⁻⁵ °C⁻¹) and negligible chemical reactivity to different reducing conditions like CO₂ and H₂O are some of the interesting physical properties of BZO which are exploited for several high temperature applications [5–8]. Due to this thermal and chemical stability, BZO has potential application in refractory industry [9]. This multifunctional material also qualify to develop as an alternative electrolyte material in solid oxide fuel cells (SOFCs), replacing traditional oxide ion conductors like yttria stabilized

zirconia (YSZ) and La_{0.9}Sr_{0.1}Gd_{0.8}Mg_{0.2}O_{2.85} (ISGM) etc. which operates at high temperatures ≥800 °C [10,11]. Perovskite BaZrO₃ (BZO) is considered as an efficient proton conductor at intermediate temperatures ≤600 °C when doped with rare earth elements and exposed to H₂ or H₂O environment [12–15]. The thermal and chemical stability of the BZO under different reducing environments attracts attention and various researchers have reported varied total conductivity (of the order of 10⁻⁶–10⁻² S cm⁻¹) for nominally identical compositions [16–18]. These troubling discrepancies in the reported conductivity of doped-BZO over these years are attributed to various factors that govern the ionic conductivity [19]. The poor sinterability of BZO ceramic results in low density, which is a limiting factor to be used as an SOFC electrolyte. The reduced density or a high percentage of porosity results in decreased ionic conductivity of the BZO ceramic. High bulk density is one of the essential requirements of a material to serve as an SOFC electrolyte which ensures the ionic transfer takes place at a faster rate throughout the bulk of the material. There are reports where the relative density of only 70% could be achieved for pure BZO after intermediate heating of compact pellets at 1200 °C for 72 h and final sintering of 1350 °C for 48 h [20]. Hence researchers have tried different methods of synthesis for obtaining highly dense BZO ceramics. A wide range of wet chemical process using

* Corresponding author.
E-mail address: elasinha@bimmesra.ac.in (E. Sinha).

Avishek Satapathy
Regional Institute of Education
Bhubaneswar-75102



E-ISSN: 2278-4136
P-ISSN: 2349-8234
JPP 2019; 8(1): 2717-2725
Received: 01-11-2018
Accepted: 05-12-2018

Sanjeeb K Das
Department of Botany, Regional
Institute of Education (NCERT),
Bhubaneswar, Odisha, India

Mahendra K Satapathy
Department of Botany, Regional
Institute of Education (NCERT),
Bhubaneswar, Odisha, India

Sidhanta S Bisoi
Department of Botany, Regional
Institute of Education (NCERT),
Bhubaneswar, Odisha, India

Rama C Mohanty
Emeritus Scientist, Department
of Botany, Utkal University,
Vanivihar, Bhubaneswar,
Odisha, India

Biodiversity of RIE campus: Plants with medicinal value

Sanjeeb K Das, Mahendra K Satapathy, Sidhanta S Bisoi and Rama C Mohanty

Abstract

Bhubaneswar, the capital city of Odisha located in the Khurda district of Odisha, India, stands between 20°12'N to 20°25'N latitude and 85°44'E to 85°55'E longitude on the western fringe of the coastal plain across the main axis of the Eastern Ghats. Regional Institute of Education (RIE), a constituent unit of National Council of Educational Research and Training, New Delhi, established in 1963 with total geographic area of about 98.4 ac (407000 sq.mt.) stands in the heart of the capital city. About 60 percent of this institute's geographical area is having wilderness. In search for medicinal plants in the wet season of 2018, about 111 plant species belong to 98 genera of 53 families having medicinal value were recorded from the campus. Due to over exploitation and loss of biodiversity, a number of medicinal plants were under serious threat. Of the plants recorded 10 and 101 species were found to belong to monocots and dicots respectively. Among dicot, Euphorbiaceae was the dominant family represented by 10 species. Similarly in monocot species, family Poaceae represented by 3 species were recorded. *Paderia foetida* and *Saraca asoca* fell into the Rare, Endangered and Threatened (RET) group and are very effective against various diseases. The genus *Phyllanthus* was represented as by six species. With degradation of environment because of anthropogenic activities, due care needs to be taken to conserve the biodiversity especially plants having medicinal value for sustainable use.

Keywords: Floral diversity, medicinal plants, ethno botany, conservation

Introduction

Medicinal plants have been playing an essential role in the development of human culture. As a source of medicine, Medicinal plants have always been at forefront virtually all cultures of civilizations. Medicinal plants are regarded as rich resources of traditional medicines and from these plants many of the modern medicines are produced. For thousands of years medicinal plants have been used to treat health disorders, to add flavor and conserve food and to prevent diseases epidemics. The secondary metabolites produced by the plants are usually responsible for the biological characteristics of plant species used throughout the world. The microbial growth in diverse situations is controlled by plant derived products. In this review we gave general overview of the medicinal plants. According to the World Health Organization (WHO) about 65-80% of the world's population in developing countries depends essentially on plants for their primary healthcare due to poverty and lack of access to modern medicine (Awoyemi OK *et al.*, 2012) [1]. Thousands of plants are used by rural and tribal communities to make crude drugs to cure various ailments. India is a highly populated country and it is difficult to provide medicine for all the people. However, the majority of the rural people use the plants as it is or their parts which are found in and around their locality as primary health care (Ramesh *et al.*, 2014) [2]. Therefore, it is important to protect and restore the plants around their living place.

Materials and Methods

The study Area:

Bhubaneswar is located in the Khurda district of Odisha, India between 20°12'N to 20°25'N latitude and 85°44'E to 85°55'E longitude on the Western fringe of the coastal plain across the main axis of the Eastern Ghats. It is situated on the South Eastern Railway line joining Howrah and Madras at a distance of 435 km South of Calcutta. The National Highway No.5 connecting Calcutta and Madras passes through Bhubaneswar. The city stands at the Western side of the "Mahanadi Delta" on the bank of river Kuakhai, a distributary of Mahanadi River, 30 km South-West of Cuttack city. The river Daya which has branched off from Kathojodi, flows along the South-eastern part of the city. Fig.1 (A)

Regional Institute of Education (RIE), a constituent unit of National Council of Educational

Correspondence

Sanjeeb K Das
Department of Botany, Regional
Institute of Education (NCERT),
Bhubaneswar, Odisha, India

Sanjeeb

Principal
Regional Institute of Education
Bhubaneswar, Odisha, India

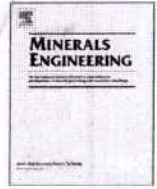
2019



Contents lists available at ScienceDirect

Minerals Engineering

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



Efficiency of Aliquat 336 for hydrometallurgical separation of Sm (III) and Co (II) from nitrate medium

Nilam Swain, Sanghamitra Pradhan, Sujata Mishra*

Department of Chemistry, Institute of Technical Education and Research (FET), Siksha 'O' Anusandhan Deemed to be University, Khandagiri Square, Bhubaneswar 751030, Odisha, India

ARTICLE INFO

Keywords:
Separation
Sm (III)
Co (II)
Aliquat 336
Kerosene

ABSTRACT

The recovery of rare earths elements (REEs) has become crucial due to their extensive use in progressive technologies. Processing of end-of-life products such as nickel-metal hydride batteries, permanent magnets and fluorescent lamps have turn out to be necessary because REEs are of limited availability due to growing demand. The present research deals with the study of separation of Sm (III) and Co (II) from nitrate medium using Aliquat 336 blended with propanol as modifier and kerosene as diluent. The effects of pH, nitrate ion, Aliquat 336 concentration, diluents, temperature and phase volume ratio on the separation of two metal ions have been examined. Extraction of Sm (III) increases with increase in pH, nitrate ion concentration and Aliquat 336 molarity. Extraction isotherm shows three theoretical stages for complete extraction of Sm (III) in presence of Co (II). Increase in shaking time and temperature have positive influence on the extraction process and complete stripping of Sm (III) has been achieved using 0.01 mol/L hydrochloric acid.

1. Introduction

In recent decades, the field of rare earth elements (REEs) has transfixed researchers throughout the world due to their enormous importance for green and low-carbon economy. REEs are currently regarded to be among the most critical elements and have got considerable usage in electric car motors, wind hydropower generators, nickel metal hydride batteries, lithium ion batteries, catalysts, computer hard drives, luminescent screens etc. They are also used in nuclear reactors, surgical instruments, missile parts, defence technologies and many more (Xie et al., 2014; Makanyire et al., 2016; Binnemans et al., 2013). So the recycling of consumer goods at end-of-life is requisite to afford the increasing demand of today's generation. Recycling of REEs is the best complementary approach to get rid of the so-called "Balance Problem" (Haque et al., 2014). In recent studies emphasis is given on the recovery and recycling of REEs to ensure the forthcoming demands with endorsement as well as minimal environmental pollution. Permanent magnets like Samarium-cobalt (SmCo) and Neodymium-iron-boron (NdFeB) composed of rare earth elements are pulling eyesight because of their wide range of applications like military technologies, missiles, aircrafts etc. Unlike NdFeB permanent magnet, the magnetic strength of SmCo magnets remains unchanged at high temperature (Gutfleisch et al., 2011). During the production of SmCo magnets, nearly 15–30% of raw material is wasted as scraps due to finishing and polishing. There

are about 30–40% Sm, 50–60% Co in a typical samarium cobalt magnet scrap along with traces of other metals like Cu, Fe, Ni, Zr (Liu and Chinnasamy, 2012). So recovery of metals from these magnetic scraps and spent magnets can be considered as the superfine alternative source of value added metals like Sm and Co. A number of studies based on recovery of Nd, Fend other metals from spent sintered NdFeB magnets/sludge have been reported (Dupont and Binnemans, 2015; Lee et al., 2013; Lyman and Palmer, 1993; Riano et al., 2017; Sun et al., 2018). The separation of samarium and cobalt from their leached solution using Cyanex 572 as extractant diluted in kerosene was carried out (Sinha et al., 2017). They adopted four stages like acid leaching, solvent extraction, precipitation and calcination to recover samarium oxide (Sm₂O₃) and cobalt oxide (Co₃O₄) from SmCo magnet scrap. Solvent extraction is the most valuable method used for the separation and purification of rare earth elements from transition metals in the field of hydrometallurgy (Tunsu et al., 2016). This is due to its speed, wide scope and effectiveness at micro and macro level. The selectivity of extractant and relative solubility of the complexes formed by the metal with extractant plays a decisive role in the separation of metal ions (Rydberg et al., 2004). The chelator - induced recovery of rare earths from the end of life fluorescent lamps with the help of mechano-chemical energy have been performed (Hasegawa et al., 2018). Using ionic liquids as extracting agents, separation of rare earths from fluorescent lamp wastes have also been carried out (Pavon et al., 2018). The waste

* Corresponding author.

E-mail address: sujatamishra@soa.ac.in (S. Mishra).

<https://doi.org/10.1016/j.mineng.2019.105872>

Received 19 February 2019; Received in revised form 10 July 2019; Accepted 11 July 2019

Available online 19 July 2019

0892-6875/ © 2019 Elsevier Ltd. All rights reserved.

Nilam Swain

Principal
Regional Institute of Education
Bhubaneswar

2018

PAPER

Check for updates

Disulfide metathesis via sulfur...iodine interaction and photoswitchability†

Cite this: *Org. Biomol. Chem.*, 2021, 19, 8539

Ashis Mathuri, Milan Pramanik, Amarchand Parida and Prasenjit Mal

Received 11th August 2021, Accepted 10th September 2021

DOI: 10.1039/d1ob01581h

rsc.li/obc

The idea of constitutional dynamic chemistry (CDC) and dynamic combinatorial chemistry (DCC) is wide-spread in the literature using the chemistry of disulfides. The synthesis of unsymmetrical diaryl disulfides is challenging due to the presence of a weak S-S bond. We report herein the synthesis of unsymmetrical diaryl disulfides from two symmetrical disulfides via a cross-metathesis reaction which was controlled by a weak sulfur...iodine (S...I) interaction. The unsymmetrical disulfides were stable in acetonitrile solution in the presence of N-iodosuccinimide (NIS) and found to be reversibly photoswitchable to the symmetrical disulfides under visible light irradiation.

Introduction

The concept of constitutional dynamic chemistry (CDC) and dynamic combinatorial chemistry (DCC) is well known in disulfide chemistry. Due to the presence of weak S-S bonds, the formation of many products is possible in equilibrium. Among disulfides, unsymmetrical disulfides are challenging to synthesize due to the chemoselectivity factor. The synthesis of unsymmetrical disulfides is possible using thiols as cross dehydrogenating coupling partners. However, the use of thiols for the synthesis of unsymmetrical disulfides has less practical utility because of their unpleasant odors. In addition, disulfide exchange reactions are also reported by using thiolate ions, solid-state exchange processes in the presence of a basic catalyst, irradiation with UV light, etc. The disulfide exchange methodology is also popularly used for the construction of various supramolecular architectures.

Disulfides are ubiquitously found in many organic and inorganic compounds of biological importance. Selective examples of disulfides used as drugs are shown in Fig. 1a. The cleavage and recombination of organo-disulfides or polysulfides generally lead to the disulfide exchange process. The exchange process is adapted to generate, alter, and degrade biologically active materials and substances. The sulfur-sulfur (S-S) bond in disulfides is easily cleavable in a reversible way using various chemical processes. The S-S bond cleavage is known to occur both heterolytically and homolytically. During homolytic cleavage, sulfonyl radicals are mainly gener-

ated through heating, photolysis, and oxidation processes. On the other hand, heterolytic cleavage requires ionic scission to produce a sulfenium ion (cation) either under acidic/electrophilic conditions or from mercaptides under basic/nucleophilic conditions.

Small molecule system chemistry has gained significant attention in supramolecular chemistry because it has revolutionized the constitution of complex molecular architectures. Noncovalent or weak interactions have substantial effects on organic systems to obtain selectivities in product formation by mimicking biological phenomena. The use of noncovalent interactions like chalcogen bonding, hydrophobic effect, halogen bonding, anion-π, cation-π, S-H...π, S...O, etc., which have utilities in organic synthesis, is emerging at a fast pace.

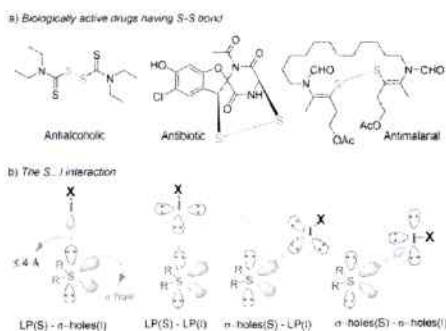


Fig. 1 (a) Examples of disulfides in natural products and drugs. (b) Types of S...I interaction.

School of Chemical Sciences, National Institute of Science Education and Research (NISER), HBNI, Bhubaneswar, PO Bhubaneswar, Via Jatni, District Khurda, Odisha 752050, India. E-mail: pmal@niser.ac.in

† Electronic supplementary information (ESI) available: NMR spectra and data. See DOI: 10.1039/d1ob01581h

Amarchand Parida

Prasenjit Mal

प्राचार्य/ PRINCIPAL
क्षेत्रीय शिक्षा संस्थान
Regional Institute of Education
भुवनेश्वर/ Bhubaneswar-751022

Unsymmetrical Disulfides Synthesis via Sulfenium Ion

Amarchand Parida, Khokan Choudhuri, and Prasenjit Mal^[a]

Abstract: An umpolung approach for the synthesis of unsymmetrical disulfides via sulfenium ion is reported. In situ generated electrophilic sulfenium ion from electron-rich thiols reacted with second thiols to yield unsymmetrical disulfides. Using an iodine catalyst and 4-dimethylaminopyridine (DMAP)/water as promoter, the target syntheses were achieved in one pot under aerobic condition.

Organic disulfides are important functional moieties found in various marine natural products,^[1] pharmaceuticals,^[2] materials^[3] and polymers.^[4] Disulfides are also known for their odors especially in kitchen items, like in onions and garlics.^[5] Pharmaceutically active disulfides are known to have anti-inflammatory,^[6] antitumour,^[7] antioxidants^[8] and antiulcer^[9] activities. Chemically, organo-disulfides are being used in catalyst,^[10] in ligand designing,^[11] towards producing fine chemicals and in functional group protections.^[12] In addition, the concept of constitutional dynamic chemistry (CDC)^[13] and dynamic combinatorial chemistry (DCC)^[14] is documented using the chemistry of disulfides. Due to the reversibility nature of the disulfide bond, formation of many products could be possible when more than one thiol building blocks present in equilibrium.^[15] Therefore, it's always challenging to synthesize selectively any unsymmetrical disulfides from mixture of thiols in one pot.^[16]

In Figure 1 a, few examples of either pharmaceutically important or naturally occurring molecules containing disulfides functionalities are shown.^[16] The known approaches for the synthesis of disulfides are mainly based on using molecular oxygen,^[17] transition metals,^[18] phosphine-free cationic rhodium(I) complex catalyst,^[19] Cu-phenanthroline catalyst,^[20] base catalyzed,^[21] non-transition metals,^[22] oxidants,^[23] sodium perborate,^[24] metal organic frame works (MOFs),^[25] microwave assisted,^[26] electrochemical methods,^[27] etc. Recently Dethe and co-workers developed synthesis of unsymmetrical disulfides using fac-Ir(ppy)₃ as photocatalyst and visible light from white LED (Figure 1 b).^[28] Similarly, unsymmetrical disulfide synthesis is also reported using O₂ as the oxidant and cobalt(III)phthalocyanine-tetra-sodium sulfonate as the catalyst (Figure 1 b).^[29] Herein, we report one pot synthesis of unsymmetrical organo-disulfides (Figure 1 c) via umpolung approach in ethanol sol-

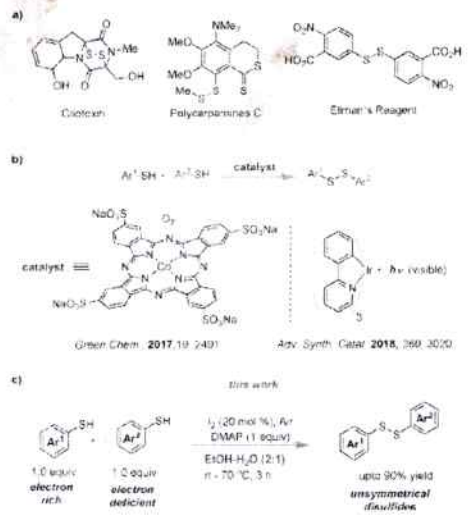


Figure 1. a) Unsymmetrical disulfides in natural products and a symmetrical disulfide in Ellman's reagent. b) Synthesis of unsymmetrical disulfides using catalysts like cobalt/phthalocyanine^[29] and photoredox catalysis.^[28] c) Our current approach.

vent, using molecular iodine as catalyst (20 mol%) and 4-dimethylaminopyridine (DMAP)-water as promoter of the reaction.

Controlling of chemical reactions by non-covalent or weak interactions are gaining significant interests. To make newer or functional materials on demand appropriate interactions like halogen bonding,^[30] charge-transfer,^[31] hydrophobic effect,^[32] cation-π,^[33] anion-π,^[34] etc. are generally used routinely. The concept of S-H...π hydrogen bonding interaction has been newly introduced in literature.^[35] Due to the S-H...π interaction, hydrogens of thiols prefer to form a stable complex with the π-electrons of arenes (Scheme 1 a). Contrastingly, we have shown here that via umpolung reactivity of sulfur or S-H bond, direct C-S coupling could be possible through an intermediate sulfenium ion (Scheme 1 b).^[36] In ethanol solvent, sulfenium ions were generated in situ using molecular iodine as catalyst and DMAP-water as a promoter of the reaction (vide infra).^[27] From the mixture of electron rich and electron deficient thiols, electron rich thiols tend to make more stable sulfenium ions. Following, electrophile sulfenium ions expected to react with the second thiols and followed by oxidation led to thermodynamically stable^[36] unsymmetrical disulfides (Scheme 1 c).

Towards optimization of the condition (Table 1), reactions were carried out at ambient temperature, under aerobic condi-

[a] Dr. A. Parida, K. Choudhuri, Dr. P. Mal
School of Chemical Sciences
National Institute of Science Education and Research (NISER)
HBNI, Bhubaneswar, PO Bhubaneswar-Via Jatni, District Khurda,
Odisha 752050 (India) | <https://www.niser.ac.in/users/pmal/profile-main>
E-mail: pmal@niser.ac.in

Supporting information and the ORCID identification numbers for the authors of this article can be found under:
<https://doi.org/10.1002/asia.201900620>

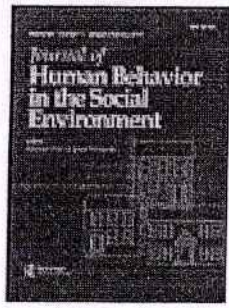
Amarchand Parida

Principal

प्राचार्य / PRINCIPAL
क्षेत्रीय शिक्षा संस्थान
Regional Institute of Education
भुवनेश्वर / Bhubaneswar-751022

2018

16



Journal of Human Behavior in the Social Environment

Routledge
Taylor & Francis Group

ISSN: 1091-1359 (Print) 1540-3556 (Online) Journal homepage: <http://www.tandfonline.com/loi/whum20>

Role of parents in the development of social competency among adolescents

Indu Bala Agarwal & Prakash Chandra Agarwal

To cite this article: Indu Bala Agarwal & Prakash Chandra Agarwal (2018): Role of parents in the development of social competency among adolescents, Journal of Human Behavior in the Social Environment, DOI: [10.1080/10911359.2018.1465004](https://doi.org/10.1080/10911359.2018.1465004)

To link to this article: <https://doi.org/10.1080/10911359.2018.1465004>



Published online: 25 Apr 2018



Submit your article to this journal [↗](#)



Article views: 16



View Crossmark data [↗](#)

Full Terms & Conditions of access and use can be found at
<http://www.tandfonline.com/action/journalInformation?journalCode=whum20>

 प्रादेशीय शिक्षा संस्थान
Regional Institute of Education
भुवनेश्वर / Bhubaneswar-751022



Magnetization reversal and tunable exchange bias in $GdCr_{1-x}Mn_xO_3$ ($x=0-0.50$)



Bibhuti B. Dash, S. Ravi*

Department of Physics, Indian Institute of Technology Guwahati, Guwahati 781039, India

ARTICLE INFO

Keywords:

Gadolinium chromites
Weak ferromagnetism
Magnetization reversal
Tunable exchange bias

ABSTRACT

Single phase samples of $GdCr_{1-x}Mn_xO_3$ ($x=0-0.50$) were prepared and their magnetic properties were studied by measuring temperature and field variations of magnetization. The Neel temperature, T_N is found to decrease from $T_N=174$ K for $x=0$ to 91 K for $x=0.50$. The magnetization reversal persists upto 5 at% of Mn substitution with a magnetic compensation temperature, T_{comp} of 136 K and 139 K for $x=0$ and 0.05 respectively. However, spin reorientation induced magnetization reversal emerges for $x=0.40$ and 0.50 samples around 30 K. Tunable positive and negative exchange bias fields in the range of -1.0 kOe to $+1.6$ kOe have been observed. The origin of magnetization reversal and exchange bias field is explained in terms of antiparallel alignment of canted ferromagnetic component of Cr^{3+} ions and the paramagnetic moments of Gd^{3+} and Mn^{3+} ions under the influence of negative internal field due to antiferromagnetically ordered Cr^{3+} ions.

1. Introduction

The presence of magnetization reversal and exchange bias in orthochromites ($RCrO_3$) have made them as one of the important class of interesting materials due to their potential applications in magnetic recording and switches [1–4]. Magnetization reversal (MR) is a process of alignment of magnetic moments opposite to the direction of the applied field under field cooled condition thereby showing a negative magnetization. It was Neel, who first predicted MR in certain ferrimagnetic spinel compounds [5] due to different temperature dependences of sublattice magnetizations. The MR behavior has been also reported in other classes of materials such as orthovanadates [6,7], manganites [8,9], orthoferrites [10], molecular magnets [11] and double perovskites [12]. In antiferromagnetic rare earth orthochromites like $La_{1-x}Pr_xCrO_3$ [13], $La_{0.5}Gd_{0.5}CrO_3$ [14], $SmCr_{1-x}Mn_xO_3$ [15] etc. the antiparallel coupling between the magnetic moments of rare earth ions (R^{3+}) and ferromagnetic component of canted Cr^{3+} ions gives rise to MR. In some of orthochromites, in addition to negative magnetization, exchange bias behavior [16,17] which has wide applications in magnetic recording devices has been reported [18,19]. The signature of exchange bias (EB) effect in a system is the unsymmetrical magnetic hysteresis loop leading to two different coercive fields at positive and negative fields or in other words the shifting of the center of loop to either towards positive or negative field axis. This usually arises as a result of anisotropic exchange interaction at the interface of ferromagnetic (FM) and antiferromagnetic (AFM) regions. Co-CoO

[20,21] nanostructure is an example of such a system where the exchange bias occurs due to the interaction between the ferromagnetic Co and antiferromagnetic CoO at their interface. This property has been widely studied in various heterostructured systems like bilayer or multilayer of FM/AFM, FM/ferrimagnet and FM/spin glass [18]. However EB is also reported in bulk samples such as $La_{1-x}Pr_xCrO_3$ [11], Sr_2YbRuO_6 [22] and $NdMnO_3$ [23] and the mechanism of EB in these systems is different from those of bilayer and multilayer.

$GdCrO_3$ is a well known perovskite having canted antiferromagnetism behavior with a Neel temperature of 170 K [24] and it is also known to exhibit magnetization reversal in both bulk and nanocrystalline forms. In the case of bulk sample, the origin of MR is due to the antiparallel alignment of Gd^{3+} and Cr^{3+} sublattice moments and their different temperature dependence [24,25] whereas in nanocrystalline material it is attributed to the core shell model [26]. In order to further tune the magnetic compensation temperature and exchange bias field we have taken up the detailed study of Mn^{3+} substitution at Cr^{3+} site of $GdCrO_3$. The structural and magnetic properties of $GdCr_{1-x}Mn_xO_3$ samples are presented in this report.

2. Experimental details

Polycrystalline samples of $GdCr_{1-x}Mn_xO_3$ ($x=0-0.50$) were prepared from stoichiometric ratio of Gd_2O_3 , $Cr(NO_3)_3 \cdot 9H_2O$ and manganese acetate all with 99.9% purity, using the standard sol-gel method. The starting oxide compound Gd_2O_3 was dissolved in nitric

* Corresponding author.

E-mail address: sravi@iitg.ernet.in (S. Ravi).

<http://dx.doi.org/10.1016/j.jmmm.2017.01.042>

Received 4 October 2016; Received in revised form 2 December 2016; Accepted 13 January 2017

Available online 16 January 2017

0304-8853/ © 2017 Elsevier B.V. All rights reserved.

Bibhuti
S. Ravi
Regional Institute of Education
Rajamahendrapuram, Andhra Pradesh, India

Structural, magnetic and electrical properties of Fe substituted GdCrO₃

Bibhuti. B. Dash, S. Ravi*

Department of Physics, Indian Institute of Technology Guwahati, Guwahati, 781039, India



ARTICLE INFO

Keywords:

Weak ferromagnetism
Magnetization reversal
Impedance spectroscopy
Gd(Cr, Fe)O series

ABSTRACT

Single phase samples of bulk GdCr_{1-x}Fe_xO₃ were prepared for $x = 0$ to 0.50. The lattice parameters obtained from Rietveld refinement based on *Pbpm* space group show that they increase systematically with Fe concentration, i.e. with $a = 5.3145 \text{ \AA}$, $b = 5.5249 \text{ \AA}$ and $c = 7.6068 \text{ \AA}$ for $x = 0$ to $a = 5.3330 \text{ \AA}$, $b = 5.5670 \text{ \AA}$, and $c = 7.6382 \text{ \AA}$ for $x = 0.50$. Magnetization measurement shows that all samples exhibit antiferromagnetic transition. Their Neel temperature (T_N) gradually decreases upto $x = 0.20$ and beyond that it increases quite sharply due to considerable concentration of Fe³⁺–O²⁻–Fe³⁺ networks. The magnetization reversal observed in the parent compound (GdCrO₃) is found to be suppressed upon Fe substitution and however for $x = 0.40$, magnetic compensation is observed at $T_{comp} = 125 \text{ K}$. They are explained by considering the variation in the magnitude of weak ferromagnetic moment for different Fe concentrations. Complex impedance spectra measured at different temperatures above room temperature show the thermally activated relaxation of charge carriers with contribution from both grains and grain boundaries. The relaxation frequency of charge carriers and dc conductivity follow the Arrhenius law with comparable activation energy values.

1. Introduction

Rare earth orthochromites RCrO₃ (R = rare earth or Y) with orthorhombically distorted perovskite (ABO₃) structure draw significant research interest due to their rich and unique magnetic properties like magnetization reversal (MR) and exchange bias (EB) [1–8]. MR and EB have been reported in several RCrO₃ (R = Gd, Sm, Tm) compounds due to the competition between the R³⁺ moment and the canted weak FM component of Cr³⁺ ions [9–11]. The structural and magnetic properties of RCrO₃ compounds are greatly tuned by substituting R and Cr ions by other rare earth and transition elements. The substitution of Cr by Fe ion in YCrO₃ induces MR with a compensation temperature of 265 K even though such MR is absent in both YCrO₃ and YFeO₃ compounds [12]. Recent reports on HoCrO₃ suggest that Fe substitution leads to increase in T_N value while the Gd substitution at Ho site gives rise to magnetocaloric behavior at low temperature [13,14]. The substitution of Mn and Fe at Cr site of NdCrO₃ is known to induce MR with a maximum magnetic compensation temperature of 169 K in NdCr_{0.85}Fe_{0.15}O₃ compound [15,16]. Similarly, the substitution of Y or Ho for Dy in DyCrO₃ lowers the magnetocaloric response while the Er substitution gives rise to increase in the magnetocaloric effect [17]. In addition, several RCrO₃ (R = Dy, Ho, Yb, Lu, Y) compounds are known to exhibit magnetoelectric and multiferroic properties simultaneously due to the coexistence of both magnetic and ferroelectric ordering

[5,18,19]. However, the origin of multiferroicity in these materials is still not understood completely. Such multiferroicity and ME behaviors have been observed in Fe and Mn substituted materials such as Dy-Fe_{0.50}Cr_{0.50}O₃ [20] and YCr_{1-x}M_xO₃ (M = Fe or Mn) [21]. The strength of ME coupling is greatly influenced by the substitution at the rare earth site [22].

GdCrO₃ is one of the interesting orthochromites having a magnetic rare earth ion with an orthorhombic crystal structure (*Pbpm* space group). It undergoes antiferromagnetic ordering with G-type magnetic structure and Neel temperature (T_N) of 170 K [9,23]. Interesting MR behavior has been reported in this compound due to the antiparallel alignment of Gd³⁺ moment with that of weak ferromagnetic (FM) component of Cr³⁺ ions due to spin canting [23]. The substitution of Mn at the Cr site and Y at the Gd site of GdCrO₃ show the magnetization reversal and tunable exchange bias behavior [24,25]. The Fe substitution for Cr leads to a giant magnetocaloric effect with a typical magnetic entropy change (ΔS) value of 29 J/Kg-K [26]. In the present work, a series of GdCr_{1-x}Fe_xO₃ ($x = 0$ –0.50) samples were prepared by citrate based sol-gel method and their structural, magnetic and electrical properties are investigated.

2. Experimental details

Polycrystalline samples of GdCr_{1-x}Fe_xO₃ for $x = 0, 0.05, 0.10, 0.20,$

* Corresponding author.

E-mail address: sravi@iitg.ernet.in (S. Ravi).<https://doi.org/10.1016/j.solidstatesciences.2018.07.018>

Received 11 May 2018; Received in revised form 25 July 2018; Accepted 26 July 2018

Available online 27 July 2018

1293-2558/ © 2018 Elsevier Masson SAS. All rights reserved.

Principal
Regional Institute of Education
Bhubaneswar / Bhubaneswar-751022



Research articles

Effect of Yttrium substitution on the structural and magnetic properties of GdCrO₃



Bibhuti B. Dash, S. Ravi*

Department of Physics, Indian Institute of Technology Guwahati, Guwahati 781039, India

ARTICLE INFO

Article history:

Received 27 January 2017
Received in revised form 23 May 2017
Accepted 11 June 2017
Available online 13 June 2017

Keywords:

Gadolinium chromites
Yttrium substitution
Magnetization reversal

ABSTRACT

We report the preparation of single phase samples of Gd1-xYxCrO3 (x = 0–0.30) compounds using the sol-gel method. Analysis of X-ray diffraction patterns shows a systematic decrease in lattice parameters a, c and volume of the unit cell with increase in Y concentration. Raman spectra recorded at room temperature shows a systematic shift of various modes towards higher wave number suggesting the presence of lattice distortion. The temperature variation of magnetization measurements show the presence of magnetization reversal and the magnetic compensation temperature is found to decrease upon Y doping. The origin of magnetization reversal is explained by considering competition between the paramagnetic moment of Gd3+ ions under the influence of negative internal field and the weak ferromagnetic component of Cr3+ ions due to canted antiferromagnetic ordering.

© 2017 Elsevier B.V. All rights reserved.

1. Introduction

Rare earth orthochromites with general formula RCrO3 (R = rare earth or Y) are an important class of multifunctional materials due to their rich physical properties like magnetization reversal (MR), exchange bias, magnetocaloric effect and multiferroicity which find potential applications in magnetic recording, data storage, thermomagnetic switches and magnetic refrigeration [1–8]. RCrO3 with an orthorhombic distorted perovskite structure exhibits canted antiferromagnetism below their Neel temperature (TN) and the canting arises due to the antisymmetric Dzyloshinskii-Moriya interaction (DM) [9,10] which also accounts for the origin of weak ferromagnetism in these materials [11]. In these orthorhombically distorted perovskite materials, the magnetic exchange interaction between Cr3+ ions and the rare earth ions (R3+) leads to spin reorientation transition at low temperature [12].

GdCrO3 is known to exhibit canted antiferromagnetic structure with a Neel temperature (TN) of 170 K and moreover it undergoes spin reorientation transition from Gd4(Gx, Ay, Fz) to Gd2(Fx, Cy, Gz) phase at Tsr = 7 K [11]. GdCrO3 is also one of the promising materials for magnetic refrigeration due to its large magneto-caloric effect with a typical change in magnetic entropy (ΔS) value of 32 J/kg-K at 5 K [8]. It also exhibits an interesting behavior of temperature induced magnetization reversal in both polycrystalline and nanocrystalline forms [1,13]. Magnetization reversal has also

been reported in other class of materials such as ferrimagnetic compounds [14], orthovandates [15] and double perovskites [16]. In ferrimagnetic compounds like spinel oxides the origin of MR is attributed to the different temperature dependences of magnetization in the two antiferromagnetically coupled sublattices. For orthovandates such as YVO3, the competition between single ion anisotropy and antisymmetric DM interaction causes the reversal of magnetization [15] and the same mechanism is found to play a role in BiFe0.5Mn0.5O3 [17] and YFe0.5Cr0.5O3 [7]. In double perovskites like Sr2YbRuO6 [16], the alignment of paramagnetic Yb3+ moments opposite to the ordered Ru3+ moments facilitates MR. In case of polycrystalline orthochromites like GdCrO3, the origin of magnetization reversal is mainly ascribed to paramagnetic moment of the rare earth ions such as Gd3+ whose direction is opposite to that of canted moment of Cr3+ ions [1,11]. In this work, we have prepared a series of Y3+ doped GdCrO3 samples by using the sol-gel method. The effect of doping on the structural and magnetic properties is presented. MR is observed in the parent compound as well as in the substituted samples. The origin of observed magnetization reversal is explained by considering the competition between the rare earth (Gd3+) moments in the negative internal field and the ferromagnetic component of canted Cr3+ moments.

2. Experimental details

Polycrystalline samples of Gd1-xYxCrO3 (x = 0.0, 0.10, 0.20, 0.30) were prepared from the stoichiometric ratio of Gd2O3, Y2O3, and Cr

* Corresponding author.

E-mail address: sravi@iitg.ernet.in (S. Ravi).

Bibhuti

[Signature]

Principal
Regional



Research articles

Magnetization reversal and exchange bias study in bulk $Gd_{1-x}Y_xCrO_3$ ($x = 0.0-1.0$)

Bibhuti B. Dash, S. Ravi*

Department of Physics, Indian Institute of Technology Guwahati, Guwahati 781039, India



ARTICLE INFO

Article history:

Received 5 October 2017

Received in revised form 21 April 2018

Accepted 23 April 2018

Available online 24 April 2018

Keywords:

Orthochromites
Weak ferromagnetism
Magnetization reversal
Tunable exchange bias

ABSTRACT

Single phase samples of $Gd_{1-x}Y_xCrO_3$ ($x = 0.0-1.0$) were prepared by sol-gel method. Lattice parameters obtained from the Rietveld refinement are found to decrease from $a = 5.3129 \text{ \AA}$, $b = 5.5210 \text{ \AA}$, and $c = 7.6040 \text{ \AA}$ for $x = 0$ to $a = 5.2428 \text{ \AA}$, $b = 5.5208 \text{ \AA}$ and $c = 7.5340 \text{ \AA}$ for $x = 1.0$. The temperature variation of magnetization measurements show that all samples exhibit antiferromagnetic transitions and the Neel temperature (T_N) decreases from $T_N = 174 \text{ K}$ for $x = 0.0$ to 142 K for $x = 1.0$. Interesting magnetization reversal behavior is observed as the temperature is lowered from T_N under field cooled condition and the magnetic compensation temperature, T_{comp} is found to decrease from 136 K for $x = 0$ to 42 K for $x = 0.70$. These samples exhibit tunable positive and negative exchange bias fields with a maximum negative value of -1.17 kOe for $x = 0.50$. The origin of magnetization reversal and exchange bias field is explained by considering the competition between the paramagnetic moment of Gd^{3+} ions under the influence of negative internal field and the weak ferromagnetic component of Cr^{3+} ions due to canted antiferromagnetic ordering.

© 2018 Elsevier B.V. All rights reserved.

1. Introduction

The study of exchange bias has drawn a great deal of interest due to its potential technological applications in magnetic recording devices, spin valves, spintronic devices and in magnetic random access memory devices [1–7]. The Exchange Bias (EB) in a system is manifested as a shift in the center of the isothermal magnetic hysteresis loop towards either positive or negative field axis. Such shifting towards positive and negative field axes is known as positive exchange bias (PEB) and negative exchange bias (NEB) respectively. This behavior is mainly observed in various heterostructured system having bilayer and multilayer of ferromagnet (FM)/antiferromagnet (AFM), FM/ferrimagnet (FIM), etc. [1,7–10]. The EB arises as a result of the anisotropic exchange interaction at the interface of FM and AFM layers when the sample is cooled down in the presence of an external magnetic field through the Neel temperature (T_N) of the AFM material [7]. The EB effect was first discovered by Meiklejohn and Bean [9,10] in the Co-CoO nanostructured system where it is attributed to the exchange coupling between the ferromagnetic Co and the antiferromagnetic CoO at their interface. Recently, the EB behavior has been reported in various bulk single phase materials, like double

perovskite, manganites, cobalites, etc. where different types of mechanisms plays a role [11–14]. For, example in $NdMnO_3$ [12] the local ordering of Nd^{3+} moments and their antiferromagnetic coupling with the net ferromagnetic component of Mn^{3+} ions give rise to exchange bias. The competition between the single ion anisotropy and Dzyaloshinskii-Moriya (DM) interaction leads to the EB in $YCr_{0.5}Fe_{0.5}O_3$ system [14]. In perovskite rare earth orthochromites ($RCrO_3$), the antiparallel coupling between the weak ferromagnetic component of Cr^{3+} ions and magnetic moment of rare earth (R^{3+}) ions gives rise to EB [15–17]. In $La_{1-x}Pr_xCrO_3$ and $NdMnO_3$ compounds, interesting tunable EB is observed by just changing the magnitude of cooling magnetic field [12,15]. Tunable positive and negative EB is reported by changing the magnitude of cooling field and varying the temperature in Sr_2YbRuO_6 , and $TmCrO_3$ [11,18]. It has been reported in some polycrystalline materials that the EB behavior co-exists with another interesting behavior known as magnetization reversal (MR), where the M switches its sign with the change in temperature [11,15,19]. It arises due to the alignment of the magnetic moments opposite to the direction of the applied field under field cooled condition. In antiferromagnetic $RCrO_3$, the magnetization reversal is observed either due to the alignment of magnetic moment of rare earth ions opposite to that of net ferromagnetic component of Cr^{3+} ions or due to the paramagnetic moment under the negative internal field [15,16].

* Corresponding author.

E-mail address: sravi@iitg.ernet.in (S. Ravi).

प्राचार्य/ PRINCIPAL

क्षेत्रीय शिक्षा संस्थान

Regional Institute of Education

भुवनेश्वर/ Bhubaneswar, 751 002

Leadership Style of Head Teachers at Secondary Level in West Bengal

Mr. Shankar Barman^[1]

Dr. Ramakanta Mohalik^[2]

Abstract:

The main purpose of this paper is to study the leadership style of head teachers at secondary level as perceived by teachers. Survey research method was applied for studying the leadership style of head teacher with nine head teachers and 22 assistant teachers selected purposefully from Government secondary schools of Coochbehar district, West Bengal, India. Self-developed questionnaire consisting of 56 items, based on head teacher leadership style was used for data collection. The collected data were analyzed by using percentage, frequency and accordingly interpretations are drawn. The study found that i) 77.3% of teachers agreed that HT have a deep rooted understanding of the school functioning. ii) 81.8% of teachers believe that HT shares visions with the teachers. iii) 81.8 % of teachers agreed that HT acts as a guide for all the staff, iv) 77.3% of teachers supported that HT provide resources needed for all round development of the school, and v) 86.4% of teachers pointed out that HT works according to the rules of the school. The study has suggested implications for head teachers to develop leadership style, school administration, overall development all staff and student as well as organising professional development programmes.

Article History: Received: 14th August 2018, Revised: 17th September 2018, Accepted: 24th September 2018, Published: 30th September 2018.

I. CONCEPTUALIZATION OF THE PROBLEM

The expansion of education, particularly at school level since Independence is one of the unparalleled events in the history of Indian education. Despite the impressive expansion of school education in almost all the states in India, there are still wide among rural, urban and tribal areas. One of the reasons may be the quality and leadership style of Head Teacher (HT) who practically implements all the policies at school level. The effectiveness of school mainly rests on the leadership style of Head of the school. The National Policy on Education 1986 and its Programme of Action laid great emphasis on the role of head teacher as an implementer of educational programmes. They are one of the few who facilitates creation of excellence in the teaching learning process. HT is the pivot of educational system as he/she is directly responsible for implementing new educational programmes from time to time. Much of the initiative and skill required for day-to-day administration as well as the dynamism and foresight needed for school planning and appraisal of activities comes from head teacher. HT has to be able organiser, efficient administrator, tactful in handling men and matters.

The Head of the educational institution is to be a guide and counsellor to the teaching staff under his charge. A great deal of performance and activity status depends upon the leadership of head teacher. He has to perform several innovative and creative functions. He interacts, motivates, inspires his subordinates and guides them for better performance. He has to perform many duties namely academic, administrative, co-curricular activities, co-ordination and understanding between different departments and units of the school. In fact organisations compete by means of their leaders then by their products. Leader gives

life to the organisation, to be more effective for the attainment of goal. Leadership is an important attribute for the development of school that set apart a successful organisation from unsuccessful organisation without leadership. Leadership is the personal quality of an individual who organises the effect of follower and directs their activities towards the attainment of organisation goal. Leadership is regarded as the process of influencing the activities of an individual or a group in effort towards goal achievement in a given situation. In school context, HT need to manage and supervise all the academic and non-academic activities of school. HT required to guide teachers in developing their effectiveness so that they can contribute for the betterment of school as well students.

II. RATIONALE OF THE STUDY

Head teacher has significant role for the development of school and students. He is the main agent for supervising the implementation of curriculum at school level. He is the source of motivation and inspiration for both teachers and students in school. Hence leadership style of head teacher has great bearing on school effectiveness and teacher professional development. Realising the importance of the leadership style of head teachers, many researches are done at National and International level. Some of the relevant studies are discussed in the following paragraph.

Arya (2017) indicated that there are two types of leadership styles of school Principal, namely supportive leadership and participative leadership styles which have significantly affecting teacher effectiveness. Kumar (2017) stated that there is no significant difference in the leadership styles of

^[1]Research Scholar, Regional Institute of Education (RIE) Bhubaneswar, Odisha.

^[2]Associate Professor in Education, RIE Bhubaneswar, Odisha.

DOI 10.1007/s10812-018-0569-9

Journal of Applied Spectroscopy, Vol. 84, No. 6, January, 2018 (Russian Original Vol. 84, No. 6, November–December, 2017)

OPTICAL BAND GAP AND PHOTOLUMINESCENCE STUDIES OF SAMARIUM-DOPED BARIUM ZIRCONATE PEROVSKITE PREPARED BY SOLID STATE REACTION ROUTE

A. Satapathy and E. Sinha*

UDC 535.37

The structural and optical properties of $Ba_{1-x}Sm_{2x/3}ZrO_3$ ($x = 0.02, 0.04, 0.06, 0.08, 0.10$) ceramics prepared by the solid-state reaction method are considered. The x-ray diffraction data confirm the cubic perovskite phase of all the compositions with space group $Pm\bar{3}m$. The effect of Sm^{3+} substitution on the optical band gap and photoluminescence properties of barium zirconate are discussed. The optical band gap decreases from 3.43 to 2.98 eV with increasing Sm^{3+} content. The Urbach energy has been found to increase with rise in concentration of dopant species. The photoluminescence spectra show an intense violet–blue emission characteristic of the barium zirconate perovskite. Visible emission due to intra-4f transitions of Sm^{3+} ions from $^4G_{5/2}$ higher excited state to 6H_j ($j = 5/2, 7/2, 9/2$ etc.) ground states has been observed in the range of 550–700 nm.

Keywords: ceramics, perovskites, optical band gap, photoluminescence.

Introduction. The rare earth (RE) activated phosphors have been gaining significant technological interest in the last couple of decades for their excellent luminescence behavior. The photoluminescence properties of these materials can be tuned up for desirable display applications in various photonic devices [1, 2]. For luminescence applications in the visible and ultraviolet (UV) spectral range, materials with a wide optical band gap are suitable candidates to act as the host matrix for optical activation with rare earth (RE) impurities. Perovskite-type materials show a broad luminescence band, which is usually associated with the presence of imperfections or defects in the crystal structure that leads to intermediate states within the band gap. $BaZrO_3$ (BZO) is one of the perovskite structured oxides ($A^{2+}B^{4+}O_3$) that has a broad range of electrochemical, optoelectronic, and refractory applications and possesses a wide optical band gap ranging from 3–5 eV, an eligible host matrix for optical activation with RE impurities [3, 4]. The multifunctional features of BZO attract attention for exploitation of different physical properties. There are several reports on the trivalent rare earth impurities doped on BZO hosts which emit within the optical window of the host material under UV excitation. In particular, most of the studies have been based on the exploitation of the B site or Zr site of BZO substituted with lanthanides like $(Yb^{3+}, Ce^{3+}, Eu^{3+}, \text{etc.})$ [5, 6]. Since these ions act as acceptors when substituted at Zr^{4+} site, it results in the creation of oxygen vacancies, thereby affecting the ZrO_6 octahedra, which alter the structural and electronic environment. Substitution at both the A and B sites can lead to changes in structural symmetry and charge distribution, and thus it creates various defects via oxygen or cationic vacancies that influence the band structures. The structural order–disorder and intermediate energy levels created within the valence band maximum and conduction band minimum govern the optical band gap and photoluminescence properties. However, there are no reports on the Sm^{3+} substitution at either the A^{2+} site or B^{4+} site of the BZO crystal lattice. Therefore, in the present study, we report the basic optical properties of Sm^{3+} ions incorporated in the A site of BZO lattice.

Experimental Procedure. Powders used in the synthesis of $Ba_{1-x}Sm_{2x/3}ZrO_3$ ($x = 0.02, 0.04, 0.06, 0.08, 0.10$) were $BaCO_3$ (99% purity, Merck, India Ltd.), ZrO_2 (99% purity, Himedia Laboratories, Mumbai), and Sm_2O_3 (99% purity, Himedia Laboratories, Mumbai). Appropriate stoichiometric proportions were weighed for preparation of the respective compositions. In this case, we have selected the concentration of dopant as $2x/3$ to maintain the charge neutrality. The initial mixtures were ground for 6 h with the help of an agate-mortar and pestle. Then the samples were subjected to calcination at 1450°C for 4 h in an electric resistance furnace. The calcined powders were ball milled for 2 h in a liquid medium for

*To whom correspondence should be addressed.

Birla Institute of Technology, Mesra, Ranchi, 835215, India; email: elasinha@gmail.com. Published in Zhurnal Prikladnoi Spektroskopii, Vol. 84, No. 6, pp. 864–869, November–December, 2017. Original article submitted September 13, 2016.

Avishek Satapathy

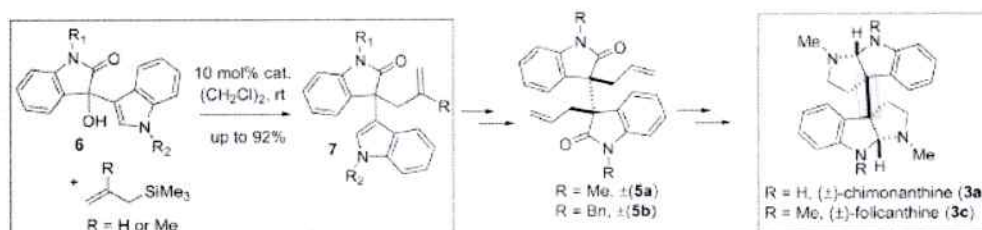
Principal
 क्षेत्रीय शिक्षा संस्थान
 Regional Institute of Education
 भवनेश्वर / Bhubaneswar-751022

FeCl₃-Catalyzed Allylation Reactions onto 3-Hydroxy-2-oxindoles: Formal Total Syntheses of Bis-cyclotryptamine Alkaloids, (±)-Chimonanthine, and (±)-Folicanthine

Lakshmana K. Kinthada, Sai Raghavendra Medisetty, Amarchand Parida, K. Naresh Babu, and Alakesh Bisai*

Department of Chemistry, Indian Institute of Science Education and Research Bhopal, Bhopal Bypass Road, Bhopal, Madhya Pradesh 462 066, India

Supporting Information



ABSTRACT: An FeCl₃-catalyzed efficient strategy for the allylation reactions of 3-hydroxy-2-oxindoles with allyltrimethylsilane has been developed. The reaction affords a variety of 2-oxindoles having quaternary center at the pseudobenzyl position in an operationally simple and inexpensive procedure. Control experiments using enantioenriched 3-hydroxy-2-oxindole show that the reaction proceeds through in situ generated 2H-indol-2-one (8). The methodology presents an efficient and concise access to the pyrroloindoline alkaloids (±)-deoxyseroline (1a), (±)-esermethole (1b), (±)-physostigmine (1c), (±)-phenserine (1d), and (±)-physovenine (1e). Eventually, we extrapolated the scope of this methodology to the formal total syntheses of dimeric cyclotryptamine alkaloids (±)-chimonanthine (3a), (±)-folicanthine (3c), and (±)-calycanthine (4).

INTRODUCTION

Construction of small molecules sharing the biologically active natural product skeleton¹ is of crucial importance for the success of a chemical genetics/genomics-based program. In this regard, 2-oxindoles are compounds of great interest as they are encountered in many biologically active molecules² and are also used as building blocks for pharmaceuticals.³ In particular, the construction of carbon atoms having four carbon ligands, i.e., all-carbon quaternary centers, is a challenging task to address owing to the resultant steric congestion.⁴ In this regard, 2-oxindoles having all-carbon quaternary centers at the pseudobenzyl position, of the type 2, are found to be indispensable intermediates in the total syntheses of the naturally occurring Calabar alkaloids deoxyseroline (1a), esermethole (1b), physostigmine (1c), physovenine (1d), and phenserine (1e) (Figure 1)^{5a-c} and many other complex pyrroloindoline alkaloids.^{5d-f} Recently, a number of elegant approaches have been reported to address total syntheses of these alkaloids, which include Movassaghi's Friedel-Crafts-based method for the regioselective and directed C3 functionalization of advanced pyrroloindoline intermediates employing a range of π -nucleophiles,^{5d} Stephenson's Ru-catalyzed visible-light mediated coupling of bromopyrroloindolines with indoles,^{5e} and Li's Ir-catalyzed radical conjugate

addition of bromopyrroloindolines with α,β -unsaturated ketone.^{5f}

On the other hand, dimeric cyclotryptamine alkaloids⁶ (3a–d and 4, Figure 2) possessing a bis-pyrroloindino[2,3-*b*]indoline moiety with a labile 3a–3a' σ -bond constitute a large family of architecturally interesting alkaloids with a wide range of biological activities.⁷ Their unique structural arrays and impressive biological activities have led to a demand for the development of novel strategies involving construction of vicinal all-carbon quaternary centers.⁸ In this regard, C₂-symmetric 2-oxindole, such as 5 (Figure 2), provides an excellent platform to access these alkaloids.^{9,10}

A number of elegant approaches have been reported for synthesizing 2-oxindoles having quaternary centers from more reactive 3-halo-2-oxindole substrates.¹¹ However, in view of the demand for efficient, economic, and environmentally friendly processes, the development of direct catalytic carbon–carbon bond-forming reactions of 3-hydroxy-2-oxindoles with prior unmodified substrates is an important task to pursue.

One of the most powerful methods for construction of all-carbon quaternary centers is the Lewis acid activation of 3-hydroxy-2-oxindoles followed by reaction with a suitable

Received: May 31, 2017

Published: July 18, 2017

Amarchand Parida

Alakesh Bisai

प्रचार्य/ PRINCIPAL
क्षेत्रीय शिक्षा संस्थान
Regional Institute of Education
भुवनेश्वर / Bhubaneswar-751022

Research Article

Cite this article: Kaur M, Agarwal PC, Kaur S, Gill TS (2018). Relativistic effects on propagation of q-Gaussian laser beam in a rippled density plasma: application of higher order corrections. *Laser and Particle Beams* 1-8. <https://doi.org/10.1017/S0263034618000228>

Received: 25 January 2018

Revised: 12 June 2018

Accepted: 13 June 2018

Keywords:

Density ripple; q-Gaussian laser beam; Relativistic nonlinearity; Self-focusing

Author for correspondence:

S. Kaur, Department of Physics, Guru Nanak Dev University, Amritsar, 143005, Punjab, India. E-mail: sukhdeep.iitd@gmail.com

Relativistic effects on propagation of q-Gaussian laser beam in a rippled density plasma: application of higher order corrections

M. Kaur¹, P. C. Agarwal², S. Kaur¹ and T. S. Gill¹

¹Department of Physics, Guru Nanak Dev University, Amritsar 143005, Punjab, India and ²Regional Institute of Education, Bhubaneswar 751022, India

Abstract

A nonparaxial investigation for propagation characteristics of q-Gaussian laser beam in rippled density plasma is studied by considering the relativistic nonlinearity. The field distribution in the medium is expressed in terms of q parameter and beam width parameter f . Nonlinear parabolic partial differential equation governing the evolution of complex envelope in slowly varying approximation is solved in a modulated density profile. Analytical theory of self-focusing including higher order terms in the expansion of dielectric function up to fourth order is developed and the variation of beam width parameter f with the distance of propagation for different parameters is studied. One may note that increased value of density ripple, laser intensity and depth of modulation, increases self-focusing whereas a lower value of q shows strong self-focusing. A comparative study between paraxial and nonparaxial study has also conducted. This study is useful for research in high energy density physics.

Introduction

Study of nonlinear phenomenon as a subject of experimental and theoretical research in laser plasma physics is an active area in modern plasma research. Interaction of laser radiation with plasma gives rise to a number of nonlinear processes such as self-focusing, self-modulation, harmonic generation etc. It is important to study the underlying principle of this nonlinear phenomenon. The laser beam propagation in plasma has potential relevance due to their applications in X-ray sources (Zhang *et al.*, 1998; Miller *et al.*, 2012), laser-driven plasma accelerators (Hoffmann *et al.*, 2005; Xie *et al.*, 2009), harmonic generation (Salih *et al.*, 2003), and fast ignition concept (Ghoranneviss *et al.*, 2008). Further, such electromagnetic interactions are also important on account of their relevance in exotic ionospheric phenomena like profile modification and distortion of radio wave signal. In order to practically realize the laser plasma-based applications, it is desirable that laser beam should propagate hundreds of Rayleigh lengths. When high power laser beam propagates through plasma, instabilities, and nonlinear phenomenon like self-phase modulation, filamentation instability, group velocity dispersion, the finite pulse effects, relativistic and ponderomotive self-focusing become important.

Among the fundamental processes self-focusing and self-trapping are important nonlinear phenomena. The self-focusing is a process in which electromagnetic beam of light comes to focus as a consequence of nonlinear response of a material medium. In a nonlinear medium, a high power electromagnetic beam creates a refractive index profile across its cross-section corresponding to its intensity profile. The refractive index of the medium increases with the beam intensity. As a result, the beam focuses of its own. Self-focusing was reported for the first time by Askar'yan (1962) and since then, it has been focus attention of scientific community for nearly five decades because it affects a number of other processes. In laser-plasma interaction, it plays a crucial role in the beam propagation. The self-focusing is strongly affected by the transverse distribution of beam irradiance.

As mentioned above, the basic physical mechanism responsible for self-focusing is nonlinear refractive index of the medium which is an increasing/decreasing function of laser intensity and thus modifies the dielectric characteristics of the medium. This mechanism takes place by various methods like ohmic heating (Litvak, 1966), ponderomotive force and relativistic mass modification (Hora, 1975). When the laser power is sufficiently large, the electric field associated with high power laser pulse leads to quiver motion of electrons with a velocity comparable with the velocity of light in vacuum. This quiver motion of electrons in laser beam further expels the electrons from high-intensity region to low intensity region due to ponderomotive force. This will set up a space charge field that retards the electrons and a quasi-steady state is created. This modifies the refractive index of the plasma, causes curvature of the wavefront and focuses the beam. The transverse gradient of the nonlinear refractive index is responsible for

3D Monte-Carlo study of toroidally discontinuous limiter SOL configurations of Aditya tokamak

Bibhu Prasad Sahoo,¹ Devendra Sharma,¹ Ratneshwar Jha,¹ and Yühe Feng²

¹Institute for Plasma Research, HBNI, Bhat, Gandhinagar 382428, India

²Max-Planck-Institut für Plasmaphysik, Wendelsteinstr. 1, Greifswald D-17491, Germany

(Received 24 February 2017; accepted 4 July 2017; published online 21 July 2017)

The plasma-neutral transport in the scrape-off layer (SOL) region formed by toroidally discontinuous limiters deviates from usual uniform SOL approximations when 3D effects caused by limiter discreteness begin to dominate. In an upgrade version of the Aditya tokamak, originally having a toroidally localized poloidal ring-like limiter, the newer outboard block and inboard belt limiters are expected to have smaller connection lengths and a multiple fold toroidal periodicity. The characteristics of plasma discharges may accordingly vary from the original observations of large diffusivity, and a net improvement and the stability of the discharges are desired. The estimations related to 3D effects in the ring limiter plasma transport are also expected to be modified and are updated by predictive simulations of transport in the new block limiter configuration. A comparison between the ring limiter results and those from new simulations with block limiter SOL shows that for the grids produced using same core plasma equilibrium, the modified SOL plasma flows and flux components have enhanced poloidal periodicity in the block limiter case. These SOL modifications result in a reduced net recycling for the equivalent edge density values. Predictions are also made about the relative level of the diffusive transport and its impact on the factors limiting the operational regime. *Published by AIP Publishing.* [<http://dx.doi.org/10.1063/1.4994534>]

I. INTRODUCTION

The plasma transport analysis for scrape-off layer (SOL) region in tokamaks having toroidally discontinuous limiters needs to consider 3D version of the effects that already complicate toroidally symmetric plasma-target setups (e.g., either a belt limiter or divertor). One such issue is an excessive wall recycling of the plasma resulting from strong ionization in relatively long connection length zones of the SOL. Unlike the extreme heat flux realizable only at ITER scale and optimized predictively,^{1,2} the limiting influence of particle flux related issues, such as excessive wall recycling, is already evident in various small to medium size devices that witness a variety of density limits.^{3–8} In ALCATOR C, for example, it was noticed that an enhanced recycling in main chamber invokes the possibility of an alternate density limit, capable of restricting essential reactor relevant studies in a moderate size device.⁴ The conclusions related to Main Chamber Recycling (MCR) from ALCATOR C observations also indicate that this effect might influence the operations of a reactor scale device where the tight baffling of the divertors may not offer control over the main chamber neutral density and therefore over the charge exchange heat losses and sputtering of the main-chamber walls, as generally expected. Many present small and medium devices aim to achieve the conditions that allow addressing a range of issues specific to reactor like environment, and their modifications and upgrade are therefore partly motivated by these issues. An upgrade version of Aditya tokamak,⁹ presently in its testing phase, is also expected to provide a detailed opportunity to address several relevant issues considering that a well-studied toroidally localized poloidal ring limiter configuration will be

upgraded to a set of discrete low-field-side (LFS) block limiters and a continuous high-field-side (HFS) belt limiter.⁹ The second phase of upgrade will also aim to access single and double null divertor configurations. Prior to its full scale upgrade version operations, the predictive 3D simulations of the limiter SOL plasma region is carried out for obtaining many desirable estimates for upgrade operations. These estimates are desired in terms of connection length distributions, total recycling flux for aimed operational conditions, density gradient scale lengths, and flow field patterns which may be compared to highly explored original ring limiter operations. The bulk of experimental activity in Aditya has been related to edge turbulence.^{10–13} With the modifications largely made to plasma facing components (PFC) and far SOL environment, the SOL plasma transport simulations additionally allow the understanding of a more guided optimization of the initial upgrade plasma operations in terms of overall particle balance and recycling rates that influence both particle and energy inputs. The knowledge of modified flow patterns is also expected to guide new physical setup of edge diagnostics. Implementation to a newer plasma configuration may additionally enrich the database, essential for refining the predictive capacity of the available complex 3D computational tools.^{14,15}

While the transport in original ring limiter SOL configuration was simulated using 3D computations,¹⁵ an upgrade relevant toroidally discontinuous block limiter configuration was recently implemented for generating predictive results. Besides the discrete limiter configuration of startup phase operations in ITER,^{1,2} these studies are also relevant to the SOL formed at higher toroidal mode numbers, in the presence of 3D magnetic field perturbations,^{16,17} or during the

Increasing frequency of large-scale die-off events in the Bay of Bengal: reasoning, perspectives and future approaches

Biswaranjan Paital^{1*}, Abhipsa Bal¹, Georgina A. Rivera-Ingraham^{2**} & Jehan-Hervé Lignot²

¹Department of Zoology, Orissa University of Agriculture and Technology, College of Basic Science and Humanities, Bhubaneswar 751003, India

²UMR 9190 MARBEC, Université de Montpellier, Place Eugène Bataillon, 34095, Montpellier, France

*[Email: biswaranjanpaital@gmail.com]

Received 06 March 2017; revised 04 May 2017

The Bay of Bengal has been suffering from increasing frequency of large-scale die-off events for the past decades. Most frequently, these events are attributed to high-speed human development and its harmful effects on environment, which is nevertheless, the biggest challenges currently faced by the world. Increasing urbanization, environmental pollution and climate change are leading to unsustainable ecosystem exploitation and raising health and disease management challenges. Considerable modulations in major ecosystems and major disturbances in the global food chain are some of the most significant consequences of this uncontrolled urbanization. Global warming and El Niño events are few particular phenomena that drive mass deterioration of terrestrial foliage and fauna as well as aquatic organisms, respectively. We here review and discuss the die-off events occurring in the Bay of Bengal for the last decades as well as all the data obtained from the analyses of such events to provide a future perspective on potential management and monitoring strategies directed towards the protection of the flora and fauna of several major ecosystems from such die-off events.

[Keywords: Aquatic environment, Bay of Bengal, climate change, conservation strategies, natural disasters, catastrophic events, satellite monitoring].

Introduction

High-speed human development is one of the biggest challenges faced by the world. Increasing urbanization and unsustainable lifestyle often leads to preoccupying levels of waste accumulation and alterations of the physico-chemical properties of the environment, challenging organisms at the lowest biological levels¹. The loss of sensitive species from impacted ecosystems leads to changes in biodiversity composition, major disturbances in the global food chain, opens windows to biological invasions and the development of pathogens and eventually leads to significant problems with human health and disease management¹⁻⁵. Global warming in particular is a cause for considerable concern due to its multiple and diverse consequences, including the mass deterioration of terrestrial foliage and fauna as well as aquatic organisms⁶⁻⁸.

As previously mentioned, change in environmental conditions challenges organisms by disturbing energetic balances and triggers changes in their

molecular and biochemical pathways⁹⁻¹¹. As a result of exceeding, for example, the thermal tolerance limits, ectotherms and other homeotherms lose control over the cellular mechanisms responsible for fueling vital processes. This causes organisms to be pushed to their physiological limits, limiting their capacity to withstand small additional shifts in their environmental conditions and eventually leading to unsustainable metabolic rates and finally, collapse¹². The resulting, sudden large-scale mortality of animals in mega ecosystems such as oceans (including coastal ecosystems) and rivers is increasing in frequency across the world. Thus, identifying the reason(s) behind these events becomes a challenging issue for current ecophysiologicalists, whilst conservationists seek suitable monitoring programs allowing highlighting potential conditions of vulnerability. There is however, cases where the reason(s) behind large die-off events remained unknown¹², leaving ecophysiologicalists facing the open challenge of understanding the physiological factors determining the sensitivity of such species, compared to other closely related organisms from catastrophic death

**Present address: Laboratoire Environnement de Petit Saut, HYDRECO, BP823, Kourou, Guyane Française.

2017



S. Kapoor

3

Study of buoyancy driven free convective flow of a micropolar fluid through a darcy-forchheimer porous medium with mutable thermal conductivity

S Rawat^{a*} & S Kapoor^b

^aDepartment of General Studies, Jubail University College, Jubail Industrial City 31961, Kingdom of Saudi Arabia

^bDepartment of Education in Science and Mathematics, Regional Institute of Education (National council of Education Research and Training), Bhubaneswar 751 022, India

Received 31 May 2016; accepted 12 June 2017

This paper presents a study of the natural convection flow, heat and mass transfer of an incompressible micropolar fluid between two vertical parallel plates containing a Darcy-Forchheimer porous medium. Asymmetric wall temperatures and concentrations are present and take into account a temperature-dependent thermal conductivity. The transformed equations for linear momentum, angular momentum, energy and species have been solved numerically using the finite element method. The effects of Darcy number (Da), Forchheimer number (Fs), Grashof number (Gr) and thermal conductivity parameter (S) on the velocity, angular velocity and temperature profiles have been studied in detail. The numerical results indicate that velocity and angular velocity (micro-rotation) increase as the Darcy number increases but they are reduced with increasing Forchheimer parameter, Grashof number and thermal conductivity parameter. Moreover, the thermal conductivity parameter increases as the temperature decreases. The effect of vortex viscosity parameter, R , on the volume flow rate, the total heat rate and the total species rate added to the fluid has also been examined. The effect of thermal conductivity parameter, S , on heat transfer rate has also been studied. A comparison with another method has also been presented and has been found to be well in agreement.

Keywords: Micropolar fluid, Porous medium, Variable conductivity, Finite element, Grashof number, Heat/mass transfer

1 Introduction

Natural convection in fluid saturated porous media constitutes an area of major activity in transport phenomena research owing to its application in a diverse number of fields including geothermal energy systems, enhanced recovery in petroleum reservoirs, filtration sciences, heat exchange between soil and atmosphere, transport of moisture through porous industrial materials and ceramic processing. The fundamental importance of convective flow in porous media has been well-reviewed in the recent book by Ingham and Pop¹. Nield and Bejan² have also addressed in detail the natural convective flows due to combined buoyant mechanisms in porous media. Rawat and Kapoor³ focused to develop a mathematical model for the comparative study of combined effects of free convective heat and mass transfer on the steady two-dimensional, laminar fluid flow past a moving permeable vertical surface subjected to a transverse uniform magnetic field.

Although, considerable work has been reported on flow heat and mass transfer in geometries with

and without porous media^{4,5}, a majority of porous studies⁶⁻⁸ have been on Darcy's law which states that the volume averaged velocity is proportional to the pressure gradient. Darcy's law however is valid only for slow (viscous-dominated) flows through porous media with low permeability. At higher flow rates or in highly porous media, there is a departure from the linear law and inertial effects become important. Physically, this departure is believed to be due to flow separation within the medium, whilst mathematically, it manifests itself as a nonlinear term in the velocity-pressure gradient relationship.

Recently, Rawat *et al.*⁹ presented for the steady, two-dimensional magneto-convection heat transfer of a two-phase, electrically-conducting, particle-suspension in a channel containing a non-Darcian porous medium intercalated between two parallel plates, in the presence of a transverse magnetic field. The channel walls are assumed to be isothermal but at different temperatures. Rawat *et al.*¹⁰ also investigate the two dimensional flow, heat and mass transfer of chemically reacting micro polar fluid over a non-linear stretching sheet with variable heat flux in a non-Darcy porous medium. The rate of chemical reaction is

*Corresponding author (E-mail: sam.rawat@gmail.com)

Principal
क्षेत्रीय शिक्षा संस्थान
Regional Institute of Education
भुवनेश्वर / Bhubaneswar-751022

Laser second-harmonic generation from an overdense plasma slab

M. KAUR,¹ P. C. AGARWAL,² AND S. KAUR¹

¹Department of Physics, Guru Nanak Dev University, Amritsar 143005, India

²Regional Institute of Education, Ajmer 305004, India

(RECEIVED 12 January 2017; ACCEPTED 4 April 2017)

Abstract

A s-polarized short-pulse laser impinged obliquely on an overdense plasma slab is shown to produce very significant second harmonic in the direction of specular reflection and transmission. The laser induces a non-linear current on electrons, which is curl free. However, with sharp plasma boundary, it gives rise to electromagnetic radiation at the second harmonic. Our formalism includes multiple reflections of the incident and second-harmonic waves from both the front and rear surfaces. The present work includes finiteness of the slab. The normalized second-harmonic amplitude acquires a sharp peak at some specific angle of incidence for a particular set of parameters dependent on thickness of the slab and plasma density.

Keywords: Laser-plasma interaction; Oblique incidence; Overdense plasma slab; Second-harmonic generation

1. INTRODUCTION

At high laser intensities the interaction between a laser beam and plasma, gives rise to a variety of non-linear effects (Marklund & Shukla, 2006; Ganeev *et al.*, 2012; Weber & Riconda, 2015; Zhang *et al.*, 2015). These include harmonic generation (HG) (Upadhyay & Tripathi, 2005), wakefield acceleration (Ibbotson *et al.*, 2010), THz (terahertz) radiation generation (Kumar *et al.*, 2011), and parametric instabilities (Klimo & Tikhonchuk, 2013). HG has its applications in the diagnostic of non-linear medium, coherent multiphoton spectroscopy, and other phenomena (Döbele *et al.*, 2000; Pirozhkov *et al.*, 2006; Li *et al.*, 2011; Liu *et al.*, 2011). Much of the work on HG in laser-produced plasma has been reported by thin foils (Teubner *et al.*, 2004), slab (Deb & Saha, 2015), gas jet (Banerjee *et al.*, 2003), and solid target (Dollar *et al.*, 2013). Some serious problems are encountered for HG from gaseous plasma, which encourages the researcher to use other targets. Increased value of laser intensity will increase harmonic intensity in gaseous plasma, cause rapid ionization of gaseous atoms, and decrease the harmonic emission. On the other hand, mismatch of the phase velocity of the laser beam and harmonic radiation affects the conversion efficiency. In a thin foil, harmonics have been mainly

observed in reflection from the front side of massive solid targets. Efficiency of the yield can be increased by phase matching. It turns the process into a resonant one. Kaur and Sharma (2008) studied third HG in a laser-produced thin foil plasma with conversion efficiency obtained as 0.01%.

Currently, there is strong interest in intense short pulse laser interaction in plasma with ultrathin foils. One of the primary objectives is to achieve proton acceleration via TNSA (target normal sheath acceleration) or RPA (radiation pressure acceleration) mechanisms. In these studies, overdense plasma foils of thickness comparable with laser wavelength or much shorter wavelengths are employed (Tripathi *et al.*, 2009). Adusumilli *et al.* (2011) have argued that when a laser beam of finite spot size (e.g., a Gaussian beam) impinges on an ultrathin foil, the radiation pressure it exerts on the foil is more on the axis and decreases with distance r . As a result, the foil acquires a curvature. The laser falling on the curved boundary is no longer normal to the boundary. Optical ray makes an angle to the surface normal. Under such a situation transmission coefficients for the s and p polarizations are different and transmitted wave does not maintain its circular polarization. They showed that s-polarized laser obliquely impinged on a foil can give rise to second-harmonic generation (SHG) in the direction of specular reflection. Their treatment is limited to semi-infinite plasma. SHG of a right circularly polarized Gaussian electromagnetic beam in an unbounded magnetized plasma has been investigated by

Address correspondence and reprint requests to: S. Kaur, Department of Physics, Guru Nanak Dev University, Amritsar-143005, India. E-mail: sukdeep.iitd@gmail.com

Identification of novel quantitative trait loci associated with brown planthopper resistance in the rice landrace Salkathi

Sangram Keshori Mohanty · Rudraksh Shovan Panda · Soubhagya Laxmi Mohapatra · Arundhati Nanda · Lambodar Behera · Mayabini Jena · Rabindra Kumar Sahu · Sarat Chandra Sahu · Trilochan Mohapatra

Received: 24 September 2015 / Accepted: 1 January 2017 / Published online: 7 January 2017
© Springer Science+Business Media Dordrecht 2017

Abstract The brown planthopper (BPH) is a potent pest of rice in Asia and Southeast Asia. Host resistance has been found to be the most suitable alternative to manage the insect. But varietal resistance has been found to be short-lived. There has been a constant search for alternate resistance genes. We developed an F_8 recombinant inbred population for the BPH resistance gene in Salkathi, an *indica* landrace from Odisha, India. Phenotyping of RILs against the BPH population at Cuttack, Odisha showed continuous skewed variation with four peaks at 2.1–3.0, 4.1–5.0, 6.1–7.0 and 8.1–9.0 SES score, suggesting the involvement of quantitative loci for resistance to BPH in Salkathi. Mapping showed the presence of two QTLs on the short arm of chromosome 4. One QTL, with phenotype variance of 37.02% is located between the markers RM551 and RM335. The other QTL, with phenotype variance of 7.1% is located between markers RM335 and RM5633. The two QTLs have been designated as *qBph4.3* and *qBph4.4*. *qBph4.3* seems to be a novel QTL associated with BPH

resistance. We have successfully transferred *qBph4.3* and *qBph4.4* into two elite rice cultivars, Pusa 44 and Samba Mahsuri. Fine mapping of the identified QTLs may lead to a successful transfer of QTLs into other elite germplasm backgrounds.


Keywords Brown planthopper · *Oryza sativa* · QTL · SSR · RIL

Introduction

Brown planthopper (*Nilaparvata lugens* Stal) is one of the most destructive insect pests in rice-growing areas of Asia and Southeast Asia. Both adults and nymphs of the insect feed on rice sheaths by sucking sap from phloem. All the growth stages of rice plant in the field are vulnerable to BPH. Mild infestations by the insects lead to yellowing of leaves, reduction in plant height, growth, vigor, number of productive tillers and grain filling. Heavy infestations cause complete drying and death of plants, a condition known as “hopperburn” (Sogawa 1982; Watanabe and Kitagawa 2000; Ali et al. 2012). BPH also transmits rice tungro, grassy stunt and rugged stunt virus (Ling et al. 1978; Khush 1979; Hibino 1989, 1996; Khush and Brar 1991; Rivera et al. 1996; Normile 2008). The habitat of the insect, rapid multiplication, high mobility and survival against selection forces has made this insect a threat to rice cultivars. BPH control by using of chemical pesticides is not efficient. It is environmentally hazardous coupled with the resurgence of the insect. Cultivation of resistant varieties is

S. K. Mohanty · R. S. Panda · S. L. Mohapatra · A. Nanda · L. Behera (✉) · M. Jena · R. K. Sahu · S. C. Sahu
Central Rice Research Institute, Cuttack, Odisha 753006, India
e-mail: l_behera@yahoo.com;
lambodarjamujhadi@yahoo.com

T. Mohapatra
DARE, ICAR, New Delhi, India

 Springer


Regional Institute of Education
Bhubaneswar/Bhubaneswar-751022