



ST. GREGORIOS COLLEGE KOTTARAKARA

Details of Research Publications





Distribution of planktonic diatoms of Chothavilai beach, Kanyakumari district

G.M. Lekshmi *, M Sukumaran** and M. Mathevan pillai**

* Department of Botany, St. Gregorios College, Kottarakara, Kerala, e-mail : gmlekshmi@gmail.com

**Department of Botany, S.T.HinduCollege, Nagercoil, Tamilnadu

Abstract

The Chothavilai beach of Thengamputhoor village located in Kanyakumari district of Tamilnadu state lying along the Southwest coast of India, is a recreation spot frequented by tourists and local people. In the present investigation emphasis was laid on the community structure of diatoms in the surface water of two stations of Chothavilai beach for a period of six months from January to June 2004. A total of 62 species of diatoms were recorded from the two stations. Diatoms population density revealed a definite and distinct seasonal pattern at both the stations. Maximum population density was recorded during monsoon season.

Keywords: Plankton, Diatom, Chothavilai beach.

Introduction

Ocean is the largest habitat and covers about 71% of earth's surface. Unlike fresh water and terrestrial habitat, sea is continuous and is inhabited by various organisms. In fact life started in the marine habitat and is called the "cradle of life". The marine habitat exhibits two clear horizontal stratifications named pelagic region or whole body of water and benthic region or bottom region. The seasonal climatic changes in the marine environment play a significant role in the ecological cycle of the Indian seas, especially Arabian sea. Observations made over the years, point to the fact that the seasonal changes brought in through the pre-monsoon, monsoon and post-monsoon phenomena along with the resultant oceanographic changes influence the overall productivity of the region significantly. Planktons are pelagic floating organisms and are moved by water current. But they cannot move against the current. Most of the planktons are microscopic in nature. Both phytoplanktons and zooplanktons occur in the sea. Phytoplankton form integral component of the marine ecosystem. Phytoplanktons are mainly composed of diatoms, green algae, blue green algae, dinoflagellates and silicoflagellates Gowda *et al.*, (2001).

Diatoms are unicellular, pennate and centric forms of diatoms are present. They reflect subtle changes taking place in their immediate environment. This feature helps us in predicting the relationship of diatoms with their immediate environment by studying their population density, species diversity, species richness and evenness. In the present investigation emphasis was laid on the community structure of diatoms in the surface water of Chothavilai beach.

Materials and methods

Micro-phytoplankton (Diatoms) samples were collected at monthly intervals from surface sea water by towing plankton net made of bolting silk (mesh aperture size 48µm) for half an hour. The collected diatom samples were fixed with acidified formaldehyde solution for the quantitative analysis using utermoh's inverted plankton microscope. The diatom taxa were identified with the help of classical works of Venkatraman (1939), Cüpp (1943), Subrahmanyam (1946), Prescott (1954), Wood (1963), Desikachary (1959, 1987), Hendey (1964, 1974), Sourmia (1968, 1970, 1978), Steidinger and Williams (1970) and Anand *et al.*, (1986).

Species diversity index (H') of the surface diatom community was analysed using the formula





ARTICLE

A Study of Antibacterial Activity of the Crude Extracts of *Biophytum sensitivum*

Lekshmi, G.M., Athiramol, V., Dency Koshy, Reena, R., Soumya Mathew, Steena, S.

Received 20/01/2015 Accepted 05/04/2015

Abstract
The leaves of *Biophytum sensitivum* extracted with ethanol and water in a soxhlet extractor were used for the study purpose. The preliminary antibacterial activities of the extracts were determined by measuring the zone of inhibition produced by the extracts against various microorganisms (*Escherichia coli*, *Staphylococcus aureus* and *Klebsiella*). The extracts were compared with gentamicin as a control and negative control (DMSO). All the extracts exhibited antimicrobial activity against the tested microorganisms. Ethanol extract exhibited more activity than water extract.
Key words: *Biophytum sensitivum*, Antibacterial, Zone of inhibition, *Escherichia coli*, *Staphylococcus aureus*, *Klebsiella*.

Introduction

Biophytum sensitivum (Mukkutti) is a perennial herb belonging to the family Oxidaceae. It has very small flowers with wide distribution in India. It is an important flower for the people of Kerala both for its medicinal values and cultural importance. *Biophytum* is used for the treatment of chest complaints, convulsions, cramps, inflammatory tumours, arthritis, back pain, bone spur, leg pains etc. Its ash is mixed with lime juice and given for stomach problems. The leaves are grinded in butter milk and used for treating dysentery. The powdered leaves and seeds were applied on wounds (Bever and Zahnd, 1979). It is a good medicinal herb and is used to clean uterus after delivery. *Biophytum sensitivum* is one of the plants used against snake envenomation.

The administration of methanolic extracts of *Biophytum sensitivum* increases the total White Blood Cell count and stimulate the hematopoietic system by increasing the count of bone marrow cells. The antitumor activities of *Biophytum sensitivum* extract was determined by both in vitro and in vivo methods. In the present study an attempt has been made to reveal that leaf extracts of *Biophytum sensitivum* possess antibacterial activity.

Materials and Methods

Healthy plants of *Biophytum sensitivum* was collected from different areas of Kottarakara of Kollam district (Kerala) during the month of November 2013. Herbarium speci-

men of the study material has been deposited in the department herbarium. Leaves were harvested, washed and dried in shade. Dried samples were powdered and 5g were extracted with ethanol and water in soxhlet extractor. The ethanol and water extract was concentrated under vacuum in a rotary evaporator.

The antimicrobials present in the plant extract were allowed to diffuse out into the medium and interact in a plate freshly seeded with the test organisms. The resulting zones of inhibition will be uniformly circular as there will be a confluent lawn of growth. The diameter of zone of inhibition can be measured in centimeters.

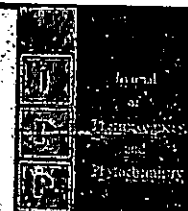
The medium was prepared by dissolving 33.9 of the commercially available Muller Hinton Agar medium (HiMedia) in 1000mL of distilled water. The dissolved medium was autoclaved at 15lbs pressure at 121°C for 15 minutes. The autoclaved medium was mixed well and poured into 100mm petriplates (25-30 mL/plate) while still molten.

One litre of nutrient broth was prepared by dissolving 13g of commercially available nutrient medium (HiMedia) in 1000mL distilled water and boiled to dissolve the medium completely. The medium was dispensed as desired and sterilized by autoclaving at 15lbs pressure (121°C) for 15 minutes. Gentamycin is used as standard antibacterial agent (concentration 20mg/mL).

Petri plates containing 20mL Muller Hinton medium were seeded with 24hrs culture of bacterial strain such as, *Staphylococcus aureus* and *E. coli*. Wells of approximately 10mm was bored using a well cutter and sample of 25, 50 and 100µl concentrations were added. The plates were then incubated at 37°C for 24 hours. The antibacterial activity was assayed by measuring the diameter of the inhibition zone formed around the well (NCCLS, 1993). Gentamycin is used as a positive control.

Department of Botany, St. Gregorios College, Kottarakara, Kerala, India

*Corresponding Author email: gmlekshmi@gmail.com



E-ISSN: 2278-4136
P-ISSN: 2349-8234
JPP 2019; 8(3): 2313-2315
Received: 10-03-2019
Accepted: 12-04-2019

GM Lekshmi
Department of Botany, St.
Gregorios College, Kottarakara,
Kerala, India

A Gangaprasad
Department of Botany,
University of Kerala,
Kariyavattom,
Thiruvananthapuram, Kerala,
India

Phytochemical analysis of *Ophiorrhiza pectinata* ARN. (*Rubiaceae*) a potential anticancer plant

GM Lekshmi and A Gangaprasad

Abstract

Ophiorrhiza pectinata (whole plant) solvent extracts (chloroform, methanol and water) were prepared by Soxhlet extraction method and these extracts were subjected to thin layer chromatography. The mobile phase used was chloroform: methanol (24: 1 ratio). Camptothecin (authentic standard) served as the reference. Retention factor value (0.6) was observed in the extracts of chloroform and ethyl acetate, corresponding to the similar band observed from reference standard (Camptothecin). Camptothecin appeared blue fluorescence under UV light and turned orange red colour while spraying dragonorff's reagent. Camptothecin was quantified using High performance liquid chromatography. A standard graph of Camptothecin was made using Camptothecin and the Camptothecin content of whole plant (field grown plant) was quantified by calibration with this standard graph. Presence of Camptothecin was confirmed, the yield of Camptothecin (field grown plant) was 250.54 $\mu\text{g g}^{-1}$ d.wt.

Keywords: Camptothecin, suspension culture, *Rubiaceae*, high performance liquid chromatography.

Introduction

The genus *Ophiorrhiza* L. (*Rubiaceae*) with about 400 species is distributed from Eastern India to the West Pacific and from South China to Northern Australia [1]. The genus *Ophiorrhiza* consists of 49 species in India [2,3]. Different species of the genus have been used in traditional medicines against snake bite, ulcers and wound healing, ulcers, helminthiasis, poisonous wounds, gastropathy, leprosy and hydrophobia [4]. Most species of *Ophiorrhiza* are characterized by the presence of a cytotoxic alkaloid, camptothecin, which is the only naturally occurring topoisomerase-I inhibitor [5,6]. The presence of camptothecin gives great importance to *Ophiorrhiza* species in cancer research and hence *Ophiorrhiza* species are economically very important due to the presence of CPT and other valuable alkaloids. *Ophiorrhiza pectinata* Arn. is a herbaceous plant and is distributed over peninsular India and Sri Lanka. The main objective of the present study is to evaluate *Ophiorrhiza pectinata* and quantify camptothecin using HPLC

Materials and Methods

Plants were harvested, washed and air dried. Dried samples were powdered and 5 g was extracted with chloroform at room temperature under constant stirring. The first extraction was carried out for 6h. The extracts were separated through Whatman No. 1 filter paper and the residues were again extracted at 5h interval till the extract became colourless. The extract was concentrated under vacuum in Rotavapor (Superfit, India).

Thin Layer Chromatography (TLC)

Glass plates (5 mm thick) of dimension 5 x 20 and 10 x 20 cm and rectangular glass chromatography chambers (30 x 20 x 25 cm, Borosil) were cleaned thoroughly and rinsed with 95% acetone and dried. TLC plates were prepared using silica gel as the adsorbent. Cleaned glass plates were kept flat closely side by side over a uniform flat surface of the TLC plating device. A slurry of silica gel was prepared by mixing silica gel with distilled water 1:2 (w/v) ratio and spread on the glass plates with the help of a TLC applicator which was adjusted to the thickness of 1.0 mm. The plates were dried at room temperature and activated at 110°C for 30 minutes in a thermo-regulated hot air oven before use. Standard sample, 1mg camptothecin (Sigma chemicals, USA) dissolved in 10 ml chloroform and concentrated samples from cultures dissolved in chloroform were spotted on TLC plates using capillaries or micro syringe placed in the chromatography chambers containing 40 ml of solvent system such as chloroform: Methanol (24:1). Which was closed with lid and kept for 10 minutes to provide a saturated atmosphere. The plates were kept slanting on the wall of the chamber and its mouth was sealed tightly with the lid. The chromatographic run was carried out at room temperature.

IN VITRO REGENERATION FROM LEAF CALLUS CULTURES OF *OPHIORRHIZA PECTINATA* ARN. (RUBIACEAE)

G.M.Lekshmi ^{1*} and A.Gangaprasad ²

¹Department of Botany, St. Gregorios College, Kottarakara, Kerala.

²Department of Botany, University of Kerala, Kariyavattom, Thiruvananthapuram.

Abstract :

Indirect regeneration in *Ophiorrhiza pectinata* Arn. an important medicinal plant(Rubiaceae) has been achieved using leaf explant. The young leaves excised from 4-6 months old plants of *Ophiorrhiza pectinata* were cultured in Murashige and Skoog (MS) medium containing agar (0.8%), sucrose(3%) and different concentrations of 2,4-D and picloram individually and in combination. Organogenetic callus induced from leaf segments were subcultured onto different regeneration media containing BA/KIN/2ip alone at lower concentrations in order to get regeneration from the callus. Leaf callus initiated from KIN (1 mg/l) and PIC (1 mg/l) on sub culturing to regeneration media produced a maximum of 6 shoots from BAP 2 mg/l. Leaf callus raised from 2,4-D (0.5 mg/l) and along with 2ip (1 mg/l) on transferred to regeneration media produced a maximum of 13 shoots in BAP (1 mg/l). Elongation of microshoots occurred on M.S. medium containing GA3 (3 mg/l), increase in concentration of GA3 decrease the shoot length. Auxins (IAA, IBA, NAA) alone induce rooting, IAA (4 mg/l) showed better rooting than IBA and NAA. Rooting shoots were transferred to liquid M.S medium over a filter paper bridge for hardening. Further these plantlets were transferred to plastic cups containing soilrite. The plant lets were wetted with Hoagland's solution periodically and subsequently hardened plants were transferred to green house conditions for establishment where they showed survival rate of 80 %.

Keywords: *Ophiorrhiza pectinata*, Camptothecin, Rubiaceae, indirect regeneration

Introduction

Ophiorrhiza pectinata Arn. belongs to the family Rubiaceae and is distributed over peninsular India and Srilanka. The genus *Ophiorrhiza* consists of about 150 species and distributed in tropical and subtropical Asia. Species of *Ophiorrhiza* are economically important and many of these species contain a high value anticancerous compound a cytotoxic alkaloid camptothecin and other valuable alkaloids. A preliminary study conducted in *O. pectinata* also contains this important alkaloid (0.0040mg/g dry wt). The present study was conducted to standardize protocols for indirect regeneration of *Ophiorrhiza pectinata* via callus culture and to find out any variation among the regenerants.

Materials and Methods

Young leaves from an actively growing plant of *Ophiorrhiza pectinata* maintained in Department garden, Department of Botany were collected and used as explants. Explants were first washed in running tap water and cleaned with detergent solution. The explants were surface sterilized by immersed in 0.1% HgCl₂ solution for 5 minutes. The explants were then washed thrice with sterile distilled water. The leaves were cut onto MS medium containing various concentrations of 2,4-D and picloram individually and in combination. After 30 days the proliferated callus were transferred to MS medium containing different cytokinins viz., BAP, kinetin and 2ip. The proliferated stunted shoots were transferred to different concentrations of GA₃ for shoot elongation. For rooting the elongated shoots were transferred to MS medium containing different concentrations of auxins like IAA, IBA and NAA. All the cultures were incubated at 25±2° C under a relative humidity of 50 to 60% and 12 hour photoperiod. After 4 weeks the rooted plants were deflasked washed and transferred to plastic cup containing sand and garden soil 1: 1. The plantlets were wetted with Hoagland's solution periodically

PHYSICO-CHEMICAL CHARACTERISTICS IN RELATION TO POPULATION DENSITY OF DIATOMS OF CHOTHAVILAI BEACH, KANYAKUMARI DISTRICT

G M LEKSHMI*, M SUKUMARAN** and M MATHEVAN PILLAI**

*Department of Botany, St. Gregorios College, Kottarakara, Kerala. **

*Department of Botany, S.T.Hindu College, Nagercoil, Tamilnadu***

Abstract

The Chothavilai beach of Thengamputhoor village located in Kanyakumari district of Tamilnadu state lying along the Southwest coast of India, is a recreation spot frequented by tourists and local people. In the present investigation emphasis was laid on the physico-chemical characteristics in the surface water of two stations of Chothavilai beach for a period of six months from January to June 2004. Maximum population density of diatoms was recorded during higher values of silicate, nitrate, salinity and rainfall.

Key words : Diatoms, Phytoplankton, physico-chemical, population density, salinity

Introduction

The inter relationship between the organisms and their immediate environment is unavoidable and inseparable. It is more so in the case of phytoplankters, because they respond quickly to the changes in the environmental conditions of the habitat where they live. The fluctuation in phytoplankton densities is due to various factors such as salinity, light, turbidity, temperature and nutrients (1,2,3,4,5) Salinity is the prime factor (6&7) high salinity favours phytoplankton abundance. In summer nitrate and phosphate were utilised exhaustively and the productivity was maximum (8) Chothavilai beach is a recreation spot frequented by tourists and local people as well. The quality of the beach and the environment should be hygienic and healthy to the fun loving people. In the present study an attempt has been made to assess the water quality and the immediate environment using the diatoms as a tool.

Materials and methods

The surface water sample was collected monthly in a plastic container. Water temperature was recorded in the surface water. Salinity was recorded with the help of a salinometer (Erma, Japan). Water pH using a pH meter (Elico). Dissolved oxygen content was estimated by modified Winkler's method. For the analysis of nutrients, water samples were filtered using a Millipore filtering system and analysed for dissolved inorganic phosphate, nitrate, nitrite, reactive silicate, sodium, potassium, calcium and magnesium.

Micro-phytoplankton (Diatoms) samples were collected at monthly intervals from surface sea water by towing plankton net made of bolting silk (mesh aperture size 48µm) for half an hour. The collected diatom samples were fixed with acidified formaldehyde solution for the quantitative analysis using utermoh's inverted plankton microscope. The diatom taxa were identified with the help of classical works (9,10,11,12,13,14,15,16,17,18,19,20,21)

The study period was demarcated as pre-monsoon (January, February and March) and monsoon (April, May and June) for the sake of convenience of study as the early onset of southwest monsoon brought rainfall in the months of April, May and June 2004.

HEAVY METAL PARAMETERS OF CHOTHAVILAI BEACH, KANYAKUMARI DISTRICT

G M Lekshmi*, M Sukumaran **and M Mathevan pillai**
*Department of Botany, St. Gregorios College, Kottarakara, Kerala**
*Department of Botany, S.T.Hindu College, Nagercoil, Tamilnadu***

Abstract

The Chothavilai beach of Thengamputhoor village located in Kanyakumari district of Tamilnadu state lying along the Southwest coast of India, is a recreation spot frequented by tourists and local people. In the present investigation emphasis was laid on the heavy metal parameters in the surface water of two stations of Chothavilai beach for a period of six months from January to June 2004. Only low concentrations of heavy metals were found in water during the study period. The concentrations of Iron and manganese were higher during the monsoon season and the concentration of copper and zinc were higher during pre-monsoon season.

Keywords : Chothavilai beach, heavy metals, monsoon season, Kanyakumari district, parameters

Introduction

Ocean is the largest habitat and covers about 71% of earth's surface. Unlike freshwater and terrestrial habitat, sea is continuous and is inhabited by various organisms. In fact life started in the marine habitat and is called the "cradle of life". The marine habitat exhibits two clear horizontal stratifications named pelagic region or whole body of water and benthic region or bottom region. Most heavy metal pollution that occurs in the coastal areas are influenced by local hydrographical conditions. Sometimes it may be due to human interference or oil spilling during fishing activities. The inter relationship between the organisms and their immediate environment is unavoidable and inseparable. It is more so in the case of phytoplankters, because they respond quickly to the changes in the environmental conditions of the habitat where they live.

Chothavilai beach is a recreation spot frequented by tourists and local people as well. The quality of the beach and the environment should be hygienic and healthy to the fun loving people. In the present study an attempt has been made to assess the water quality on the heavy metal parameters.

Materials and methods

The surface water sample was collected monthly in a plastic container. Water samples were collected from the surface region of the coast and immediately kept in an ice box and transported to the laboratory to avoid contamination. The water samples were then filtered through a Millipore filtering unit using Millipore filter paper (mesh 0.45 μ). The filtered water samples were pre-concentrated with ammonium pyrrolidinedithiocarbamate (APDC), methyliso-butyl ketone (MIBK) extraction procedure followed by (1)

Filtered water was divided into two 500ml aliquots and the pH was adjusted to 4 ± 0.1 by careful dropwise addition of 5% nitric acid. The heavy metals were pre-concentrated and separated from the bulk matrix by complexation with APDC and extraction into MIBK. The organic layer containing metal chelates was collected and back extracted with 50% nitric acid and diluted with metal free double distilled water to a minimum quantity (25ml). Re-extraction of each sample with the addition of APDC and MIBK to each aliquot established the blank.

The extracted samples of water were aspirated into atomic absorption spectrophotometer (Varian Techtron, AA 1100) for the determination of (Cu, Zn, Mg and Fe) heavy metals.

A series of standard metal solutions (Cu, Zn, Mg and Fe) were prepared in the optimum concentration range with metal free double distilled water. Calibration curves were prepared by plotting absorption against concentration of the working solution for each element. Metal concentrations in the samples were calculated with the help of these calibration curves.

The study period was demarcated as pre-monsoon (January, February and March) and monsoon (April, May and June) for the sake of convenience of study as the early onset of southwest monsoon brought rainfall in the months of April, May and June 2004.



SHORT NOTE

no. of citation - 1

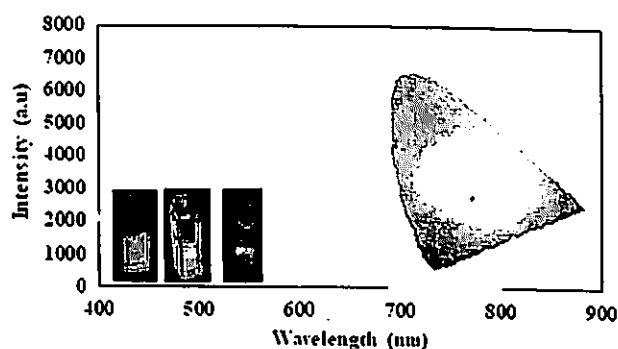
Tunable light emission using crystalline carbon dots

Jancy John^{1,2} · Raji Mary Mathew² · Titu Thomas² · Rani Abraham³ ·
I. Rejeena⁴ · R. Jayakrishnan² · Francis Chacko⁵ · Vinoy Thomas²

Received: 16 December 2017 / Accepted: 24 April 2019 / Published online: 4 May 2019
© The Optical Society of India 2019

Abstract Carbon quantum dots (CQDs) with an approximate size of 8 nm were prepared by a simple and cost-effective green technique—pyrolysis of cotton. Synthesized CQDs exhibit broad fluorescence covering almost blue and green light wavelengths. They show low cytotoxicity and good photostability. A simple mixing of rhodamine 6G chloride with highly fluorescent carbon dots in water led to aggregation of dye molecules on carbon dot surface. Controlling the emission of free rhodamine 6G dye with that of the resultant carbon dot-aggregated rhodamine 6G composite resulted in efficient white light emission with the CIE coordinate (0.305, 0.313). Suitable mixture of blue-light-emitting CQD in aqueous solution and rhodamine 6G dye can potentially be applied for tunable white light emission.

Graphical abstract



Keywords Carbon quantum dots · Optical materials · Tunable light emission

Introduction

Owing to the increasing demand for white light sources in various fields such as lighting and displays, exploration of efficient and cost-effective white-light-emitting materials has dominated the lighting research. White-light-emitting diodes (WLEDs) are promising light sources due to its long life time, compact size and low power consumption [1]. Fluorescent carbon-based materials have received increasing attention in recent years due to exceptional advantages such as high optical absorptivity, chemical stability, biocompatibility and low toxicity [1–8]. These materials mainly include carbon dots (CDs), nanodiamonds, carbon nanotubes, fullerene and fluorescent graphene [2, 4]. The prominent properties of fluorescent carbon-based materials differentiate them from traditional fluorescent materials

✉ Vinoy Thomas
vinoythoma@gmail.com

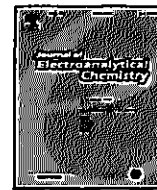
¹ Department of Physics, Mar Ivanios College, Trivandrum, India

² Department of Physics, Christian College, Chengannur 689122, India

³ Department of Chemistry, Christian College, Chengannur 689122, India

⁴ Department of Physics, MSM College, Kayamkulam, India

⁵ Department of Chemistry, St Gregorios College, Kottarakara, India



A novel heterogeneous catalyst based on reduced graphene oxide supported copper coordinated amino acid – A platform for morphine sensing

V. Anitha Kumary ^{a,*}, Pinky Abraham ^a, Renjini S ^a, B.E. Kumara Swamy ^b, T.E. Mary Nancy ^c, Aparna Sreevalsan ^a

^a Post Graduate and Research Department of Chemistry, Sree Narayana College for Women, Kollam 91001, Kerala, India

^b Department of P.G. Studies and Research in Industrial Chemistry, Jnana Sahyadri, Kuvempu University, Shankaraghatta-577 451, Shimoga, Karnataka (S), India

^c Post Graduate and Research Department of Chemistry, Fatima Mata National College (Autonomous) Kollam, 691001, Kerala, India

ARTICLE INFO

Article history:

Received 28 April 2019

Received in revised form 1 July 2019

Accepted 7 August 2019

Available online 08 August 2019

Keywords:

Electrochemical sensor
Reduced graphene oxide
Copper-alanine complex
Morphine
Diclofenac
Modified electrode

ABSTRACT

A reduced graphene oxide (RGO) supported electropolymerised copper coordinated amino acid (Cu-poly(Ala)) was deposited on a glassy carbon electrode (GCE) by a two-step process and its application as a sensor is demonstrated herein. The prepared nanocomposite presented a novel way for the design of an electrochemical sensor by incorporating the fascinating characteristics of amino acid alanine as the molecular host providing cavities and Cu^{2+} as the active centre generating a platform for electrochemical deposition of RGO. The sensor was able to detect both phenolic as well as tertiary amine group of morphine (MO). A lowering of potentials by 270 mV and 145 mV compared to bare GCE was monitored, which is much lower than available reports. An enhanced rate constant of the order of $3.5 \times 10^5 \text{ mol}^{-1} \text{ L s}^{-1}$ was obtained. This novel sensing platform for MO produced a very low detection limit of 47 nM with a very good linear dynamic range 50 nM to 80 μM . The sensor displayed good anti interference ability, stability and was successfully applied to real sample analysis.

© 2019 Elsevier B.V. All rights reserved.

1. Introduction

Morphine (MO) is an opiate analgesic, and one of many commonly used narcotic painkillers. This naturally occurring alkaloid is derived from the seeds of Papaver somniferum poppy plant. Morphine works to reduce severe pain by changing the way the central nervous system (CNS) responds to pain located throughout the body. People abuse it for the euphoric feeling it gives and leads to addiction. When consumed in overdose or abused, it is toxic. There are many serious side effects such as slow heartbeat, disruption in central nervous system, hallucination, muscle stiffness, respiratory issues and even coma. Heroin (3,4-diacetyl morphine) the most abused and rapidly acting opiate, is the prime indicator of drug abuse which is synthesized from morphine [1,2]. Also morphine can be used to investigate of opiate abuse for epidemiological purposes of drug abuse control as well as for forensic cases as an indicator of heroin usage. It is estimated that 8 million people abuse opiates in the world [3]. It also finds use in identification of causes of intoxication or death in cases of clinical and pathological purposes [4]. The widespread use of illicit drugs demands improved methods for their determination in seizure and in biological samples. Due to all these issues, it is extremely important to monitor morphine doses and protect against overdose. As a consequence of the importance

of morphine detection for human health and for identification of opiates abuse, many quantitative analytical methods have been developed and used. Among them liquid chromatography coupled with UV detection [5], thin layer chromatography [6], resonance scattering [7], time resolved chemiluminescence [8], spectrometry [9], immunoassay [10] and electrochemical methods are available [11–13]. But electrochemical methods are preferred over other techniques due to low cost, fast response, simplicity, high sensitivity and ease of use.

The integration of nanomaterials in to biosensors has led to significant improvements in signal transduction as they exhibit unique electronic, physical and chemical properties such as high surface area to volume ratio, good thermal and electrical properties and high electrical conductivity. Thus incorporation of nanomaterials on electrode surface can widely improve the electrochemical performance of the devices for the determination of biomolecules. Recently, scientists are inclined to use graphene based nanocomposites especially grapheneoxide metal/metal oxides/MWCNTs/polymer etc. [14–20]. Graphene has shown excellent performance in many biosensing applications because of their novel properties such as excellent conductivity, high stability, fast electron transfer rate, large surface area, ultralight weight and mechanical strength. [21].

Functionalization of nanomaterials leads to significant improvement in the performance of biosensors by promoting electrochemical properties resulting in high electron transfer rate and better biocompatibility than a single component. The combination of graphene with other

* Corresponding author.

E-mail address: anithasreevalsan@gmail.com (V.A. Kumary).



Electrochemical synthesis of thin-layered graphene oxide-poly(CTAB) composite for detection of morphine

Pinky Abraham¹ · S. Renjini¹ · T. E. Mary Nancy² · V. Anitha Kumary¹

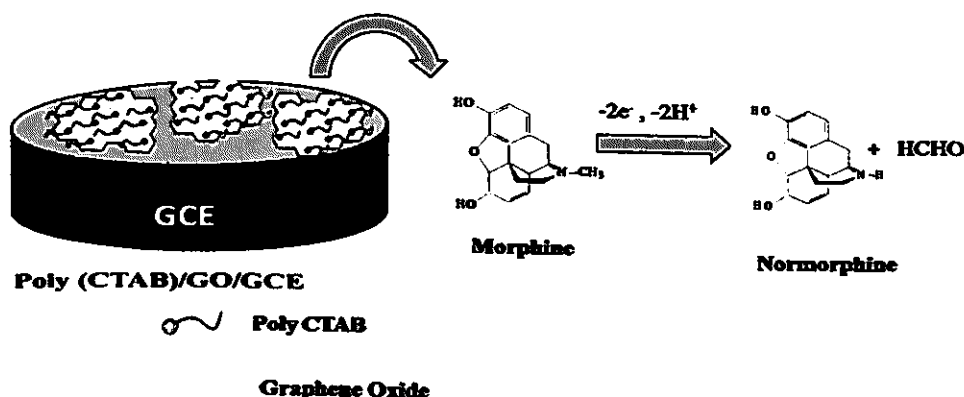
Received: 22 June 2019 / Accepted: 24 October 2019
 © Springer Nature B.V. 2019

Abstract

In this work, poly(cetyltrimethylammoniumbromide)/graphene oxide (poly(CTAB)/GO) composite was synthesized via in situ electropolymerisation and used as novel sensor for morphine (MO) detection. The CTAB functionalized graphene sheet offers large surface area which remarkably enhances the electrochemical response of MO compared to that of bare glassy carbon electrode (GCE). The surfactant CTAB with its hydrophilic head and hydrophobic tail plays a significant role in enhancing the catalytic property of the electrode. The electrostatic interaction between cationic group of poly (CTAB) and lone pair on nitrogen atom of tertiary amine group of MO favours the electro oxidation of tertiary amine group rather than phenolic group. A detection limit of 0.36 μM and a wide linear range of 50–60 μM feature the merits of the proposed composite in the analysis of MO. This sensor shows good repeatability, reproducibility, stability and anti interference properties. It is also tested in real samples.

Graphic abstract

Schematic representation of the electrochemical behaviour of the modified electrode poly (CTAB)/GO/GCE towards morphine.



Keywords Poly(CTAB) · Graphene oxide · Morphine · Surfactant · Electrochemical detection

Electronic supplementary material The online version of this article (<https://doi.org/10.1007/s10800-019-01367-2>) contains supplementary material, which is available to authorized users.

✉ V. Anitha Kumary
 anithasreevalsan@gmail.com

Extended author information available on the last page of the article

1 Introduction

Morphine (MO), a member of opiate family, is best known for its pain relieving ability in patients undergoing surgical procedures. Its frequent use leads to disruption in central nervous system and cause severe side effects [1]. Around 90% of orally administered MO is excreted from the body

Published online: 20 November 2019



Graphene-Palladium Composite for the Simultaneous Electrochemical Determination of Epinephrine, Ascorbic acid and Uric Acid

Renjini S.,* Pinky Abraham, Aparna S., and Anitha Kumary V. ©²

Post Graduate Department of Chemistry, Sree Narayana College for Women, Kollam, Kerala 691001, India

The unique properties of graphene blended with palladium deposition were used for sensing application by virtue of its charge transfer properties. Epinephrine (EP) is anodically oxidized on a glassy carbon electrode (GCE) modified by palladium graphene composite in phosphate buffer solution of pH 7. The electrodeposited palladium over the GCE – graphene surface ensures fast electrochemical determination of EP. The electrode served as a sensing platform for the simultaneous voltammetric determination of EP, ascorbic acid (AA) and uric acid (UA). The electrochemical deposition of palladium has greatly enhanced the surface properties. Cyclic voltammetry (CV), differential pulse voltammetry (DPV) and chronoamperometry were used to assess the electrochemical performance. Investigations reveal that the process is adsorption controlled involving two electrons and the average catalytic rate constant is $2.39 \times 10^3 \text{ M}^{-1}\text{s}^{-1}$. Palladium incorporated electrode sensitively determined EP in presence of the usual interferents uric acid (UA) and ascorbic acid (AA) with well resolved peaks at very minute concentrations. DPV method enabled the highest sensitivity of 100nM for EP, 170nM for UA and 22μM for AA. The modified electrode offered excellent performance toward real samples such as blood serum and urine.

© The Author(s) 2019. Published by ECS. This is an open access article distributed under the terms of the Creative Commons Attribution 4.0 License (CC BY), <http://creativecommons.org/licenses/by/4.0/>, which permits unrestricted reuse of the work in any medium, provided the original work is properly cited. [DOI: 10.1149/2.0941914jes]



Manuscript submitted May 24, 2019; revised manuscript received September 9, 2019. Published October 7, 2019.

Epinephrine (EP), ascorbic acid (AA) and uric acid (UA) are important biomolecules that co-exist in the extra cellular fluid of the central nervous system and serum. EP is an important catecholamine neurotransmitter responsible for various biological and chemical processes. EP is synthesized through a natural process in human body from L-tyrosine. Studies on the electrochemistry of EP is important because it regulates heart beat and plays a significant role in treatment of diseases such as cardiac arrest, anaphylaxis, hypertension, glaucoma, bronchitis, bronchial asthma and other allergic conditions.¹ Uric acid (UA) is the primary product of purine metabolism² and its level ranges from 41–88 mgmL⁻¹ in serum.³ Abnormal concentration level of UA is an indication of several diseases, such as gout, hyperuricemia and Lesch – Nyhan syndrome, Leukemia, Pneumonia etc.^{4–6} Ascorbic acid, commonly known as vitamin C also plays a very significant role and essential to maintain proper function of immune system.^{7,8} Being an antioxidant, it reacts with histamines and peroxides and in reducing the cancer incidences.^{9–11} Monitoring the levels of these biomolecules is therefore of great importance and has been a challenge to researchers. Many electrochemical strategies^{12–15} have been designed and applied for the detection of these samples. Methods like liquid chromatography,^{16–18} fluorometry,^{19,20} chemiluminescence,^{21,22} capillary electrophoresis²³ and spectrophotometry²⁴ are being used for the detection of EP, AA and UA. Whereas electro analytical techniques are advantageous for the detection of these electro active molecules by virtue of low cost, fast response, simple instrumentation, high sensitivity and facile miniaturization. But the coexistence of EP, AA and UA results in interference due to their close oxidative potentials. This difficulty in obtaining well resolved signals demands the use of modified electrodes capable of producing resolved signals.

Many reports on modified electrodes are available for the determination of EP, AA and UA, such as electrodes modified by conducting polymers, amino acids, nanocomposite materials etc. Among the different nanomaterials graphene based materials received great interest because of their fascinating surface structure and versatile electrical and mechanical properties.^{25–27} Graphene is one atom thick planar sheets of sp² bonded carbon atoms that are densely packed in a honeycomb crystal lattice, which is primarily obtained from reduction of graphene oxide.²⁸ Functionalization of graphene leads to improvement of surface area and related properties resulting in enhanced electrode kinetics, when used for electrode modification.²⁹

There are reports of glassy carbon electrode modification with metal nanoparticles-graphene composites for the electrochemical quantification of EP leading to enhanced sensitivity and low detection limits by virtue of an increased electroactive surface area and efficient electron transfer.³⁰ Metal nanoparticles-dispersed graphene are best known for their synergistic effect in the analytical determination of many biomolecules.³¹ Noble metal nanoparticles find potential applications in catalysis, energy conversion, sensors and fuel cells.^{32,33} Palladium is best known for its catalytic effect^{34–37} and an electrode modification based on graphene palladium can greatly enhance the surface properties of an electrode.³⁸

Graphene sheets are protected by a cloud of π conjugated electrons that prevent the individual carbon atoms from chemical interactions. Any topological defects in graphene can break this barrier and enable the exposure of reactive carbon atoms. Therefore, functional groups or dangling atoms in graphene help to establish strong bonds with a second component. Metal reinforced graphene composites possess outstanding physical and mechanical properties making it an ideal reinforcement material for composites. As graphene is a zero-bandgap material, the presence of defects and functional groups help to open a bandgap and induce a semiconductor behavior.³⁹ Defective sites of graphene are preferred to clean graphene surfaces for the dispersion of metal nanoparticles. Graphene interacts and binds more strongly with transition metals like Co, Ni, Pd and Ti. The hybridization between d-states of transition metals with p_z states of graphene leads to a bandgap opening.

Chemical reducing agents are avoided by choosing a green method of solar exfoliation for the preparation of reduced graphene oxide. In solar exfoliation heating rate is so rapid that exfoliation takes place at much lower temperature than thermal exfoliation and evolution of CO₂ and decomposition of functional group occur immediately after irradiation. Layers of reduced graphene oxide expanded due to release of CO_x gases during irradiation. Additionally, reduction of graphite oxide in aqueous suspension leads to agglomeration of graphene sheets. Moreover, solar exfoliated reduced graphene oxide was found to be highly conducting.^{40,41} Thus, solar exfoliated reduced graphene oxide can offer more effective electrochemical surface area making it suitable for electrode modification. The abundance of palladium on the earth is at least fifty times more than that of platinum, which has raised the interest for intensive research on palladium nanoparticles in areas of electrocatalysis. Palladium forms strong bonds with reduced graphene oxide, which results in altered electronic configuration and band structures near the dirac points.^{42,43} The strong interaction between the reduced graphene oxide and palladium nanoparticles

*Electrochemical Society Student Member.
²E-mail: anithasreevalsan@gmail.com



An Electrochemical Sensor based on Electrodeposited CTAB Film on Glassy Carbon Electrode for Detection of Morphine

PINKY-ABRAHAM*, S. RENJINI, V. ANITHAKUMARY and P.G. CHITHRA

Department of Chemistry, Sree Narayana College for Women, Kollam-691001, India

*Corresponding author: E-mail: pinkyabrahampanavila80@gmail.com

Received: 26 July 2019;

Accepted: 17 September 2019;

Published online: 18 November 2019;

AJC-19687

A simple, effective and rapid method for the electrochemical detection of morphine is described based on glassy carbon modified electrode with poly(CTAB). In this work, poly(CTAB) thin film was generated through electropolymerization of the surfactant CTAB. The formation of nanoporous thin film of poly(CTAB) was confirmed by field emission scanning electron microscopy (FESEM) with energy dispersive spectra (EDS) and Fourier transform infrared spectroscopy (FTIR). The electrochemical behavior of morphine is explained in terms of the anodic oxidation of its tertiary amino group. The limit of detection was calculated as 0.2 μM with a good regression between concentration and peak current of morphine by using differential pulse voltammetry within the range of 50 nM to 20 μM . The poly(CTAB)/GCE based sensor shows excellent electrochemical performance for the detection of morphine and this sensing platform can be effective for the detection of similar molecules.

Keywords: Electrochemical sensor, Poly(CTAB), Morphine.

INTRODUCTION

Morphine is an opiate analgesic and one of commonly used narcotic pain killers. Among such drugs, morphine is the most abused and possess a high addiction rate. If morphine is used consistently, the user becomes both physically and psychologically dependent [1]. Therefore, the level of morphine is to be strictly monitored, fast and sensitive detection methods are to be adopted for the proper usage of morphine.

There are various techniques like UV-visible spectroscopy [2], high performance liquid chromatography [3], fluorometry [4], surface plasma resonance [5] and electrochemical methods [6-10] are available for the determination of morphine. Among them electrochemical method are unique due to its fast response, simplicity, selectivity, low cost and miniaturization. Many researchers used diversely modified electrodes for the determination of morphine with high sensitivity and selectivity. The commonly used modifiers are glassy carbon electrode [7], gold nanoparticle modified carbon paste electrode [8], ordered mesoporous carbon modified glassy carbon electrode [9], gold nanoparticle decorated graphene electrode [10], aluminium electrode

modified with metallic palladium and prussian blue [11], glassy carbon electrode modified with multiwalled carbon nanotube/chitosan composite [12], graphene nanosheet modified glassy carbon electrode [13], ionic-liquid type multiwalled carbon nanotube paste electrode [14] and polymer modified electrode [15], etc. The physical and chemical properties of polymer may be tailored over a wide range of characteristics, they play a versatile role in sophisticated electronic measuring devices such as sensors [16,17].

Many electroactive polymers have emerged as attractive candidate as sensor due to their electrochemical, electrical and optical properties. There are several reports on the use of cationic surfactant based polymer for electrochemical detection of various analytes with sensitivity and selectivity [18-20]. The surfactant CTAB received attention by virtue of its unique structure consists of a water compatible hydrophilic head and an oil compatible hydrophobic tail. The present work focus on the electropolymerization of CTAB in acidic medium and application of this polymer modified glassy carbon electrode for the detection of morphine. The sensor poly(CTAB) showed high sensitivity and better catalytic activity towards morphine.

JN



Current
Analytical
Chemistry



Solar Exfoliated Graphene Oxide: A Platform for Electrochemical Sensing of Epinephrine

(E-pub Ahead of Print)

Author(s): Renjini Sadhana, Pinky Abraham, Anithakumary Vidyadharan*.

Journal Name: Current Analytical Chemistry

DOI : [10.2174/1573411015666190104110928](https://doi.org/10.2174/1573411015666190104110928)

Abstract:

Introduction: Solar exfoliated graphite oxide modified glassy carbon electrode was used for the anodic oxidation of epinephrine in a phosphate buffer medium at pH7. The modified electrode showed fast response and sensitivity towards epinephrine molecule (EP). The electrode was characterized electrochemically through cyclic voltammetry (CV) and differential pulse voltammetry (DPV). Area of the electrode enhanced three times during modification and studies reveal that the oxidation process of EP occurs by an adsorption controlled process involving two electrons. The results showed a detection limit of $0.50 \pm 0.01 \mu\text{M}$ with a linear range up to $100 \mu\text{M}$. The rate constant calculated for the electron transfer reaction is 1.35 s^{-1} . The electrode was effective for simultaneous detection of EP in presence of ascorbic acid (AA) and uric acid (UA) with well resolved signals. The sensitivity, selectivity and stability of the sensor were also confirmed.

Method: Glassy carbon electrode modified by reduced graphene oxide was used for the detection and quantification of epinephrine using cyclic voltammetry and differential pulse voltammetry.

Results: The results showed an enhancement in the electrocatalytic oxidation of epinephrine due to the increase in effective surface area of the modified electrode. The anodic transfer coefficient, detection limit and electron transfer rate constant of the reaction were also calculated



A review on recent approaches in the field of hot dip zinc galvanizing process

S.M.A. Shibli *, B.N. Meena, R. Remya

Department of Chemistry, University of Kerala, Kariavattom Campus, Thiruvananthapuram, Kerala 695 581, India



ARTICLE INFO

Article history:

Received 7 November 2014

Accepted in revised form 22 December 2014

Available online 27 December 2014

Keywords:

Hot dip galvanization

Intermetallics

Metal/metal oxide incorporation

Galvannealed coating

Aluminide coating

ABSTRACT

The recent developments in the field of hot dip zinc coating are reviewed with special reference to different industrial applications. The improvements in physical and chemical structural composition due to pre- and post-modification processes are discussed. The present review has the focus mainly on the readership of young researchers engaged in this field. Very recent developments on the hot dip galvanization processes are highlighted. Their industrial competencies with aluminium dipping are also briefly discussed. The scopes for immediate future developments are also highlighted then and there.

© 2014 Elsevier B.V. All rights reserved.

Contents

1. Introduction	210
2. The process	211
2.1. Selection of substrate	211
2.2. Preparation of the base surface	212
2.3. Hot dip galvanization	212
2.3.1. Bath temperature	212
2.3.2. Dipping time	212
2.3.3. Withdrawal speed	212
2.3.4. Bath composition	212
3. Evaluation of coating composition	213
4. The phase reaction and formation of intermetallics	213
5. Metal and metal oxide addition in molten zinc bath	213
6. Annealing of hot dip zinc coatings	214
7. Recent developments in hot dip galvanization of high strength steel	214
8. Competency with aluminium dipping	214
8.1. The advantages of aluminium hot dipping	214
8.2. Influence of alloying elements in the formation of intermetallic layers vs aluminium	214
8.3. Corrosion resistant and oxidation resistant characteristics of aluminide coating vs aluminium	215
9. Conclusions	215
Acknowledgment	215
References	215

1. Introduction

Steel of different forms, is an integral part of building and construction industry due to its high strength and durability. Although many new and advanced materials have been developed for engineering

* Corresponding author. Tel.: + 91 85470 67230(mob), +91 471 2308682(off), +91 471 2167 230(Res).
E-mail address: smashibli@yahoo.com (S.M.A. Shibli).

CrossMark

Cite this: RSC Adv., 2015, 5, 8006

Investigations on the development of MCM-41 as a potential mesoporous silica based reference material for the analysis of multi-textural properties†

N. Sudheesh,[‡] Manu Vasudevan,[§] Haresh M. Mody, Hari C. Bajaj and Ram S. Shukla*

Investigations on the time dependent analysis of the structural and textural properties of the mesoporous silica material MCM-41 were performed by analyzing the samples at regular intervals for one year by powder X-ray diffraction (PXRD) and nitrogen sorption techniques for samples stored (i) under a dry nitrogen atmosphere in a glove box and (ii) under dry ambient atmospheric conditions. The stability and durability of this high surface area material gave promising results under both storage conditions in terms of its structural and textural properties. Under the typical storage conditions employed, the values of various textural properties, including the surface area (SA, $\text{m}^2 \text{g}^{-1}$), pore volume (PV, $\text{cm}^3 \text{g}^{-1}$), pore diameter (PD, Å) and wall thickness (WT, Å) determined by nitrogen adsorption were found to be 1030 ± 49 , 1.015 ± 0.066 , 2.755 ± 0.60 and 17.04 ± 0.61 respectively for the glove box samples. Almost identical values (SA $1022 \pm 45 \text{ m}^2 \text{g}^{-1}$, (PV $0.933 \pm 0.065 \text{ cm}^3 \text{g}^{-1}$, (PD $2.754 \pm 0.14 \text{ Å}$, (WT $16.58 \pm 0.81 \text{ Å}$) were obtained for the samples under ambient atmospheric conditions. The experimental analysis indicated that this material has potential as a standard reference material for the analysis of the multi-textural characteristics of high surface area mesoporous materials.

Received 30th September 2014
Accepted 16th December 2014DOI: 10.1039/C4RA15094
www.rsc.org/advances

1. Introduction

Porous materials are of scientific and technological importance because of the presence of voids of controllable dimensions at the atomic, molecular, and nanometer scales, enabling them to discriminate and interact with molecules and clusters, and interact with atoms, ions and molecules not only at their surfaces but through the bulk of the materials. The distribution of sizes, shapes and volumes of the void spaces in porous materials directly relates to their ability to perform the desired functions of a particular application. The need to create uniform pore sizes, shapes and volumes has steadily increased over recent years because these factors can lead to superior properties which find applications in various fields such as catalysis,¹ adsorption,² hybrid optics,³ biomedical devices,⁴ sensors,⁵ drug delivery⁶ separation processes⁷ and many more.

All of these applications are largely dependent on the textural properties of the materials. This interest in various porous matrices has triggered the need for a new generation of environmentally stable and durable standard reference materials for textural analysis. The characterization of novel and nanoporous films, spheres, fibers and monoliths requires a new standard reference material for textural analysis. Thus, studies on the textural properties are very important for such materials. The surface area (SA), pore volume (PV), pore diameter (PD) and wall thickness (WT) constitute the major textural properties that are of importance to the above applications.

Every instrument and apparatus has to be standardized and calibrated at appropriate intervals to ensure accurate and precise performance and data collection. Many of these instrument techniques need a reference material or standard for calibration. Surface area and pore size analyzers need standard reference materials for calibration. The Institute for Reference Materials and Measurements (IRMM), the Bundesanstalt für Materialforschung und -prüfung (BAM) and the National Institute of Standards and Technology (NIST) are major suppliers of surface area standards,^{8–11} and reference standards with surface areas ranging from 0.0686 to 258.0 $\text{m}^2 \text{g}^{-1}$ are available. The BAM is the major producer and supplier of reference standards for pore size analysis. CRM BAM-PM-10.3 and CRM BAM-PM-10.4 are the standards for pore size analysis. The high surface area standards are activated nanoporous

Discipline of Inorganic Materials and Catalysts, Council of Scientific and Industrial Research, Central Salt and Marine Chemicals Research Institute, G. B. Marg, Bhavnagar, Gujarat - 364 002, India. E-mail: rshukla@csri.org, sudhanarayana@gmail.com, Fax: +91 228 23669 0, Tel: +91 228 2367 06

† Electronic supplementary information (ESI) available. See DOI: 10.1039/C4RA15094

‡ Present address: Department of Chemistry, N. S. S. College, Pandalam, Pathanamthitta, Kerala - 689 501, India.

§ Present address: Department of Chemistry, St. Gregorious College, Kottarakkara, Kollam, Kerala - 691 331, India.

Ethnobotanical Documentation of Some of the Indigenous Medicinal Plants used to Treat Menstrual Disorders by Kani Tribes of Palode Forest Area of Thiruvananthapuram, Kerala

Dr. Archana G.R

Assistant Professor, Department of Botany
St. Gregorios College, Kottarakara, Kollam, Kerala

Abstract: Kerala is well known for its ethnic diversity and has a long history in traditional health practices and home remedies. The present work enumerates the traditional uses of 35 medicinal plants belonging to 25 host families that are used to treat menstrual disorders by the Kani tribes of Palode forest area of Thiruvananthapuram district of Kerala. Ethnobotanical documentation is very important for biodiversity conservation. Hence, there is an urgent need for documentation of this information before it gets vanished. This information will surely help in the development of many novel drugs for female reproductive problems.

Index Terms – Ethnobotanical documentation, Kani, Menstrual disorders, Traditional herbal remedies, Tribes

INTRODUCTION

Medicinal plants have been used from time immemorial, and numerous cultures rely on plants for their primary health care needs. Nowadays there has been a tremendous increase in the use of plant based health products in developing as well as developed countries. India has a long history in traditional health practices in local health tradition as well as home remedies. These are especially aimed in improving the health condition of women and children. Local health traditions are well known for mother and child care treatments. In Kerala, this diversified system of traditional practices prevails among the rural communities since centuries. Ethnomedicine is usually plant based and ingredients are from locally available flora and fauna. They are less expensive and have no side effects. Traditional medicine is the main source of tribal as well as rural communities of Kerala. The Kanis also known as "The Kanikkar" are the most significant tribal community in Kerala. They are mostly seen in Thiruvananthapuram, Kollam and Pathanamthitta region of Kerala State. These tribals have developed their own traditional ways of diagnosis and treatment of diseases and fulfill their basic requirements in this regard from the nearby forest. They have a very good knowledge of the plant resources, based on generations old experience. A wide range of herbal traditional medicines are used to treat female reproductive disorders like irregular menstrual cycle, enhance fertility and delivery problems.

Irregular menstruation is nowadays a serious problem. It can be explained as the irregularity of length of monthly cycles in a woman usually accompanied with bleeding in between cycles. The cycles may vary from 8 to 21 days. The variations of 21 days or more is considered highly irregular and abnormal. If the frequency is of less than 8 days we call it as Polymenorrhea and if it is more than 36 days, it is termed as Oligomenorrhea.

The cause of irregularity in menstrual cycles is basically hormone imbalance. It leads to missed periods, bleeding in between periods, blood clots, cramps during periods, Painful menstruation, Excessive bleeding lasting for a longer period than normal or very less bleeding, abnormal duration of bleeding. The herbs for irregular menses help improve the functioning of reproductive structures in a natural way. The herbs for Polymenorrhea or Oligomenorrhea help produce proper hormones for the complete functioning of ovaries and therefore to naturally start the menstrual cycle again. This way the imbalance in the body is aided in a natural herbal way.

Although the tribal people traditionally use many ethno-medicinal plants to cure many gynaecological disorders, yet not so much documentation has been done earlier. Phytochemical data on several of these plants is highly lacking. Hence keeping in view of this aspect, the present study was initiated among the Kani tribals of Palode forest area of Thiruvananthapuram of Kerala state.

REVIEW OF LITERATURE

In the early days of Ethnobotanical documentation, researchers concentrated their works on large geographical areas such as entire state or whole district. Later the studies were limited to particular tribal group or village study. This continued up to

A New species of Foliar Mycobiont from *Myristica* swamps of Shendhurney Wildlife Sanctuary, Kollam, Kerala

Dr. Archana G.R

Assistant Professor, Department of Botany
St. Gregorios College, Kottarakara, Kollam, Kerala

Abstract: Extensive and systematic field trip collections were conducted from 2014-2016 in the *Myristica* swamps of Shendhurney Wildlife Sanctuary, Kollam of Kerala State. The present study resulted in the identification of a new foliar mycobiont from this area on a hitherto unrecorded endemic host. Hence, detailed microscopic study was conducted to identify the fungi. It was identified as *Asterina vbhosagoudarii* sp.nov. on *Gymnacranthera canarica* (King) Warb. Detailed description and photomicrographs has been provided in this paper.

IndexTerms – *Myristica* swamps, Mycobiont, Shendhurney, Follicolous fungi, *Asterina*.

1. INTRODUCTION

The *Myristica* swamps are one of the most critically endangered ecosystems of the world. These are very unique freshwater swamps that require special biotic and abiotic conditions for its survival. These have now become extremely fragmented and require immediate need for its conservation. A detailed study of the *Myristica* swamps of Southern Kerala has been carried out by Nair P.V and his colleagues in 2007. In Kerala, these swamps are found in Kulathupuzha, Shendhurney and Anchal areas of Kollam district. These swamps are well known for its endemism and abundance of plants belonging to the *Myristicaceae* family. Most swamps are presumably extinct due to human impacts of various kinds. Many floristic studies have been conducted in these swamps. But, the foliar fungal studies are lacking here. Though these are obligate parasites, in many instances, they leave no mark of their existence on the host surface after removal of the colonies. Therefore, a better understanding of biology of these fungi is greatly needed. Hence, systematic field trip collections were conducted from 2014 to 2016 to these swamps to unravel the hidden foliar fungi of this region. The present study resulted in the discovery of a new foliar fungal species *Asterina vbhosagoudarii* sp.nov. on *Gymnacranthera canarica* (King) Warb. from the *Myristica* swamps of Shendhurney Wildlife Sanctuary, Kerala. The collections were identified and deposited in the St. Gregorios College Herbarium (SGCH), Kottarakara.

REVIEW OF LITERATURE

The systematic study of the microbes, including fungi started only after the invention of the microscope and fungi were the first recognized causative agents. Subsequently, the Indian researchers hosted the flag of fungi by writing the Monographs on *Clavariaceae* (Thind, 1961), Indian *Cercosporae* (Vasudeva, 1963), *Mucorales* of India (Tandon, 1968), Indian *Polyporaceae* (Bakshi, 1971), *Hyphomycetes* (Subramanian, 1971), *Myxomycetes* (Thind, 1977), *Ustilaginales* (Mundkur & Thirumalachar, 1952), *Phyllachora* (Kamat *et al.*, 1978), *Meliolales* (Hosagoudar, 1996), Soil fungi (Nagamani *et al.*, 2005), etc.

With reference to the Western Ghats, Ramakrishnan *et al.*, Thirumalachar and his co-workers (*fide* Rangaswami *et al.* 1970), Hosagoudar (1995) have contributed much to the follicolous fungi of Western Ghats. Subramanian (1986) has envisaged his work in the Western Ghats. Bappammal *et al.* (1995) have brought out more than 100 taxa of Powdery Mildews of Tamil Nadu. The studies on the fungal flora of the Western Ghats region reveal that Kerala is rich in fungal biodiversity (Subramanian, 1986). Hosagoudar *et al.* (1996a) recorded 1044 taxa belonging to 414 genera of fungi from the state of Kerala till 1995. Sankaran *et al.* (1997) have reported 1223 species of fungi belonging to 464 genera. Florence (2004) has recorded a total of 1990 species of fungi belonging to 583 genera from Kerala. Kirk *et al.* (2001) maintained the family *Asterinaceae* within the order *Hysteriales* which comprises 37 genera and 410 species. Kirk *et al.* (2008) placed the *Asterinaceae* and *Schizothyriaceae* within the *Capnodiales*. Hongsanan *et al.* (2014) revised the genera of order *Asterinales* and maintain 17 genera including *Asterina* and *Lembosia* within a single family *Asterinaceae* and the family *Lembosiaceae* is considered as a synonym of *Asterinaceae*, based on morphological and molecular data. During year 1995-2012, V. B. Hosagoudar and his co-workers extensively studied the taxa of *Asterinales* from India, and found some morphologically variant specimens than the earlier described genera in *Asterinaceae*, and hence he proposed some new teleomorphic genera namely, *Ishwaramyces*, *Maheshwaramyces*, *Bheemamyces*, *Vishnumyces*, *Gangamyces* and anamorphic genera *Bramhamyces* and *Mahanteshamyces*.



Review—Review on the Progress in Electrochemical Detection of Morphine Based on Different Modified Electrodes

Pinky Abraham,¹ Renjini S.,^{2,*} Poornima Vijayan,² Nisha V.,² Krishna Sreevalsan,³ and V. Anithakumary^{2,z}

¹Post Graduate Department of Chemistry, St. Gregorios College, Kottarakkara, Kollam, Kerala 691531, India

²Post Graduate and Research Department of Chemistry, Sree Narayana College for Women, Kollam, Kerala 691001, India

³Government Medical College, Kottayam, Kerala 686008, India

Morphine is a powerful opioid pain medication and commonly used narcotic pain killer and is toxic during overdose or when abused. Compared to conventional analytical techniques, the electroanalytical method has significant advantages viz. low cost, simplicity, ease of operation and facile miniaturization. In the present paper different approaches based on various modifications adopted for effective electrochemical sensing of morphine are reviewed in a comprehensive way. Among different modified electrodes available for the detection of morphine, carbon based materials—CNTs and graphene—display effective quantification and are attractive in terms of cost compared to noble metals. In addition, the performance of reported sensors in terms of their including detection range (LDR), limit of detection (LOD) and technique used are presented. The present review compares various electroanalytical techniques adopted for the determination of morphine.

© 2020 The Author(s). Published on behalf of The Electrochemical Society by IOP Publishing Limited. This is an open access article distributed under the terms of the Creative Commons Attribution 4.0 License (CC BY, <http://creativecommons.org/licenses/by/4.0/>), which permits unrestricted reuse of the work in any medium, provided the original work is properly cited. [DOI: 10.1149/1945-7111/ab6cf6]



Manuscript submitted September 18, 2019; revised manuscript received January 13, 2020. Published February 3, 2020. *This paper is part of the JES Focus Issue on Sensor Reviews.*

Morphine, an alkaloid derived from the poppy plant is the world's first true and real drug. Morphine is a naturally occurring phenanthrene derivative (Fig. 1a). It has been available for centuries and appeared in Pliny's *Historia Naturalis* (AD 77) as opium, the resin derived from poppy sap. The Friedrich Wilhelm Adam Sertürner, a German pharmacist and a pioneer of alkaloid chemistry took the first step in identifying opium's active ingredient, morphine in 1803.¹ It is currently obtained using techniques greatly unchanged over eight millennia.^{2–5}

The extraction of morphine was first achieved by Nicolas Lemery (1645–1725) due to the differential solubility of morphine in water, alcohol, and organic solvents.² In Europe, the commercial production of morphine began as early as in 1820s and the 1830s in the different parts of the world.^{6–10} The combination of the greater potency of morphine over opium and the ability to inject the solution directly in to the blood stream provided swifter pain relief.⁶ In 1912 the United States and many other countries signed the International Opium Convention which controlled the import, manufacture and sale of morphine.¹¹ The World Health Organizations recommended morphine as the most commonly used opioid for moderate to severe pain in people with cancer in the UK and other European countries and in the United States for non-malignant pain.¹¹

Morphine acts directly at pain modulating receptors in the nervous system, termed opioid receptors.^{12–14} These receptors are distributed throughout the central nervous system (CNS) with high concentration in the nuclei of tractus solitarius, peri-aqueductal gray area (PAG), cerebral cortex, thalamus and the substantia gelatinosa (SG) of the spinal cord. They have also been found on peripheral afferent nerve terminals and many other organs. When morphine binds the opioid receptors, the pain killing message is transmitted inside the cell through G protein cascade. The G protein is the most common method of signaling in our cells. It increases conduction through potassium channels, decreases conduction through calcium channels, and inhibits adenylyl cyclase. These changes blunt the effect of signaling systems that transmit pain.^{13,14}

Morphine is addictive and leads to drugs abuse. When morphine acts in the reward center of the brain—the area that makes eating and other essential processes feel pleasurable. The brain reacts to morphine by building more components for the G protein signaling

system. As time goes on more and more morphine is needed to have the same effect on the system. When morphine is removed, the normal function of the pleasure system is blunted by the bloated G protein signaling system leading to severe withdrawal systems.

Morphine usually as the sulfate or hydrochloride can be given orally, intramuscularly, intravenously, subcutaneously, rectally, epidurally and intrathecally. The intramuscular dose is 0.1 to 0.2 mg Kg⁻¹, peak effect is in 30–60 min and duration action is 3–4 h. In intravenous administration total dose is similar. Morphine can be given epidurally at 10% and intrathecally at 1% of the parenteral dose. The dose to be used is determined by the patient's age, not their weight. The dose is adjusted according to the response, so patients need to be observed more frequently than four-hourly.¹⁵

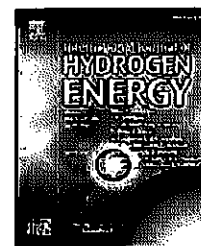
In clinical medicine morphine is regarded as the gold standard or bench mark of analgesic used to relieve severe or agonizing in cancer patients. It is used as the starting compound for the synthesis of other opioids such as hydromorphone, oxycodone and heroin, whose analgesic effect and addiction are so strong so as to be considered as drugs of abuse.^{16–19} On the other hand morphine is toxic when overdose or abused and can also influence various immune functions as well as disruption in central nervous system, respiratory rate and low blood pressure. In addition morphine analysis in biological fluids has been applied both in forensic cases and pharmacokinetic studies. All these facts points towards the need for developing a sensitive, selective and convenient electrochemical sensor for the strict monitoring of morphine in many environmental and biological samples is necessary.

Electrochemical Methods—a Better Approach for Detecting Morphine

Several analytical methods like chemiluminescence,²⁰ surface plasmon resonance,²¹ immunoassay,²² gas chromatography,²³ HPLC with UV,²⁴ radioimmunoassay,^{25,26} HPLC with amperometry,²⁷ resonance light scattering,²⁸ liquid chromatography coupled with UV detection,²⁹ thin layer chromatography,³⁰ resonance scattering,³¹ time resolved chemiluminescence,³² spectrometry,³³ immunoassay³⁴ are being employed for the detection of morphine. Although these methods can offer good selectivity, they often require advanced technical expertise, complex pretreatment steps, time consuming, and are expensive. Thus an alternative strategy for the detection of morphine is necessary. Unlike surface plasma resonance, chromatographic techniques, electrochemical sensors can

*Electrochemical Society Student Member.

^zE-mail: anithasreevalsan@gmail.com



Photocatalytic hydrogen generation by WO₃ in synergism with hematite-anatase heterojunction

P. Jineesh ^a, T.C. Bhagya ^a, R. Remya ^c, S.M.A. Shibli ^{a,b,*}

^a Department of Chemistry, University of Kerala, Kariavattom Campus, Thiruvananthapuram, Kerala, 695 581, India

^b Centre for Renewable Energy and Materials, University of Kerala, Kariavattom Campus, Thiruvananthapuram, Kerala, 695 581, India

^c Department of Chemistry, St. Gregorios College, University of Kerala, Kottarakkara, Kollam, Kerala, 691 531, India

HIGHLIGHTS

- Ternary WO₃/TiO₂/Fe₂O₃ nanocomposite with tandem n-n heterojunctions was synthesized.
- The multilane upgraded the charge transfer pathway at the tandem n-n heterojunctions.
- WO₃ boosted the synergism of heterojunctions, augmented swift transfer of electrons.
- Photocatalytic H₂ generation rate of the WO₃/TiO₂/Fe₂O₃ was significantly enhanced.

ARTICLE INFO

Article history:

Received 18 March 2020

Received in revised form

20 April 2020

Accepted 5 May 2020

Available online 31 May 2020

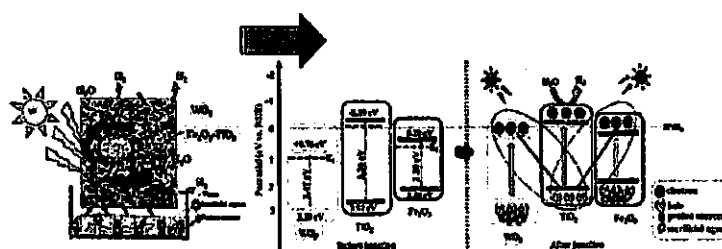
Keywords:

Water splitting

Hydrogen

Photocatalyst

GRAPHICAL ABSTRACT



ABSTRACT

The present study reports about exploration of a multi-component photocatalytic system comprising of WO₃, TiO₂ and Fe₂O₃ with tandem n-n heterojunctions. The ternary WO₃/TiO₂/Fe₂O₃ nanocomposite with WO₃ nanoparticles over the interfaces of Fe₂O₃ and TiO₂ is synthesized by wet precipitation followed by thermal decomposition. The WO₃/TiO₂/Fe₂O₃ nanocomposite has an enhanced photocatalytic performance towards hydrogen generation by water splitting reaction under visible light irradiation, when compared to the Fe₂O₃/TiO₂ system. A band gap of 2.10 eV, favouring visible light absorption was achieved with the distribution of WO₃ nanoparticles over the interfaces of Fe₂O₃ and TiO₂. The as prepared WTF heterojunction exhibited a maximum hydrogen production rate of 10.2 mL h⁻¹ for a catalyst loading of 0.025 g mL⁻¹. The enhanced photocatalytic performance is tested in presence of various sacrificial agents and proton source. In both cases, the higher

* Corresponding author. Department of Chemistry, University of Kerala, Kariavattom Campus, Thiruvananthapuram, Kerala, 695 581, India.

E-mail address: smashibli@yahoo.com (S.M.A. Shibli).

<https://doi.org/10.1016/j.ijhydene.2020.05.043>

0360-3199/© 2020 Hydrogen Energy Publications LLC. Published by Elsevier Ltd. All rights reserved.



Contents lists available at ScienceDirect

Materials Today: Proceedings

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

8



Development and characterization of organoclay filled polyetherimide nanocomposites for anticorrosive coatings

Ajith James Jose^a, Francis Chacko^{b,*}, Runcy Wilson^c, Muthukaruppan Alagar^d

^a Department of Chemistry, St. Berchmans College (Autonomous), Changanassery, Kerala, 86101, India

^b Department of Chemistry, St. Gregorios College, Kottarakkara, Kerala 691531, India

^c Department of Chemistry, St. Cyril's College, Adoor, Kerala, 691529, India

^d Centre for Excellence for Advanced Materials Manufacturing Processing and Characterisation (CoE-AMMPC), VFSIR University, Vadlamudi, Guntur, 522 213, India

ARTICLE INFO

Article history:

Received 4 May 2020

Accepted 9 May 2020

Available online xxx

Keywords:

Nanocomposite

Anticorrosion

Dispersion

Agglomeration

Impedance

ABSTRACT

Polyetherimide (PEI)/organically modified Fluorohectorite (OFH) nanocomposite were prepared by dispersing OFH in PEI matrix. The structural as well as morphological characteristics of the nanocomposites were investigated using X-ray diffraction (XRD), Scanning Electron Microscopy (SEM), Atomic Force Microscopy (AFM) and Transmission Electron Microscopy (TEM). The thermal and mechanical properties of the PEI nanocomposites were found to be significantly improved by the incorporation of organically modified fluorohectorite nano clay into the PEI matrix. The water uptake of the nanocomposites was investigated in detail as a function of clay content and it was minimum for composites with 3 wt% of filler. The anticorrosion properties of clay polymer nanocomposite (CPN) coatings were evaluated by means of various electrochemical methods which include Electrochemical Impedance Spectroscopy (EIS) and Open Circuit Potential Measurements (OCP). The results obtained from various analyses showed that the PEI/OFH nanocomposites coatings possess better anticorrosion properties.

© 2020 Elsevier Ltd. All rights reserved.

Selection and peer-review under responsibility of the scientific committee of the International Conference on Energy and Environment.

1. Introduction

One of the burning issues in the industrial applications of metals is its corrosive nature. Various techniques are available to protect these metal surfaces from corrosion and many of them are chromium based. These chromium based anticorrosive materials are hazardous to the ecosystem of living beings and aquatic animals [1]. Surface coatings on the metal surfaces, is an efficient method to control corrosion. In this work, polyether-block-polyamide (PEBA) copolymer is selected as anti-corrosive material due to its properties such as low cost, ecofriendly nature, insolubility in most inorganic solvents and elevated softening temperatures, [2]. One of the problems that can be faced while using polymer material is the formation of an additional pathway on the metallic substrate for corrosive species, which in turn promotes a localized corrosion. This can overcome by reinforcing the polymeric matrix with suitable nano materials which will increase

the length of the diffusion pathway and decrease the permeability [3–5].

The polymer/clay nanocomposites have got a considerable scientific attention from both industrial and academic fields for last several years due to their enhanced mechanical properties [6–8], enhanced thermal properties [9], flammability resistance [10], ablation performance [11] and barrier properties [12–16]. The improved barrier properties of the polymer/clay nanocomposites can be attributed to the nanoscale structural effect and the interaction between inorganic and organic materials. The barrier performance of nanocomposite is particularly determined by the clay content, aspect ratio, and the degree of dispersion of silicate layers [17]. The extent of dispersion of silicate layers in the polymer matrix can be improved by modifying the nanoclay using ion-exchange reactions which can replace interlayer cations with quaternary alkyl ammonium or alkyl phosphonium ions. This will lower the surface energy and thereby enhance the interfacial adhesion between clay mineral and polymer matrix [18].

In this work, we have studied the anticorrosion performance of PEI/OFH clay nanocomposites coatings on cold rolled steel in simulated saline atmosphere. The fluoro hectorite clay was organically

* Corresponding author.

E-mail address: fran77cis@yahoo.com (F. Chacko).

<https://doi.org/10.1016/j.matpr.2020.05.232>

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

Selection and peer-review under responsibility of the scientific committee of the International Conference on Energy and Environment.

EVALUATION OF ANTICANCER PROPERTY OF AMBLYONE FROM AMORPHOPHALLUS PAEONIIFOLIUS (ELEPHANT FOOT YAM) USING *IN SILICO* ANALYSIS

M. S Latha^{*1,2}, Anju Alex^{2,3}, Divya Mariam John¹

¹Dept. of Chemistry, Sree Narayana College, Chathannur, Kollam, Kerala, India

²Dept. of Chemistry, Sree Narayana College, Kollam, Kerala, India

³Department of Chemistry, St. Gregorios College, Kottarakara, Kollam, Kerala, India

*Corresponding author: lathams2014@gmail.com

ABSTRACT

The present work aims at evaluating the anticancer activity of Amblyone, a phytochemical present in the tuber of *Amorphophallus Paconiiifolius* (Elephant foot yam) and compare its activity with the commonly used antiapoptotic drug Tetrahydroisoquinoline amide substituted phenyl pyrazole derivative. Anti cancer activity is analyzed by docking the ligands against the antiapoptotic B-Cell Lymphoma-2 protein (Bcl-2) [PDB ID: 2w3l] using AutoDock Tool software. A docking score of -12.2 kcal/mol is obtained for the phytochemical Amblyone compared with -7.7 kcal/mol for Tetrahydroisoquinoline amide substituted phenyl pyrazole derivative. The better docking score is an indication that the amblyone can bind firmly on the groove of Bcl-2 protein which regulates the activity of pro-apoptotic proteins by direct binding and sequestration. The absorption, distribution, metabolism, excretion (ADME) and toxicity properties of the ligands are studied using Pre ADMET software. The *in silico* studies are further supported by *in-vitro* studies of the crude sample using A549 (Lung cancer) cells by direct observation of cells using Inverted phase contrast microscope followed by colorimetric assay method (MTT) and direct microscopic observations.

Keywords: Apoptosis, Docking, *Amorphophallus Paconiiifolius*, Amblyone.

1. INTRODUCTION

Cancer is a growing threat to the humans across the world. There are different types of cancer and most of them can be treated successfully using chemotherapy or radiation therapy if detected at an early stage. Most of the drugs are developed to enhance apoptosis. The major mechanism by which this cancer therapy occurs is through a p53-dependent pathway [1]. B-cell lymphoma-2 (Bcl-2) family members play a critical role in regulating and executing apoptosis [2]. Hence they are a promising target for anticancer drugs. The bcl-2 family of proteins consists of twenty five pro-apoptotic and anti-apoptotic (inhibiting) members, which interact to maintain a balance between newly forming cells and old dying cells. Any alteration in the expression of B-cell lymphoma-2 (Bcl-2) family members can lead to development of resistance to cytotoxic antineoplastic drugs and delay apoptosis in response to radiation therapy [3], preventing the hope of cancer survivors by conventional cancer treatment methods.

Bcl-2 family proteins are integral membrane proteins mainly present on the outer membrane of mitochondria having a binding groove that binds the BH3 domain of pro-apoptotic family members [4]. This binding process prevents the oligomerization of pro-apoptotic family members and the initiation of the apoptosis cascade [5]. Structural studies showed that the binding groove of Bcl-2 proteins can incorporate small molecules and such molecules facilitate cell death by preventing the anti-apoptotic effect of Bcl-2 family proteins. It is most successfully demonstrated with the small molecule ABT-737 by clinical trial [6].

This paper presents a phytochemical substitute which can interact with bcl-2 family of proteins with minimal side effects [7]. It is then compared with a known anticancer drug Tetrahydroisoquinoline amide substituted phenyl pyrazole molecule. The comparison study is based on docking procedure using Autodock Vina.

The selective Bcl-2 inhibitor activity of Tetrahydroisoquinoline amide substituted phenyl pyrazoles was already established by high throughput screening

**Intellectual Capital Impact On Firm Performance, Shareholders
Capm Expected Return And Value At Risk Of Selected Mnc's**

RENY THOMAS

Assistant Professor

Department of P.G. Commerce

St.Gregorios College, Kottarakara, Kollam.

Affiliated to the University of Kerala, Thiruvananthapuram.

SARATHSAJAN

Assistant Professor

Department of P.G.Commerce

St.Gregorios College, Kottarakara, Kollam

Affiliated to the University of Kerala, Thiruvananthapuram.

ABSTRACT

The purpose of this study is to investigate the impact of intellectual capital on financial performance and profitability of selected companies in India. In total 5 companies were selected as the sample. The study made use of secondary data sourced from annual reports and financial statements of these companies from audited and reliable sources like company websites and Y charts. The study reveals that value added intellectual capital and its components have a significant association with the company's financial performance and profitability. The study therefore recommends, inter alia, to the management of the company to endeavour to provide adequate information and a supportive work environment and development programs that will automatically increase the efficiency and productivity of the labour. The study will be very beneficial to the different policy makers by considering the importance of intellectual capital in evaluate the financial performance of the company. However, among the main limitations, this study does not cover other sectors such as the service sector in the same region

KEYWORDS: *Knowledge capital, Intellectual capital*

INTRODUCTION

The term "Knowledge economy" (Fritz Mechuip) Propagated by Philip Kotler has got the global attention from last two decades as the knowledge asset became the supreme asset in the organization and industries. The knowledge assets or

INTERIM BUDGET 2019: AN ANALYSIS OF THE BREAKTHROUGH CONCEPTS IN

JCC impact facts - 4.839 JANUTSHELL

Arun Mohan¹ & Sumi Alex²

¹Assistant Professor, Department of Commerce, St Gregorios College, Kottarakkara, Kerala, India

²Assistant Professor & HOD, Department of Commerce, St Gregorios College, Kottarakkara, Kerala, India

Received: 16 May 2019

Accepted: 22 May 2019

Published: 29 May 2019

ABSTRACT

The highly awaited Finance Bill, 2019 was presented on 1st February 2019 and it became an Act following Presidential assent on 21st February 2019. From a direct tax perspective, the Act mainly places its impetus on the needs and wants of the common man. Even though the issues like corporate taxation, change in the accounting year, etc. were the issues common to everyone's interest, the Government refrained from making any sweeping changes to the aforesaid prevailing provisions and has rightly left the same to be dealt in the full financial budget to come. The interim budget bears the indisputable stamp of careful analysis and deliberations from the policymakers so as to cater to the specific needs of the needed and also taking into account the interests of all concerned.

KEYWORDS: Interim Budget 2019, Finance Bill 2019, Tax Reliefs

INTRODUCTION

In the atmosphere of the Elections, the union Budget 2019 was extremely-anticipated, being considered as the performance pointer of the present government. The interim budget was presented on 1st February 2019 by the interim Finance Minister Shri Piyush Goyal. This budget is claimed to be the only a starting point of the "Dream Budget" by the BJP government to be. This being an interim budget, no key policy changes could have been proclaimed. Nevertheless, remaining within the four corners of the code of conduct, it seems that the government has moved to great lengths to delight the common man and the farmers to a great extent. As of the direct tax outlook, there are some, considerable reliefs granted to the common man.

CHANGES IN DIRECT TAXES- AN ANALYSIS

This being the pre-election Budget, their stood prospects of change in tax slabs, which have not turned out to be true. In Budget 2015, Hon'ble Finance Minister had guaranteed that the basic rate of Corporate tax would be reduced from 30% to 25% over the next five years. Once again, the corporate sector has been let dejected, as the Corporate tax rates also remain untouched. This puts Indian domestic industries in an uncompetitive position as equated to the other key Asian economies.

AN EMERGING TRENDS IN TEACHING AND LEARNING : A STUDY

Reny Thomas

Guest Lecturer in St Gregorios College ,Kottarakara, Kollam Dist, Kerala

ABSTRACT

Education is the most powerful weapon which you can use to change the world. Education is the key to eliminating gender inequality, to reducing poverty, to creating a sustainable planet, to preventing needless deaths and illness, a symbol of hope and confidence in the future of mankind. Teaching and learning are the two sides of education. Learning is about a change: the change brought about by developing a new skill, understanding a scientific law, changing an attitude. The change is not merely incidental or natural in the way that our appearance changes as we get older. Learning is a relatively permanent change, usually brought about intentionally. Learning is internal to learners. Abbatt and McMahon say: 'Teaching is helping other people to learn'. Teaching is a set of events, outside the learners which are designed to support internal process of learning. Teaching (Instruction) is outside the learner. Teaching involves setting appropriate learning expectations for students, and, for that purpose, includes selection and sequencing of activities or kinds of interactions that would lead to expected learning. Teaching is human engineering and soul doctoring. Teaching refers to the multiple tasks carried out by teacher for leading the learners to the expected learning. Educational psychologists tell us that any activity which leads to a change in our behavior is 'learning'. This paper elucidates the recent trends in teaching and learning in the 21st century .

Keywords: *Recent trends in teaching and learning, Types of learning, Learning process.*

INTRODUCTION

Learning is one of the most important mental function of humans, animals and artificial cognitive systems. Learning is a key process in human behavior. All living is learning. Learning is the process of acquiring new information and memory is the retention or storage of that information. The individual is constantly interacting with and influenced by the environment. This experience makes him to change or modify his behavior in order to deal effectively with it. Therefore, learning is a change in behavior, influenced by previous behavior. As stated above the skills, knowledge, habits, attitudes, interests and other personality characteristics are all the result of learning.

Learning prepares the learner for the next successive stage of life, be it personal, social, or professional. However the quantum and quality of education depend upon various factors like social and geographical mobility, economic development and socialization and various other aspects. Thus for proper adaptation to the

E-technology in the Aid of the Farmers

Dr. Deeja. S,

Department of Commerce, St Gregorios College, Kottarakara

Abstract

The history of agriculture is the story of man's progress in controlling for his own advantage the plants that make products useful to him by applying his knowledge. Agriculture is major sector in the enhancement of economy of any country. Information has the potential to improve efficiency in all spheres of agriculture. Through the exchange of knowledge from different agriculturally-involved individuals from all over the world, improvement of techniques can be experienced as well. It has made an impact on how information is shared, and being able to use this information for the progression of the agricultural sector and gives a great positive impact that is helpful for everyone. The main phases of the agriculture production include crop cultivation, water management, fertilizer application, pest management, harvesting, post-harvest handling, transport of food products, packaging, food preservation, food processing /value addition, quality management, food safety, food storage, and food marketing. All stakeholders of agriculture industry need information and knowledge about these phases to manage them efficiently. In Indian context, farmers in India are recommended to use Information and Information Technology for agriculture. India's food production and productivity can be increased by proper use of Information Technology for farming purposes.

Keywords

E-technology and E-agriculture

Introduction

Agriculture in India is the core sector for food security, nutritional security, and sustainable development & for poverty alleviation. It contributes approx. 14 % of GDP. Indian Landscape is dominated by small and marginal farmers (80%) and increasing their productivity and incomes can make a major contribution to reducing hunger and poverty. So the future of sustainable agriculture growth and food security in India depends on the performance of small and marginal farmers. Enhancing their work on field in India is favoured by the Green revolution, Evergreen revolution, Blue revolution, White revolution, yellow revolution, Bio technology revolution and the most recent one being Information and communication technology revolution. However, the technological changes in Indian agriculture started in 1960s when access to modern inputs, especially high yielding variety of seeds, fertilizers, mechanization, credit and marketing facilities improved. The central government also introduced intensive area development programme in 1960.

Impact of information and communication technology in agriculture can be evaluated broadly under two categories. First, Information technology as a tool for direct contribution to agricultural productivity and secondly as an indirect tool for empowering agriculturalists to take informed and quality decisions which will have positive impact on the agriculture and allied activities conducted. It has made an impact on how information is shared, and being able to use this information for the advancement of the agricultural sector gives a great positive impact that is beneficial for everyone. Agricultural biotech and InfoTech together are helping to create new tools to attack the problem of rural poverty, generate employment of farm productivity and production, improvement quality and explore marketing and income generating opportunities in newer days. To bridge the information gap between the farmers and to build productive and competitive market, different IT interventions support rural and under-developed markets to become efficient and productive like new methods for precision agriculture like computerized farm machinery that applies for fertilizers and



ISSN 2278 - 6880

Year 2018-19

(यू.जी.सी. से अनुमोदित मासिक पत्रिका) Approved journal of UGC

हिन्दी विद्यापीठ,
टी.सी. 44/2670, जगती,
तिरुवनन्तपुरम- 695014
केरल।

May 2018



संस्थापक संपादक :
स्व.पी.जी.वासुदेव

संपादक:
डॉ. एम. एस. विनयचन्द्रन
Mob: 9447657301
msvinayachandran61@gmail.com

मुख्य संपादक :
डॉ. वी. वी. विश्वम
Mob: 9446662694
vvviswam@yahoo.in

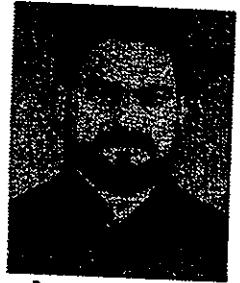
वर्ष : ३०
मूल्य : २० रुपये मात्र

अंक : 5

मई : 2018

वार्षिक चन्दा : दो सौ रुपये मात्र

नाटककार के रूप में डॉ. रामकुमार वर्मा एक समग्र मूल्यांकन



जोग पणिवकर

समस्त चरांचर जगत् में मनुष्य ही एक ऐसा मनोरंजन प्रिय प्राणी है, जिसने अपने मन की प्यास की परितृप्ति के लिए मनोरंजन को उतना ही आवश्यक समझा है, जितना तन के लिए अन्न, जल और वस्त्र आवश्यक है। इस आवश्यकता की पूर्ति के लिए मनुष्य अनादिकाल से अपनी रुचि और परिस्थिति के अनुरूप नृत्य, संगीत तथा सामाजिक एवं धार्मिक उत्सव, नाटक आदि विविध साधनों का आविष्कार करता चला आ रहा है। मनोविनोद के इन माध्यमों में नाटक आनन्दोपलब्धि का प्रबलतम साधन है।

नाटक, साहित्य की एक विशिष्ट महत्वपूर्ण विधा है। यथार्थ जीवन की अनुकृति ही नाटक है। नाटक में हमें जीवन की छाया प्रतिबिंबित होती दिखाई देती है। वह हमारी सुप्त चेतनाओं को जागृत करता है, मृत अभिलाषाओं को जीवित कर उन्हें स्पन्दित और अनुप्राणित करता है। वह पुराण और इतिहास के गड़े

मुद्दों को जीवन-दान देता है। हमने नाटक देखकर क्रान्तियों की हैं, सामाजिक रुढ़ियों में उथल-पुथल मचाई है, जीवन की रूप-रेखायें बदली हैं। साहित्य की अन्य विधाओं की अपेक्षा नाटक में लोक-हित और लोक-रंजन की अत्यधिक क्षमता है। अतः सफल नाटक लिखने में वे ही नाटककार समर्थ हो पाते हैं, जो समग्र युग-जीवन और साहित्य को एक सूत्र में बाँधने की क्षमता रखते हैं। वास्तव में, नाटककार मानव जीवन का शाश्वत साथी है और नाटक जीवन का प्रेरक प्रतिबिंब है। आधुनिक युग के, ऐतिहासिक नाट्य-क्षेत्र के सफल नाट्य-स्तंभ, आधुनिक एकांकी के जनक माने जानेवाले डॉ. रामकुमार वर्मा नाटक को जन-जन तक पहुँचाने में कामयाब हुए हैं।

आधुनिक युग के साहित्यकारों में बहुमुखी प्रतिभा के डॉ. रामकुमार वर्मा का विशिष्ट एवं महत्वपूर्ण स्थान है। वर्माजी के व्यक्तित्व में एकसाथ आलोचक, नाटककार, साहित्य

शास्त्र के मर्मज्ञ पण्डित, दार्शनिक, कवि, सफल प्राध्यापक, कुशल प्रशासक एवं युग निर्माता और उत्कृष्ट एकांकीकार के रूपों का सुंतुलित सम्मिश्रण विद्यमान है। उन्होंने अपनी विलक्षण प्रतिभा का सफल परिचय प्रत्येक क्षेत्र में समान रूप से दिया है। कवि और गद्यकार के साथ ही वे आलोचक और दार्शनिक भी हैं, इसी कारण उनकी कृतियों में अनुभूति और चिन्तन का पक्ष सजीव एवं सबल रहा है। साहित्य के सृजन और अनुशीलन दोनों क्षेत्रों में उन्होंने स्तुत्य कार्य किया है। द्विवेदी युग के अन्तिम चरण से लेकर आधुनिक प्रयोगवादी काल तक उनकी साहित्य-साधना का क्षेत्र विशाल होते हुए भी कतिपय प्रवृत्तियों के कारण अपनी मौलिकता बनाये हुए हैं।

वर्माजी ने इतिहास-प्रसिद्ध राष्ट्रायकों के चरित्रों के सहारे प्राचीन भारतीय संस्कृति तथा सभ्यता को जीवित करके दर्शकों तथा पाठकों के हृदय में राष्ट्र-प्रेम की भावना

जगा देने की कोशिश की है। वर्माजी के सभी नाटकों के इतिहास-प्रसिद्ध नायक प्रायः अपनी मातृभूमि की रक्षा के लिए प्राणों की बलि देने को सदा तैयार रहते हैं। वास्तव में वर्माजी अपनी मातृभूमि की अखण्डता एवं प्रावात्मक एकता के शक्तिशाली अन्देशवाहक के रूप में हमारे सामने आये हैं। भारतीय संस्कृति अथवा भारतीयता उनके नाटकों का गद्य विषय है।

हिन्दी एकांकी नाटक साहित्य के क्षेत्र में क्रान्तिकारी परिवर्तन लाने ले साहित्यकार हैं डॉ. रामकुमार वर्मा। वर्माजी को हिन्दी एकांकी जनक मानने में कोई अपत्ति नहीं। कारण यह है कि वे सबसे ले एकांकी नाटक लिखनेवाले जिसने बादल की मृत्यु नामक एकांकी रचा जिसका कोई ब्यानक नहीं, नाटकीय गुण नहीं, किन्तु शक्ति की प्रधानता है। उनके एकांकी साहित्य पर बंगला, संस्कृत अंग्रेजी शैली का गहरा असर है। उनका एक प्रसिद्ध संग्रह है - इतिहास के (२६ एकांकी नाटक) कुल कर वर्माजी ने १२० से अधिक एकांकी नाटक लिखे हैं जो विभिन्न क्षेत्रों में प्रकाशित हैं। उनके रचनाओं का एक दोष है- कथानक आवश्यक विस्तार। डॉ. वर्मा हेतु की विविध विधाओं में

अपनी लेखनी चलायी है लेकिन उनकी कीर्ति एकांकियों की रचना में ही स्थापित हुई है। यदि उन्हें हिन्दी का सर्वश्रेष्ठ एकांकी नाटककार मान लिया जाय तो इसमें कोई अतिशयोक्ति नहीं।

हिन्दी नाटक साहित्य, खासकर ऐतिहासिक नाटक के संदर्भ में वर्माजी के नाटकों को एक बड़ी उपलब्धि मानी जा सकती है। वर्माजी ने ऐतिहासिक, पौराणिक, मनोवैज्ञानिक, सामाजिक आदि विभिन्न विधाओं में नाटक लिखे हैं लेकिन उनकी विशेष रुचि अधिकांशतः ऐतिहासिक नाटकों के क्षेत्र में रही है। उन्होंने ऐतिहासिक नाटकों के साथ सांस्कृतिक नाटक भी लिखे हैं। इतिहास और कल्पना का सुंदर समन्वय उनके नाटकों में देखने को मिलता है।

प्राचीन भारतीय संस्कृति की महत्ता को दिखाने के लिए वर्माजी ने अपनी रचनाओं में संस्कृति एवं कला की महत्ता प्रदर्शित की है। मानवतावाद वर्माजी के नाटकों का प्रतिपाद्य विषय है। विजय पर्व के सम्राट अशोक का हृदय-परिवर्तन मानवतावाद का एक सफल उदाहरण है। उन्होंने सांस्कृतिक संपन्नता के लिए संस्कार की महत्ता का प्रतिपादन भी किया है।

डॉ. वर्मा ने उदात्त चरित्रों के सहारे भारतीय संस्कृति के मूल आदर्श-

तत्त्वों-करुणा, प्रेम, त्याग, क्षमा, तपश्चर्या, औदार्य, अहिंसा आदि को प्रकाशित करके मानव का उत्थान किया है। वर्माजी ने अशोक, राणा प्रताप, चन्द्रगुप्त, नाना फडनावीस जैसे ऐतिहासिक पात्रों द्वारा सांस्कृतिक जीवन के महत्व पर भी जोर दिया है।

रामकुमार वर्मा के अनुसार धर्म दरअसल एक ही है। सब धर्मों के मूल-तत्त्वों में कोई अन्तर नहीं है। धर्म की उपयोगिता मानव-जाति को संतुलित रखने में है। धर्म की स्थिति जीवन की पवित्रता में है। वर्माजी ने हिन्दू और इस्लाम धर्म को समान रूप से देखा है। उनके अनुसार हिन्दू और मुसलमान इनसानियत के लिबास हैं, इनसानियत के टुकड़े नहीं हैं। उन्होंने हिन्दू-मुस्लिम एकता पर जोर देकर नाटकों की रचना की है।

वर्माजी ने अपने नाटकों में मुख्य रूप से बौद्ध-धर्म को अधिक प्रधानता दी है। अधिकांश नाटकों में ईश्वर की महिमा भी गायी गयी है। कारण यह है कि उनके नाटकों में अधिकांश पात्र ईश्वर में विश्वास रखनेवाले हैं। वर्माजी के अधिकांश नाटकों में भगवान बुद्ध के सत्व, अहिंसा, त्याग, क्षमा, करुणा आदि सकारात्मक तत्त्वों का सन्निवेश हुआ है।

प्रत्येक राष्ट्र की नीति अथवा राजनीति का विस्तृत विवेचन वर्माजी



कैरलाप्योति

केरल हिन्दी प्रचार सभा
की मुख पत्रिका

(केन्द्रीय हिन्दी निदेशालय की
विषयीय सहायता से प्रकाशित)

प्रबन्ध संपादक

डॉ.एस. राजप्पन नायर

मुख्य संपादक/संपादकीय दायित्व

प्रो.डी. तंकप्पन नायर

सह संपादक

आर. जोसफ

संपादकीय समिति

प्रो. (डॉ.) डी.नेलसन

पी. राजेन्द्रन

डी. ओमना अम्मा

आर.सुकुमारन नायर

पी. सदाशिवन नायर

जी.द्रौपति

आर.माधवि अम्मा

प्रो.एन. माधवनकुट्टि नायर (मंत्री)

सूचना : लेखकों द्वारा प्रकट किये गये मत
उनके अपने हैं। उनसे संपादक का सहमत
होना आवश्यक नहीं।

पृष्ठ : 48 दल : 11

अंक : फरवरी 2014

माघ-फाल्गुन 1935

अनुक्रमणिका

संपादकीय	3
हिन्दी नाटक साहित्य और मोहन राकेश	
डॉ. आशाराणी.बी.पी.	4
प्रेमचन्द के उपन्यासों में सामाजिकता - श्रीदेवी. एस.	8
हिमयुगी चट्टानें - जी. गोपीनाथन	13
हम चींटे हैं	
मूल: कांजियोट्ट जयन अनुवाद: जी. रवीन्द्रन पिल्लै	19
डॉ. रामकुमार वर्मा के नाटकों में राष्ट्रीय भावना	
प्रो. डॉ.वी. जोण पणिक्कर	20
मलयालम समालोचना : स्वरूप एवं विकास	
डॉ. चित्रा.एन.आर	26
डॉ.पांडेय को अकादमी पुरस्कार	32
प्रश्नोत्तरी-11 - डॉ. पी.जे.शिवकुमार	33
'वयलिन' वाद्ययंत्रों की रानी	
कणियाम्पुष्पा सुब्रह्मण्यम्	34
बहुमुखी प्रतिभा के धनी डॉ.एस. राजप्पन नायर	
प्रो. डी. तंकप्पन नायर	37
राष्ट्रीय एकता बाल-मेला	
स्कूली छात्रों का राष्ट्रीय एकता शिबिर	
शिबिर के विवरण की प्रस्तुति : बी. सोमशेखरन नायर	39

मुख्यचित्र : बालमेला के समापन सम्मेलन का उद्घाटन

श्री.वी.कृष्णकुमार कर रहे हैं।

कैरलाप्योति

फरवरी 2014

१५५



डॉ. रामकुमार वर्मा के नाटकों में राष्ट्रीय भावना

प्रो. डॉ.वी. जोण पणिक्कर



राष्ट्रीय भावना से तात्पर्य:-

साहित्य को समाज अथवा राष्ट्र का प्रतिबिम्ब कहा गया है। राष्ट्र का साहित्य से अटूट एवं अपरिहार्य संबंध है। भारत में 'राष्ट्र' शब्द का प्रयोग बहुत प्राचीन काल से ही होता रहा है। वेदों में तथा ब्राह्मण ग्रन्थों में भी इस शब्द का प्रयोग मिलता है। शतपथ ब्राह्मण में समृद्धियुक्त जनसमूह को राष्ट्र की संज्ञा दी गयी है।

राष्ट्र और राष्ट्रीयता के संबंध में अनेक भारतीय और पाश्चात्य विद्वानों ने विविध परिभाषा और व्याख्या की है। डा. हज़ारी प्रसाद द्विवेदी के अनुसार, "राष्ट्रीयता का अर्थ यह है कि प्रत्येक व्यक्ति राष्ट्र का एक अंश है और उस राष्ट्र की सेवा के लिए, उसे धन-धान्य से समृद्ध बनाने के लिए, उसके प्रत्येक नागरिक को सुखी और संपन्न बनाने के लिए, प्रत्येक व्यक्ति सब प्रकार के त्याग एवं कष्ट को स्वीकार करना चाहिए।" 1 डा. राधाकृष्णन के अनुसार राष्ट्रीयता का अर्थ तो यह है कि "हम अपनी आत्मा की, सम्मान तथा ईमानदारी की, यथाशक्ति रक्षा करें और समस्याओं को सुलझाने में अपने व्यक्तिगत दंग को बनाए रखें" 2 डा. अम्बेडकर के शब्दों में; राष्ट्रीयता श्रेणीगत चेतना की एक अनुभूति है, जो एक और

तो उन व्यक्तियों को जिनमें यह इतनी प्रगढ़ होती है कि अर्थिक संघर्ष या समाजगत उच्चता-निम्नता के कारण उत्पन्न होनेवाले भेदभावों को दबाकर एकसूत्र में बाँधे रहती है। और दूसरी ओर उनको ऐसे लोगों से पृथक् करती है, जो उस श्रेणी के नहीं हैं।" 3

ज़िर्मन के अनुसार - "ऐसे जनसमूह को विशिष्ट भू-भाग के प्रति तीव्रता, अंतरंगता और गौरव की संसृष्ट भावना से संयुक्त हो, राष्ट्र है" (A nation is a body of people united by a corporate sentiments of peculiar intensity, intimacy, and dignity, related to a definite home country)" 4

यहाँ भू-भाग राष्ट्र का बाह्य पक्ष है और जनसमूह एवं उनमें अन्तरंगता एवं गौरव की संसृष्ट भावना से उसका अन्तःपक्ष व्यंजित होता है। स्टालिन के अनुसार, - "राष्ट्र वह जन समुदाय है जो ऐतिहासिक दृष्टि से विकसित और स्थायी होने के साथ-साथ सर्वसामान्य भाषा, भू-भाग आर्थिक जीवन और संस्कृति में परिलक्षित होनेवाली विशेष मनोवैज्ञानिक रचना से युक्त हो।" 5

राष्ट्र के व्यक्ति राष्ट्रीयता के उन तत्वों की प्रशंसा करते हैं जिनमें मानवतावाद का समर्थन होता



है। वह राष्ट्रीयता की विचारधारा का जन्म प्रजातन्त्र की भावना के जन्म के साथ-साथ मानते हैं। जब व्यक्ति राष्ट्र-हित के लिए आपके स्वार्थों और संकुचित सीमाओं का उत्सर्ग करता है, तभी सच्ची राष्ट्रीयता का जन्म होता है।

साहित्य में राष्ट्रीयता से आशय केवल स्वेदश पर लिखे गये साहित्य से नहीं, वरन् संपूर्ण साहित्य से है। राष्ट्र के महत्त्व पर विचार करते समय यह व्यक्त किया जा चुका है कि राष्ट्रीयता का संबंध भावना से है। इस रूप में वह एक अमूर्त वस्तु है जो मानसिक तत्वों पर आधारित है। राष्ट्रीयता मानव समाज के विकास का एक ऐतिहासिक चरण है। इसलिए इसका विचार बहुत व्यापक है। यह केवल भावुकता का पर्याय मात्र नहीं है। राष्ट्रीयता के इस व्यापक क्षेत्र में जाति, धर्म, संप्रदाय, भाषा एवं भावात्मक एकता आदि समाहित होना ज़रूरी है।

राष्ट्रीयता में धार्मिक एकता एक महत्वपूर्ण तत्व है। प्राचीनकाल में सारी जीवन-प्रणाली धर्म द्वारा संचालित थी। धर्म, अर्थ, काम, मोक्ष में धर्म का ही प्राधान्य है। धर्म व्यक्ति के सामाजिक एवं नैतिक स्तर को ऊँचा करता है। धर्म ने युग-युगन्तर से जाति तथा समाज के जीवन को संचालित किया है। धर्म मनुष्य की आस्था और भावना पर आधारित है, परन्तु राष्ट्रीयता बुद्धि और तर्कों पर धर्म का स्थान व्यक्तिगत होता है और राष्ट्रीयता प्रायः समष्टिगत

है। भारत में सच्ची राष्ट्रीयता की भावना उत्पन्न करने में धर्म सदा बहुत बड़ी बाधा रहा है।

आधुनिक काल में धर्म के प्रति मानव का दृष्टिकोण बहुत तेज़ी से बदलता जा रहा है। विभिन्न धार्मिक विश्वासों के रहते हुए भी एक ही राष्ट्र के प्रति पूर्ण आस्था की भावना रखी जा सकती है। हम पहले भारतीय हैं और बाद में हिन्दू, मुसलमान, इसाई, सिक्ख आदि हैं। आज इस भावना का प्रसार होना चाहिए। धार्मिक विद्वेष के फलस्वरूप ही भारत की राष्ट्रीयता को हिन्दुस्थान और पाकिस्तान के रूप में खण्डित होना पड़ा। स्पष्टतः राष्ट्रीय चेतना के विकास के लिए यह आवश्यक है कि धर्म अपने स्वस्थ रूप का त्याग न करें। यह भी कहना उचित होगा कि सभी नागरिक अपने धार्मिक विकासों से संचलित होते भी अन्य धर्मावलंबियों के प्रति उदारता का भाव रखें और तभी सच्ची राष्ट्रीयता का विकास होगा। धार्मिक विरोध अवश्य राष्ट्रीयता को खण्डित कर सकता है।

जातिगत एकता राष्ट्रीयता का प्रबलतम बंधन है। जाति का संबंध रक्त संबंध से है। राष्ट्र का विचार जातियों के समुदाय, भाषाओं के समुदाय के साथ जुड़ा हुआ है। जाति का अपने देश से अटूट नाता बन जाता है। जातीयता की दृष्टि से आज सभी राष्ट्र एक दूसरे के बहुत निकट आ गये हैं। किसी भी देश में एक अकेली जाति का निवास नहीं

A PEER REVIEWED JOURNAL

ISSN 2347 8152

अंक : 9

शोध दर्पण

कथा साहित्य विशेषांक

(11)



हिन्दी विभाग
केरल विश्वविद्यालय
कार्यवट्टम, तिरुवनंतपुरम
2019

श्री नरेश मेहता के उपन्यासों में मानवीय संवेदना

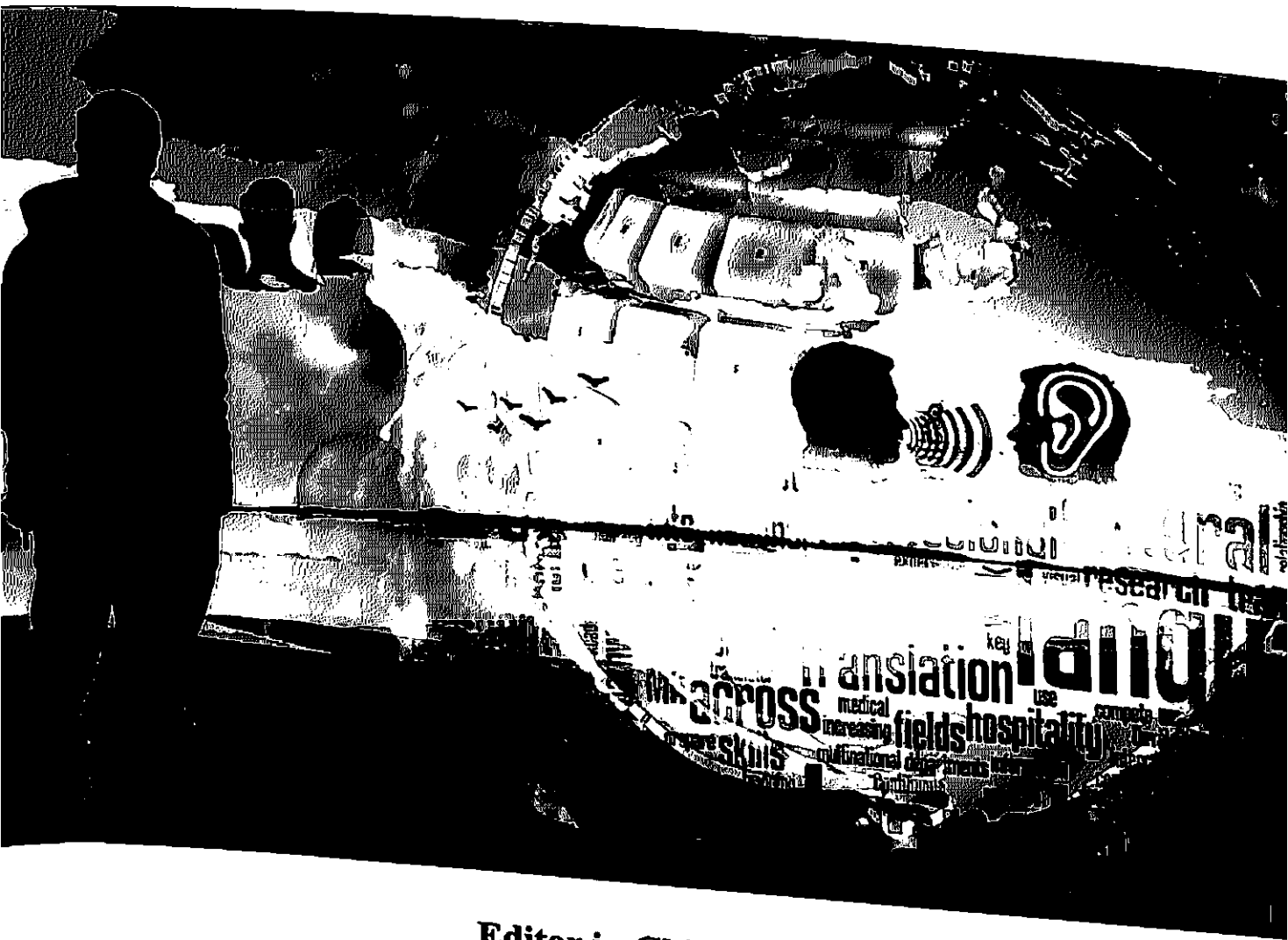
डॉ.जोग पणिकर.वी

मानव संवेदनाशील प्राणी है। अतः अन्य जीवों की अपेक्षा मानव-मन की भावनाएँ अतिसूक्ष्मता से ग्रहण हो जाती है। संवेदना का कोशगत अर्थ है - जीवन का व्यापक अनुभव ज्ञान या अनुभूति। इसका सामान्य अर्थ है समान वेदना का अनुभव। दूसरों के दुख को अपना दुख समझना ही संवेदना है। बिना संवेदना का मनुष्य पत्थर जैसा मालूम पड़ता है। संवेदना ही मनुष्य को मानव बनाती है। कहा जाता है कि पहला कवि वियोगी होगा। उनके हृदय से निसृत आह-कराह से गाने का उपज होता है। उसकी आँखों से आँसु उमड़ जाती है। अंत में वह जाने बिना कविता की रचना होती है। जो मनुष्य अपने सुख में खुशी तथा दुःख में रो नहीं सकता। उसका जीवन नहीं कहलाता है। वास्तव में साहित्यकार के हृदय से निसृत संवेदना ही पाठक के हृदय को हिला सकती है। एक सफल रचनाकार संवेदना की छाया में रहकर एक उत्तम कृति का सृजन करता है।

श्री नरेश मेहता भारतीय विचारधारा को संपूर्णता में आत्मसात करनेवाले महान रचनाकार हैं। आप के साहित्य में हमारे समाज का संपूर्ण पक्ष चित्रित हुआ है। आज़ादी केबाद विशेषकर वैज्ञानिक संसाधनों ने समाज के जिन पक्षों को प्रभावित किया उनमें मानवीय संबंध भी अछूते नहीं रहे। नारी जगत की शिक्षा और जागरण ने भी मानवीय संबंधों को प्रभावित

World Translation

An International Multidisciplinary Peer Reviewed Refereed Research Journal



Editor in Chief
Prof. Ashok Singh

Dr Surendra pandey
(Editor)

Dr vikash kumar
(Editor)

समकालीन हिन्दी नाटकों की सामाजिक स्थिति: एक विश्लेषणात्मक अध्ययन

डॉ. जोग प्रणिक्कर, बी

असि. प्रोफसर, हिन्दी विभाग, सेन्द गिगोरियोस कॉलेज, कोट्टारक्करा

साहित्य और समाज दोनों एक सिक्के के दो पहलु के समान हैं। समाज में ही साहित्यकार जन्म लेता है, बड़ा होता है और अंत में उसकी जीवन लीला भी समाज में ही समाप्त हो जाती है। कहा गया है कि मनुष्य एक सामाजिक प्राणी है इसलिए एक साहित्यकार अपने आस पास के वातावरण से अपनी तत्कालीन समाज तथा सामाजिक परिस्थितियों से जो कुछ ग्रहण करता है, अनुभव करता है, स्वाभाविक रूप से उनके साहित्य में स्वतः ही अभिव्यक्त हो जाता है। कोई भी युग का साहित्यकार और उनके साहित्य तत्कालीन परिवेश से प्रभावित होता है क्योंकि साहित्य समाज का दर्पण माना जाता है। समाज में जो परिवर्तन हो रहा है उसका प्रतिबिम्ब समाज रूपी आईने में पड़ता है।

नाटक एक साहित्यिक विधा है जिनके कारण उनका संबंध समाज के साथ है। हिन्दी नाटक साहित्य समय – समय पर तात्कालीन समय से प्रभावित हुआ है। जिसके कारण हिन्दी नाट्य साहित्य से समय – समय पर अपनी आत्मा, रूप और रंग को बदला है। यही तात्पर्य समकालीन हिन्दी नाटकों का है। 'समकालीन' शब्द का सीधा अर्थ होगा – हमारे अपने काल का। समकालीन का अर्थ एकदम तात्कालीन भी नहीं होता। इस निबंध में पिछले तीन दशकों के कुछ महत्वपूर्ण नाटकों को ध्यान में रखकर सामाजिक चेतना पर विचार – विमर्श किया जाएगा। समकालीन हिन्दी नाटकों से हमारे तात्पर्य उनही नाटकों से हैं, जो अपने समय के समाज का पूरा चित्र प्रस्तुत करता हो, साथ ही हमारी संवेदना भी प्रकट करता है।

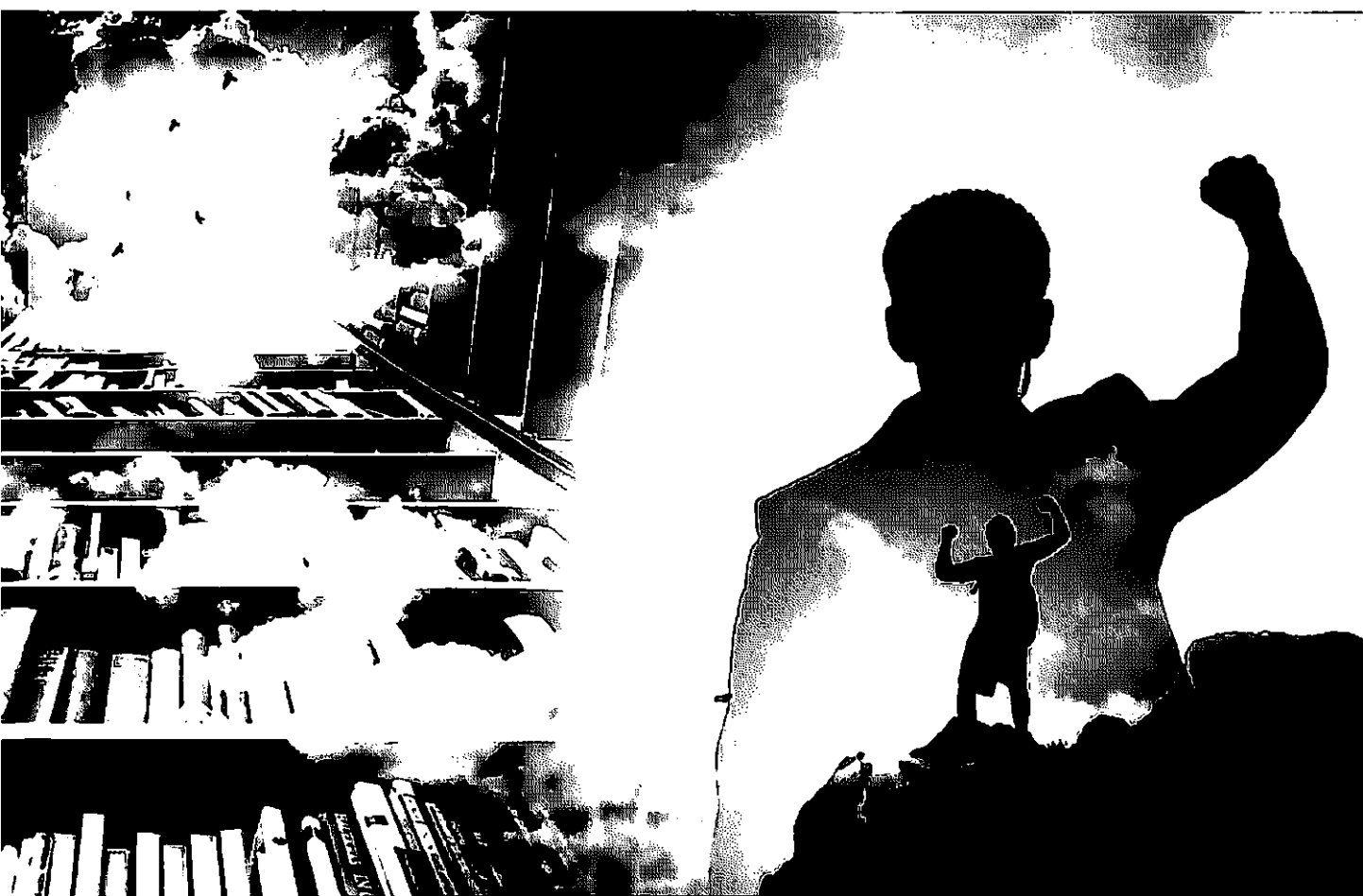
नाटक साहित्य की सर्वोत्तम विधा है। क्योंकि नाटक में एक ही समय में विभिन्न रुचियों तथा भिन्न वर्गों के लोगों को प्रसन्न करने की शक्ति विद्यमान रहती है। नाटक दृश्य काव्य है। वह अपना उद्देश्य दृश्य के द्वारा प्रस्तुत करता है। उसी के द्वारा नाटक सत्य की अनुभूति अपने दर्शकों को कराता है। इसीलिए कहा गया है कि नाटकमूलतः सामाजिक स्थितियों की अनुकृति है। नाटक में मनुष्यजीवन की विविधता, वातावरण, देशकाल और तात्कालीन विचारों, भावनाओं का चित्रण होता है। "समकालीन हिन्दी नाटकों के संबंध में जयदेव तनेजा लिखते हैं समकालीन हिन्दी नाटक और रंगमंच के अध्ययन का प्रधान बिन्दू है – समकालीन भारतीय सामाजिक संरचना तथा उसके अंदर चल रहे संघर्ष, अन्दरद्वन्द्व तथा दबावों, तनावों एवं प्रभावों के विश्लेषण के माध्यम से मौजूदा भारत के वर्तमान संस्कृतिक स्वरूप को जानना – पहचानना और उसके संदर्भ में आज के हिन्दी रंगकर्म को समझना परखना है।" १

Vol -10, ISSUE-6, July-December 2019

ISSN :2319-7137

INTERNATIONAL Literary Quest

An International Multidisciplinary Peer Reviewed Refereed Research Journal



Prof. Ashok Singh
(Editor in Chief)

Dr. Vikash kumar
(Editor)

Dr. Surendra pandey
(Editor)

हिन्दी एकांकी का जनक – डॉ. रामकुमार वर्मा

डॉ. जोण पणिकर.वी

असि. प्रोफेसर, हिंदी, सेन्ट गिगोरियोस कॉलेज, कोट्टारक्करा।

एकांकी नाटक के क्षेत्र में डॉ. रामकुमार वर्मा का प्रादुर्भाव उस समय हुआ जब हिंदी एकांकी का स्वरूप स्थिर नहीं हो पाया था। इसके पूर्व जो प्रयास इस क्षेत्र में किए गए उन पर बंगला, संस्कृत एवं अंग्रेजी शैली का बहुत ही प्रभाव पड़ा था। डॉ. रामकुमार वर्मा वे पहले व्यक्ति हैं जिन्होंने हिन्दी एकांकी के क्षेत्र में क्रान्तिकारी परिवर्तन किया है। हिंदी एकांकी को मौलिक रूप में उपस्थित करने का श्रेय इसी किसी को दिया जा सकता है तो वह अकेला व्यक्तित्व है – डॉ. रामकुमार वर्मा।

डॉ. रामकुमार वर्मा को हिंदी संसार एकांकी का जनक मानता है। उन्होंने एक साक्षात्कार में इस बारे में बताया है – “मैं अपने साहित्यिक मित्रों के प्रति आदर से शीश झुकता हूँ जो मुझे हिंदी एकांकी का जनक मानते हैं।” मैंने हिंदी एकांकी की विषयगत जितनी भी विधाएँ हो सकती हैं, सब लिखी हैं। पौराणिक, ऐतिहासिक, सांस्कृतिक, पारिवारिक, सामाजिक, मनोवैज्ञानिक, दार्शनिक आदि विषयों पर मैंने एकांकियों की रचना की है। मैंने आचार्य भरत मुनि के नाट्यशास्त्र पर विस्तृत विचार व्यक्त किए हैं। एकांकियों की नाना विधाओं की रचना की है। मैंने जिज्ञासा एवं कौतुहल की ओर विशेष ध्यान दिया है।

डॉ. वर्मा का विचार और चरित्र की उद्भावना में मौलिकता है। यह मानना होगा कि टेकनिक का उन्होंने सुस्थिर रूप दिया है। उन्होंने आधुनिक ढंग के एकांकी लिखने की नौव पथ-प्रदर्शक के रूप में डाली। अतः यह कहना उचित होगा कि हिंदी साहित्य में एकांकी नाटक लिखनेवाले सर्वप्रथम लेखक डॉ. रामकुमार वर्मा ही हैं।

डॉ. वर्मा पाश्चात्य शिल्प से प्रभावित आधुनिक एकांकी-कला के आरंभकर्ता हैं। परन्तु इनका जीवन दर्शन, इनकी विचार धारा, इनकी समस्याएँ, इनके तर्क आदि भारतीय हैं और इनको आधार बनाकर ही उन्होंने एकांकियों का निर्माण किया है। उन्होंने मनोविज्ञान तथा संघर्ष को जोड़कर जीवन का महान सत्य को जितनी कुशलता के साथ अभिव्यक्त किया है उतना अन्य कोई एकांकीकार इनसे नहीं कर सका। आपका रचना-शिल्प इतना मौलिक एवं महत्वपूर्ण है कि उसमें स्वाभाविकता, यथार्थता और मनोवैज्ञानिकता को अंकित करनेवाली शैली के स्पष्ट दर्शन हुए हैं। यही कारण है कि डॉ. रामकुमार वर्मा एकांकी के आरंभकर्ता, प्रवर्तक हैं, पथ-प्रदर्शक हैं और किसी सीमा तक जन्मदाता भी हैं।

डॉ. रामकुमार वर्मा के एकांकियों पर पाश्चात्य प्रभाव स्पष्ट रूप से झलकता है किन्तु विषय और शिल्प में वे मौलिकता भी बनाए रखते हैं। उनके एकांकी लेखन की शुरुआत में बंगला, संस्कृत एवं

अंग्रेज़ी का प्रभाव था। प्रसाद के “एक घूँट” पर भी इन भाषाओं का प्रभाव देखा जा सकता है। “एक घूँट” आधुनिक एकांकी से दूर है। एकांकी मात्र एक अंक का होने के कारण ही है अन्यथा उसमें लंबे स्वागत, समस्या, कथानक आदि एकांकी की भाँति नहीं है। इसलिए वर्माजी के आरंभिक एकांकी न केवल प्रयोगात्मक दृष्टि से वरन नींव की दृष्टि से महत्वपूर्ण ठहरते हैं। डॉ.वर्माजी पश्चिमी प्रभाव को स्वाभाविकता एवं आवश्यकतानुसार ही ग्रहण करते हैं। उनके एकांकियों की कथावस्तु हमारे आसपास के वातावरण से भी गयी होती और उसमें आदर्श की यथोचित स्थापना भी मिलती है। उनके प्रायः सभी एकांकियों की कथा यथार्थ पर आधारित है तथा उसमें एकांकीकार का उद्देश्य रूपी आदर्श भी साथ साथ चलता यह आदर्श एकांकी के आरंभ में भी एकांकीकार के मस्तिष्क में तय होता है। इस प्रकार आदर्शवादी विचारधारा का प्रचार करना डॉ.वर्मा के व्यक्तित्व का एक अंग है।

डॉ.वर्मा का पहला एकांकी नाटक बादल की मृत्यु है जो सन् 1930 में में प्रकाशित हुआ था। बाद में यह एकांकी पृथ्वीराज की आँखें में संकलित है। यह बेलजियम के प्रसिद्ध कवि और नाटककार मेहरलिंग के नाटकों के आधार पर लिखा गया एक फैंटसी है। इसमें कोई कथानक नहीं, किसी तरह की नाटकीयता नहीं, कवित्व की प्रधानता है। यह युगान्तकारी एकांकी के बाद वे पश्चिमी विचारधारा और शिल्प के अपनी मौलिक प्रतिभा का समन्वय कर अनेक एकांकी लिखे और हिंदी एकांकी साहित्य में नवयुग का निर्माण किया। रंगमंच के अभाव में हिंदी में नाटक केवल पढ़ने की चीज़ बनकर रह गयी थी परन्तु डॉ.वर्मा की यह सबसे बड़ी विशेषता यह है कि उसके लगभग सभी एकांकी अभिनेय है और कई बार मंच पर अभिनीत और आकाशवाणी पर प्रसारित हो चुके हैं। उन्होंने एकांकी नाटक में रंगमंच तथा अभिनेयता को बहुत अधिक प्रमुखता दी है। उन्होंने स्वयं एक पत्रिका में लिखा है – “रंगमंच की भारी असुविधाओं से मैं ने संघर्ष किया अतः जब किसी नाटक की कल्पना मेरे हृदय में आते हैं। रंगमंच मेरे मानस पटल पर पहले ही आ खड़ा होता और पात्रों की अथवा कथावस्तु की माँग करता है। यह होता है कि मशीन के पुर्जों की भाँति मेरी कथा अथवा पात्र अपने आप यथा स्थान आ सिमटते हैं। प्रेम में जुड़े हुए चित्र की तरह मेरे नाटक की कल्पना पर उतर होती है।”²

डॉ.वर्मा के पास रचनात्मक क्षमता के साथ ही कवि हृदय तथा समीक्षात्मक दृष्टि भी है। इस कारण वे अपने एकांकियों को समझने-परखने में भी सक्षम है। एकांकी का सैद्धान्तिक विवेचन और समय-समय पर की गयी टिप्पणियाँ द्वारा उन्होंने रंगमंचीय विकास और एकांकी के शिल्पगत विकास में महत्वपूर्ण भूमिका निभायी है। अपने पहले ही एकांकी संग्रह – “पृथ्वीराज की आँखें” - में उन्होंने नाटक और एकांकी में भेद समझाते हुए भूमिका लिखी है। इस तरह का विवेचन का कार्य उन्हीं के द्वारा आरंभ हुआ। सामाजिक एकांकी के आतिरिक्त उनके ऐतिहासिक एवं पौराणिक विषयों पर लिखे गए एकांकियों की भी एकांकी विकास में महत्वपूर्ण भूमिका रही है। ऐतिहासिक एकांकियों की परंपरा डॉ.रामकुमार वर्मा से ही आरंभ होती है।

Impact factor - 2.135



BODHI

**International Journal of Research in
Humanities, Arts and Science**

An Online, Peer Reviewed, Refereed and Quarterly Journal

Vol: 2

Special Issue: 24

April 2018

E-ISSN : 2456-5571

UGC approved Journal (J. No. 44274)



**CENTRE FOR RESOURCE, RESEARCH &
PUBLICATION SERVICES (CRRPS)**
www.crrps.in | www.bodhijournals.com

AESTHETICS OF DALIT AUTOBIOGRAPHIES

C.S.Sreelekshmi
sreelekshmi92@gmail.com

Abstract

The paper aims to address the misconceptions that define the aesthetics of Dalit literature as different from the mainstream literature and to navigate the different perspectives which help in determining its richness. The writers and critics of literature see Dalit writings as lacking in imagination and repetitive in its themes. The writers of Dalit literature has brought to the forefront the invisibility of their existence who suffer severe blows of racial injustices and reminiscences their by-gone culture and heritage. With reference to the autobiographies of Om Prakash Valmiki's *Joothan: A Dalit's Life*, Sharan Kumar Limbale's *Akkarmashi: The Outcaste*, BamaFaustina's *Karukku* the study has attempted in deciphering the in-betweenness and rootlessness of the so-called relegated sections, thereby unraveling their lives and invigorating the communities to articulate their voice for freedom and liberation. The native shock and cultural dilemma these writers confronted has become a discourse for the communities to recapitulate their perceptions of history to resist the bifurcated notions of a nation according to race and class. The study also deals explicitly with disseminating emancipation from their double conscious identities and emanating the constructed prejudices of the society.

Keywords: Dalit literature Dalit aesthetics, Dalit consciousness, collective consciousness, trauma, representation, cast hierarchy

Introduction

The marginalized psyches conceptualized in Dalit writings, in particular, Dalit autobiographies, have contributed in validating or ratifying the crippled identities of the downtrodden Dalits. This socially liable group is bifurcated in the name of caste. The varying degrees of humiliation and oppression the Dalits suffered at the hands of the Upper caste is being recapitulated in its fullest essence by these writers. They not only deal with the negation and self-alienation they have encountered, but also express their need to articulate their voice of liberation. Thus the quintessence of Dalit literature revolves around the very many aspects of self-assertion, representation and forming a cultural politics of their own, irrespective of gender, race, caste and ethnicity. Though realism dominated Dalit literature, the "values of equality, freedom, justice and solidarity" (Limbale 120) forms its aesthetics. It is self-reflexive of its history and further questions the socio-cultural practices which abets in creating a discourse "on the past, present and future of dalits" (Yesudasan 149).

The so-called mainstream literature fails to apprehend this charisma of Dalit literature and

admonishes its aesthetic nuances, debilitating the people and their literature. Some of the non-dalit writers attempted to decipher the dilemmas surmounting their lives but none of their works could speak with candor about their pejorative existence. Even the enticed readers of the mainstream literature too find it difficult to understand the Dalit sensibility and the Dalit aesthetics. Nonetheless, the writers of Dalit literature have tried to amalgamate and converse with the civil society, producing an episteme "to facilitate the eruption of dalit voice and truth, breaking the silence and darkness in the midst of the prevailing politics of knowledge" (Yesudasan 150). Writers like B. R. Ambedkar, Mahatma Jyotirao Phule, Ayyankali, Baburao Bagul, Mariamma Chedath, Namdeo Dhasal, Arun Kamble, Sivakami, Unjai Rajan Abhimani, Gunasekaran and others have championed in bringing forth the dalit consciousness and the dire need to liberate them from the clutches of thralldom.

Autobiographies are a vehicle to elicit effectively the traumatized experiences of the Dalits and the cultural contestations they confront in a society which is regarded as the monopoly of the Upper castes. These narratives

also record their ardent emotions, abominable oppression which dates back centuries and their lamentations and hardships, thereby authenticating their experiences of the past, to evoke them to vocalize their identifiable position and unmask their camouflaged existence. Om Prakash Valmiki's *Joothan: A Dalit's Life*, Narendra Jadhav's *Outcaste: A Memoir*, Sharan Kumar Limbale's *Akkarmashi: The Outcaste*, BamaFaustina's *Karukku* etc. are some among the exemplary works which fores had owed Dalit consciousness. The Dalit life and characters depicted by these writers seek for liberation, asserts freedom and equity through reconciliation and amity, and not by the violent rejection and demolition of the dominant groups. They have evolved into constructing a niche for their progenies by tracing their history, thus providing them with an identity of a better individual, untouched by the clichéd outlook of race and class. In *Towards an Aesthetics of Dalit Literature*, Limbale opines that the aesthetics of Dalit literature rests on three things: first, the artist's social commitment; second, the life-affirming values present in the artistic creation; and third, the ability to raise the readers' consciousness of fundamental values of life like equality, freedom, justice, and fraternity. (120)

In fact, this has been the prerogative with which the writers anticipate their predicament by making use of the potent tools of artistic excellence to navigate and annihilate their fate as the inhabitants of an 'area of darkness'.

Valmiki's *Joothan: A Dalit's Life* presents the horrendous journey the author underwent as an untouchable from his childhood till the end of his life. The institutionalized hegemony of the Brahminical Upper caste Hindus enunciated in *Joothan* calls for re-creating a Dalit consciousness per se "a consciousness of struggle, a consciousness that brings revolutionary change both in the outside world and in our hearts, a consciousness that leads the process of social change" (Valmiki x). The deliberate use of the

title *Joothan*, meaning the leftover food, is reflective of the humiliation, the suffering and the demeaned existence of the Dalits in the society. It encapsulates how the Dalits preserve and rely on the *joothan* to sustain their lives. They are forced into accepting *joothan* from the Upper caste; nonetheless they have to face severe violence. The narrative realistically portrays the exclusion of rights in every sphere of their lives, including the right to own a land, right to education, right to self-affirmation and individuality. Valmiki lends them the voice to articulate their stigmatized presence in the society and makes room for their liberation from such an 'imagined community'. To him, the best tool to challenge their deprived status and to create a space of negotiation is only through education. But such privileges of education are shunned to the underprivileged category. Valmiki breaks the shackles of serfdom and caste-based discrimination by uplifting himself with help of education. In every step of his he experienced humiliation, mental torture and anguish. His determination to elevate his fellow men and to strengthen their zeal to exterminate their bygone struggle of "perpetual physical and mental persecution" (Valmiki xxx) finds its culmination in *Joothan*. Valmiki remarks that his outpouring of the dilemmas of Dalit life is, in fact, the "unraveling of my self, layer upon layer" (Valmiki viii) thus forming the collective consciousness of the community. Through this work Valmiki has brought about a radical change in conceiving the ignominies and ironies that encompasses their social and cultural milieu thereby exhorting his men to fight "for abolishing the whole bogey of caste-structure and caste-hierarchy" (Valmiki 14)

Bama too like other Dalit writers desired for "a new society made up of justice, equality, and love" (xxiii). She conceived her autobiography *Karukku* not only as a confessional account of the "unjust social structures" (xxiii) that ruined the lives of the dalits, but envisages a



Impact factor
= 2.135

BODHI

**International Journal of Research in
Humanities, Arts and Science**

An Online, Peer Reviewed, Refereed and Quarterly Journal

Vol: 2

Special Issue: 25

April 2018

E-ISSN : 2456-5571

UGC approved Journal (J. No. 44274)



**CENTRE FOR RESOURCE, RESEARCH &
PUBLICATION SERVICES (CRRPS)**

www.crrps.in | www.bodhi-journals.com

DECONSTRUCTING THE CONCEPT OF HERO IN KENZABURO OE'S A PERSONAL MATTER

Betty Merin Eapen

bettymerineopen@gmail.com

Abstract

Kenzaburo Oe (b.1935), the liberal intellectual and vociferous critic of Japanese society and politics, is one of the most influential voices in the contemporary world literature. He is recognized as the foremost writer who brought in the concept of grotesque realism to Japanese writings. The innovative themes and concerns of Oe's works incorporate the issues of nuclear deracination, disorientation, madness resulting from confinement, and conflicts – those among children, among individuals and between individuals and society. His distinctive contribution to the world of literature earned him the prestigious Nobel Prize in 1994.

I intend to undertake a fundamental revaluation of the concept of existentialism in Kenzaburo Oe's *A Personal Matter* (1964). Existentialism is not a modern concept; it existed before Renaissance. Existentialism in its currently recognizable form was developed by the 19th century Danish philosopher Soren Kierkegaard and the German philosopher Friedrich Nietzsche. The concept of existentialism manifests striking variations in Western and Eastern literature. After the wars, existentialism struck the Japanese intellectuals not as a philosophy but as a mood or an attitude – a sensibility. The writings of Oe, who represents the contemporary Eastern writers, deviate from those of Sartre, Camus, and Heidegger.

I propose a critical reading of the text, with a focus on Oe's use of existential concepts, taking into account the fact that Japan reflects certain significant 'native' responses and concerns. The principle concern of all existentialists is to affirm the priority of individual existence. Akin to the western existentialist protagonists, those of Oe too are found searching for the meaning in life. They are very similar in the way that people achieve those ends – through personal responsibility and free will. But, they are essentially humanistic to the extent that they value the ability of humans to make their own choices and lead their own lives. Their free will and freedom of choice eventually come to their rescue.

Keywords: Existentialism, alienation, absurdity, anti-hero,

Introduction

"The innocent hero is a vanishing breed. The alienation of the hero defines the shape of the novel. He who once figured as an Initiate, ends as a rebel or as a victim" (257 Gurung). For centuries heroes and heroic characters have been the focal point of literature and culture. The hero is one who represents honesty, integrity and bravery: one who leads his people away from crisis, a saviour and a leader, however with the passage of time, this stereotypical representation has undergone a radical change- from that of a hero to an antihero. With the rise of alienation, hedonism, inhumanity, despair and authoritarianism in the modern world, post modern novel delineates the anxiety about the deprivation of meaning and identity in the modernized society.

Instead of creating a hero who is an epitome of honesty, integrity and bravery, Kenzaburo Oe creates an anti hero who reflects the contemporary spirit in its totality; its anxiety,

despair, neurosis, boredom and mental vacuity. In *A Personal Matter*, Oe presents the protagonist, Bird as a fragmented man deprived of identity. As a prime example of post modern confusion, despair and the anguish of time, space and destiny, Bird searches for an existential fulfilment. Bird believes that real freedom is freedom from all bondages of life. Societal, familial and personal constraints which form bondages make him believe that salvation lies in the African grass. Bird's raging desire echoes the longing of a Jew to reach the "Promised Land"! Bird, a twenty seven year old English teacher at Cram School, often broods over his dream of going to Africa. "I've wanted to go to Africa for years, and that my dream of dreams has been to write a chronicle of my adventures when I got back called *Sky Over Africa*" (5). He finds Africa as the perfect place for a hideout from obligations and responsibilities. The life he lives, for him, seems to be meaningless and absurd. Realising himself



TeLeS

(Teacher, Learner & Society)

A Multidisciplinary Biannual Journal

Special Issue - March 2015

Pages	12	THE BINARIES OF LOVE AND REVOLUTION: A STUDY OF PABLO NERUDA'S SELECT POEMS Minu. A	55-60
1-4			
	13	A POSTCOLONIAL MAPPING OF TRANSCULTURAL ETHNICITY, SUBJECTIVITY AND IDENTITY IN THE POETRY OF GWENDOLYN BROO Nisha Mathew	61-65
5-13			
14-18			
	14	ENVIRONMENTAL PARADIGMS IN CONTEMPORARY AUSTRALIAN POETRY Susan Alexander	66-69
19-22			
	15	THE SELF-IMPOSED RELEGATION: INTER-GENERATIONAL RELATIONSHIP IN ANITA DESAI'S FIRE ON THE MOUNTAIN Sowmya Mary Thomas	70-73
23-25			
26-31			
	16	RETHINKING TEACHING IN THE 21ST CENTURY - ONLINE TEACHING: EMERGING PARADIGMS P.Kanaha Lakshmi	74-82
33-35			
36-39			
	17	A STUDY ON STUDENT TEACHERS ATTITUDE TOWARDS MOTHER TONGUE IN B.ED PROGRAMMING IN KANYAKUMARI DISTRICT. Poonkodi	83-86
40-44			
	18	EFFECTIVENESS OF MIND MAP FOR LEARNING BOTANY AT HIGHER SECONDARY LEVEL Dr.Nimmi Maria Oommen & Riya Anna Philip	87-92
45-50			
	19	TEACHING SKILLS IN THE GLOBAL PERSPECTIVES R.T.Jegotheeswari	93-98
51-54			
	20	A TRUE AUTEUR: ANALYZING PEDRO ALMODÓVAR'S INNOVATIONS IN SPANISH CINEMA. Ganesh.S	99-103

A TRUE AUTEUR: ANALYZING PEDRO ALMODÓVAR'S INNOVATIONS IN SPANISH CINEMA.

Ganesh.S, Research Scholar, University of Kerala,
Thiruvananthapuram, Kerala

The enthusiasm that movies project in exploring and analyzing vivid ideologies mark its mass appeal. In addition to the aesthetic pleasure which originates from the entertainment value of films, the world of movies sometimes provides a sophisticated consciousness about the entrenched principles that they portray onscreen. Film makers who employ such awareness are the true authors of visual narration. The term auteur considers "the director (and not the script writer) centrally as the author of the film (Roberts and Wallis 1974). Pedro Almodóvar is one such auteur who has created alertness about the ideological stereotyping in mainstream narrative movies. His films portray "the sensational and the taboo-breaking with absolute naturalness" (Allinson 19). He "prefers to turn life into art" rather than using the "film medium as a mirror to nature" (Allinson 19). He

has created a distinctive artistic world in his movies where the dominant ideologies of visual narration have no specific identity of their own.

Almodóvar was born on September 24, 1949 in Calzada de Calatrava of Spain. He started his writing career "with comics and articles created for counterculture magazines" (Lin 48). He then began using "the photo-novella form of graphic story telling, using photographs instead of drawings to illustrate stories" (Lin 48). Almodóvar's first feature film, *Pepi Luci Bom, and All Those Other Girls* (1980) was based on his photo-novella *Erecciones generales*. *Labyrinth of Passions* (1982) was his second film which uses the metaphor of the labyrinth "to describe life in a Spanish capital suddenly liberated from decades of dictatorship, suddenly freed from the weight of recent Spanish history" (Allinson 3). *About My Mother* (1999) is his Academy Award winning film which

criticizes the power politics of patriarchy. *I am So Excited* (2013) is his latest work which examines the ambiguity in gender relations.

Roberts and Wallis writes: "If the film-maker was to be seen as author they would have to exhibit through a series of films clear 'auteur' characteristics". They are 'visual style', 'narrative structure and features', 'particular character traits/ situations' and unique 'sets of themes' (128). These are the distinguishing features of an auteur. Almodóvar's films exhibit a faithful sensibility in the articulation of these features. Most of his films explore the aesthetic possibility of issues such as homosexuality and subculture which were once considered as taboo in Spanish motion picture industry. His film narratives celebrate irrationality and disorder as a challenge against the traditional conventions of aestheticism.

Almodóvar's movies exhibit an unconventional visual style with strong colors, outlandish costumes and aberrant camera movements. In Almodóvar's visual narration, "the objective perspective is generally associated with longshots, deep focus and a static camera, while subjective

shots are more likely to be close-up in shallow focus and/or with a moving camera" (Allinson 160). His movies are also famous for the artistic fusion of different shots. As an instance in *Dark Habits* (1983) "When Yolanda sings in response to the statue Mother Superior, a complex combination of point of view shot, shot/reverse angles, and panning serves to enhance the equivocal proxemics between the two women" (Allinson 166). Another peculiar feature of Almodóvar's visual style is his artistic exploration of the high and low angle shots. In *Dark Habits*: "After a tracking shot following Yolanda along the street, into the building and up the stairs, there is a very low angle shot of Yolanda and her boyfriend Jorge. This is followed by a high angle shot of her in the bathroom and then another very low angle shot of Jorge dead on the floor" (Allinson 165). It can be seen as an experimental gesture from Almodóvar to promote the subculture of Madrid in these low angle shots. Almodóvar's movies exhibit a powerful affinity for strong colors, especially for the color red. In *High Heels* (1991) and *Volver* (2006) the preponderance of the color red is

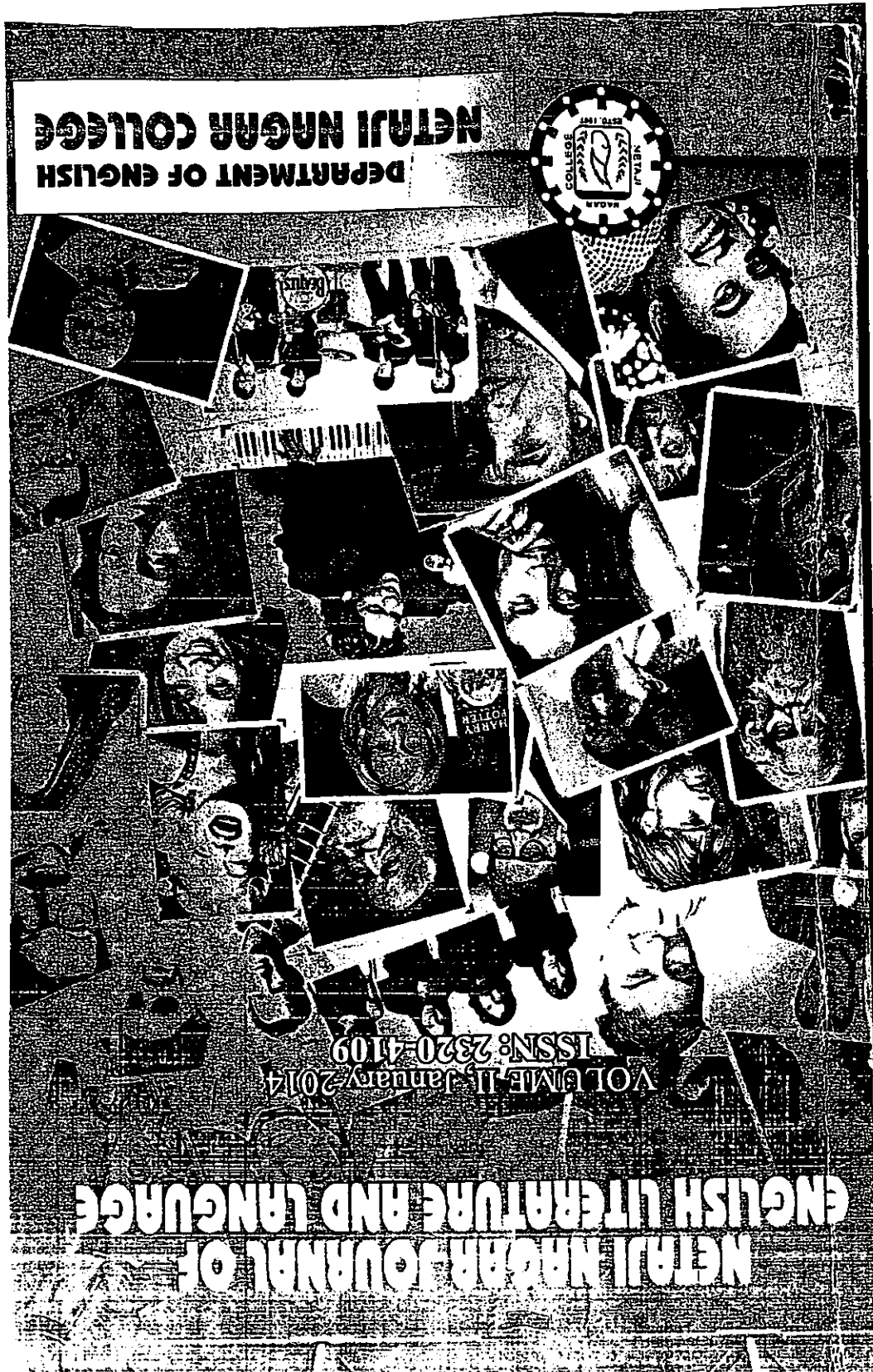
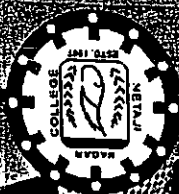
explicit. In *High Heels*, "Lethal's tighter skirt, long gloves and shoes are red, symbolizing him as a point of inferiousness and danger" (Allinson 141). In *Volver* Raimunda's predicament is symbolized in the color red. The red fire extinguisher which occupies half of the screen when Raimunda attempts to call her daughter Paula, is representative of Paula's murder. At the end of that shot, the red color of that fire extinguisher fills the screen and then turns into the red of a bus which passes Paula. In *Matador* (1986) also the presence of the color red is predominant. Red dominates "in the casting session and in the chous chous hall, in Eva's living room, and for Eva's last confrontation with Diego, where she dresses in bright red with a long red necktie" (Allinson 183). It is because of this unique style Almodóvar has been frequently referred as the 'enfant terrible' (Allinson 5) of Spanish cinema.

Almodóvar can be aptly called as a 'woman's director' because he has "consistently placed women centre frame in his cinema" (Smith 2). Powerful patriarchal male figures are non-existent in most of his movies. He attributes autonomy to the

feminine world by making them the supreme masters in narration. It is indeed an open challenge against those mainstream assumptions which portray female as secondary or the other. In the dominant classical cinema women are always portrayed in a lighter or passive tone. They always have only supporting roles to perform and that too under the domination of a male hero. In such movies of the classical tradition, men are the epitome of courage, arrogance, domination and activity. They are the promoters of patriarchal idealism. In movies like *Volver* or *All About My Mother* Almodóvar has consciously destructed these assumptions by exposing the politics of gender relations. In Almodóvar's movies the stereotyped mechanism of gender dichotomies are "self-conscious" deployed, resulting in a parodic and often comic stance with regard to both female passivity and masochism (Allinson 75).

Almodóvar's association with the cult element of Spanish movie influenced him in shaping his artistic career. Movida, the Spanish cultural movement was an "explosion of new trends in music, fashion, design, and film" (Allinson 14).

DEPARTMENT OF ENGLISH
NETAJI NAGAR COLLEGE



VOLUME II, January 2014
ISSN: 2320-4109

NETAJI NAGAR JOURNAL OF
ENGLISH LITERATURE AND LANGUAGE

EDITORS:

MADHUBANTI BASU ROY
Lecturer, Department of English
Netaji Nagar College

NILANJAN CHAKRABORTY
Lecturer, Department of English
Netaji Nagar College

ADVISORY EDITORIAL BOARD:

- **Prof.Dipendu Chakraborty**- Professor (Retd.) in the Department of English, University of Calcutta
- **Prof.SukantaChaudhuri**- Professor (Retd.) in the Department of English, Jadavpur University
- **Prof. Lyn Innes**- Professor (Retd.) in the School of English, Kent University
- **Prof.Swapan Kumar Chakravorty**- Professor in the Department of English, Jadavpur University
- **Prof.SinjiniBandyopadhyay**- Professor in the Department of English, University of Calcutta
- **Prof.Chandrani Biswas**- Associate Professor in the Department of English, St. Xavier's College (Autonomous), Kolkata
- **Prof.Niladri R. Chatterjee**- Associate Professor in the Department of English, Kalyani University

Publisher: Dr. Sandip Kumar Paul
Principal, Netaji Nagar College
170/436, N.S.C Bose Road
Kolkata- 700092.

Mahi Way:

Female Images in Popular Culture

Geethu Thomas²

Phd Scholar, English and Foreign Languages University, Hyderabad

In the essay "What is Popular Culture", John Storey tries to introduce us to the various connotations of the term popular culture. An obvious starting point for any attempt to define popular culture is to say that popular culture is simply culture that is widely favored or well liked by many people. Any definition of popular culture must include a quantitative dimension however a quantitative index by itself is not sufficient to provide an adequate definition of popular culture. A second way of defining popular culture is to suggest that it is the culture that is left over after we have decided what high culture is. In this definition, popular culture is branded as inferior culture. A third way of defining popular culture has been as mass culture. Popular culture is a hopelessly commercial culture. According to this definition, it is mass produced for mass consumption and its audience is a mass of non discriminating mass consumers. A fourth definition contends that popular culture is the culture that originates from the people. A fifth definition of popular culture draws on Gramsci's concept of hegemony. Hegemony is the way in which dominant groups of society through a process of intellectual and moral leadership seek to win the consent of the subordinate groups in society. Popular culture is seen as the site of struggle between the 'resistance' of subordinate groups in a society and the forces of incorporation operating in the interests of the dominant groups of society.

This paper thus tries to contest the definition that popular culture is merely commercially produced mass culture which culturally dopes its consumers by blindly propagating the ideologies of the dominant classes. It argues against this accusation and says that popular culture rather becomes a site of clash between the ideologies of the subordinate and the dominant classes, rather than exhibiting a complete hegemony of the dominant classes. The production of programmes and the reception patterns of the audience are also analyzed in order to substantiate the argument that the masses cannot be culturally doped. Indian television programs are taken as a text of popular culture to analyze its various sides. The paper looks at the representation of women in the Hindi series *Mahi Way* and finds out the contradictory portrayal of women present in the same serial to prove how the various ideas about womanhood circulate in the same text and are struggling for predominance and the absence of one homogeneous narrative regarding the idea of women.

The paper also takes into account the power vested in the masses to accept, reject and create subjective meanings out of the same text and negates the perspective that the audience is passive and easily manipulated.

Mahi Way, a 25 episode series, aired on Sony TV, in 2010, tells the travails of a modern urban young Indian woman in a metropolitan city. The show revolves around 25 year old Mahi Talwar, and follows her daily life which circulates around her family, office and friends. Set in an upper middle class milieu in Delhi, the show deals with a touch of humor the genuine issues that a contemporary woman faces. The show claims to give a realistic representation of the life of a modern young Indian woman and shies away from melodrama. *Mahi Way* might appear to contain and endorse the idea of the liberated woman of the 21st century, which it does, but along with it, unconsciously various other discourses about womanhood coexist and struggle with each other. I will try to bring to light the play of all these discourses simultaneously in the text.

One of the discourses that find representation in the series is the idea of the strong independent modern female as developed by Western feminism. Mahi is representative of the new urban young woman of the 21st century. She is ambitious and career-oriented. Her relationships are not confined to family and relatives, but close relationships are also formed with friends and colleagues. *Mahi Way* breaks away from the usual representations of a female moving around only within the four corners of a house, as we see in the Hindi soap operas, to show Mahi traversing in various social spaces apart from her home like pubs, restaurants, office and holiday destinations to portray the vibrant lifestyle of today's upper middle class urban youth. Her dress code also has widened to leave the saris and the salwars aside, and embrace more western wear like dresses and jeans. Moreover she occupies a secular space, far removed from the religiosity that surrounds the Hindi soap heroines. All these traits that Mahi expresses are symbolic of the image of womanhood that the Western discourse of feminism endorses.

However the patriarchal ideologies of womanhood also come to the scene to make its claim when Mahi's concerns and dreams about love and marriage are unraveled. Even though financially independent and happy, Mahi still feels incomplete without the presence of a partner or a boyfriend in her life. This mindset is embodied the most in Mahi's mother Ranjita who finds it unacceptable that Mahi is still unmarried at the age of 25, and constantly hassles her to the end. Mahi too holds on to extremely romantic notions of love and marriage. The narrative arc of the series is centered around the quest for true love. Mahi's mother gives

her an ultimatum that if she does not manage to find a guy of her choice to marry in 6 months, she has to agree for an arranged marriage, and thus starts Mahi's search for a perfect husband. Three men come into her life, Ishan, Shiv and Dev. The series seems to move towards the fairy tale ending when Ishan proposes Mahi and Mahi agrees to marry him. But the tables turn and the narrative of patriarchy is questioned when in the series finale Mahi refuses to marry Ishan on the day of the marriage. She tells him, "I am marrying you for all the wrong reasons". She confesses that she is marrying him only for the sake of getting married and that she is not ready for marriage. She further says, "I want to get married only when I want and to whom I want to. And maybe I would never want to get married. I am just trying to find myself". And she leaves the marriage. Thus Mahi has the courage to leave a picture-perfect marriage. But after saying all these ground-breaking utterances, the serial ends with Mahi's call to Shiv, signifying the possibilities of a new relationship for Mahi, again reasserting the popular stereotype and patriarchal concept of a woman needing a man at the end of the day.

Another discourse which tries to impose its opinions on womanhood in the series is that of capitalism. The concept of beauty has been imposed on womanhood since eternity and the forces of capitalism have manipulated this idea in order to sell millions of products. As a result, beauty and consequentially womanhood has become commodified. Beauty parlors, cosmetics, accessories and clothes are considered as indispensable elements of womanhood. *Mahi Way* is filled to the brim with perfectly groomed women, be it Mahi's boss Ramona and her colleagues, her best friend Roshni or her perfect sister Anjali. *Mahi Way* portrays such a society, specifically, the world of the upper middle class and the rich, where external appearance is mythologized as being quite important to the making of a successful woman. To a certain extent, *Mahi Way* by portraying such a society unconsciously endorses such an image of femininity. The fashion industry forms a major background to the show - Mahi works for a fashion magazine Trend; Mahi's boyfriend Ishan is the owner of a fashion brand and her best friend Siddharth is a fashion designer. It seems to portray materialism and a culture of consumption as conditions for belonging to the league of successful urban young women.

However at the same time there is a counter narrative happening against the objectification of femininity by capitalism as Mahi's physical appearance breaks all notions of feminine beauty created by fashion industry. She is no size zero diva, she is an overweight bordering on obese girl, who though initially quite concerned about her visual appearance gradually as the series progresses, realizes that there is more to

human life than possessing a perfect body. Perfection and standards of beauty are often merchandized and constructed by the capitalist industries. The series uses various narrative devices to break the stereotypical images of beauty and femininity propagated by society. The standards of perfect and svelte bodies are broken when Mahi's imperfect body is portrayed in images that are usually reserved to showcase picture-perfect feminine beauty. Mahi's romantic montages with her heroes (usually reserved for petite and pretty Hindi heroines) or her flaunting her body in a swimsuit (usually donned by size zero models) force us to reconsider our unconscious prejudices and stereotypes about how a female should look. *Mahi Way* thus rebels against popular conceptions of beauty and femininity formulated by the cultural industry.

Thus it is clear how *Mahi Way* contains within itself various clusters of images of womanhood - some feminist, some patriarchal, some capitalist and some counter hegemonic. Thus in the presence of such diverse and contradictory discourses, it is disputable to portray popular culture as being utterly manipulative and merely a vehicle of the ideology of the dominant classes. Moreover further evidence of the fact that popular culture is not simply an unraveling of the ideologies of the dominant class and administered as opium to the masses, is the fact that the cultural products are not blindly accepted by the people. Among the thousands of cultural products launched as part of mass culture, acceptance is gained only by few. The audience does not accept whatever is streamed to them.

When we examine the audience reception to *Mahi Way*, the first thing we have to take into account is the fact that the masses are not a homogenous entity, and the second thing is that we can never predict the success or failure of a show. According to John Fiske, cultural commodities are not containers or conveyors of meaning and pleasure, but rather provokers of meaning and pleasure. He says that the production of meaning/pleasure is finally the responsibility of the consumer and is undertaken only in his/her interests. This is not to say that the material producers do not attempt to make and sell meanings and pleasure - they do, but their failure rate is enormous.

The production of *Mahi Way* was significant due to the fact that *Mahi Way* marked the entry of film production giant Yash Raj Films into television. They came up with a bouquet of shows along with heavy marketing. The impetus of marketing was on the fact that these shows are different and caters to the visual pleasures of the contemporary modern audience. *Mahi Way* was marketed as the "first contemporary representation of a young girl on television", It was marketed on the strengths of its renewed images of women. Marketing head and Vice president of

ENGLISH ACTIVITIES UPDATE

a biannual journal of literature and cultural studies

Volume 5 Number 2, July 2014

ISSN 0976-3643

**CENTRE FOR FACULTY RESOURCE
DEVELOPMENT IN ENGLISH**

Dwaraka, Next to SBT, Sasthamangalam, Trivandrum - 695 010

www.englishupdate.org

E-mail: english.update@gmail.com

Contents

From the Editor's Desk	5
Redefining the Binaries: A Study of the Films of Kim Ki-duk	
Indu V.S	7
Kishore Ram	
Dream Turns Trauma: Benyamin's <i>Goat Days</i> as a Trauma Narrative	13
Gayathri Devi M.	
The Art of Signification: Analysing the Postmodern Sensibility in the Films of Pedro Almodóvar	23
Ganesh S.	
'She' Through His Eyes: Subjugation of Women in New Wave Malayalam Movies	29
Arathi Lal	
Anxiety/Pleasure: A Psychological Reading of Michael Haneke's <i>Funny Games</i>	37
Sithara G.	
The Theme of Alienation in O'Neill's <i>Long Day's Journey into Night</i>	45
Neena M.	
The Lived Experiences of Partition: A Study of Anis Kidwai's <i>In Freedom's Shade</i>	49
Niranjana Nair P.	

The Art of Signification: Analysing the Postmodern Sensibility in the Films of Pedro Almodóvar

Ganesh.S

Abstract

Postmodernist films occupy a prominent place in world cinema, which is characterized by their powerful defiance over the traditional paradigm of filmmaking. In Spain, such films have displayed a novel approach towards aesthetic expressionism and Pedro Almodóvar became one of its ardent followers. In an absolute postmodern fashion, his movies employ parody, self-reference, hybridity and meta-cinema to explore and analyze the ambivalence of signification. His movies are therefore, exponents which supersede the traditional ideologies of heteronormativity and objectification. This paper intends to analyze how Almodóvar has artistically incorporated the elements of postmodernism which bestow new dimensions for the art of filmmaking as an avant-garde manoeuvre.

The ingenious enthusiasm that Spanish cinema displays in embracing new ideologies and experiments marks its individuality. The varying socio-political scenario in Spain has always been an inspiring force for this unique movie culture. As a result, Spanish cinema has witnessed several innovations and has had very productive periods. It has acted both as an advisor of national ideologies and also as a powerful mentor of modern idealistic discourses. During Franco's regime in Spain, the three major kinds of films favoured by the nationalist government were militaristic 'cinema of crusade', an escapist musical 'cinema of folklore', and a pious sentimental 'cinema of priests' (Smith 39). Luis Lucia's *La hermana Sulpicio* (*Sister San Sulpicio*, 1951), Ladislav Vajda's *Marcelino, pan, y, vino* (*Marcelino, Bread and Wine*, 1954) and Jose Luis Saenz de Heredia's *Raza* (*Race*, 1942) are some of

such films which imparted a traditional mode of nationalism in Spanish visual narration. After Franco's dominion, the Spaniards witnessed the advent of *la Movida madrileña*, a cultural renaissance during the 1980s which imparted the elements of postmodernism like kitsch and carnivalesque in feature films. Pedro Almodóvar is one among the most prominent followers of this new vision while others being Ivan Zulueta and Fernando Trueba.

Almodóvar, who is fondly called as the '*enfant terrible*' (Allinson 5) for his postmodern ideologies, has exhibited an extreme rejection of all orthodox boundaries. He discards conventionality in his visual style which is "characterized both by a refusal to make art imitate life, and by a refusal to accept his own work and persona as controversial" (Allinson 19).

Postmodernism is "an open set of approaches, attitudes and styles to art and culture that started by questioning or exceeding or fooling with one or more aspects of modernism" (Kart 14). Mark Allinson in his *A Spanish Labyrinth: The Films of Pedro Almodóvar* finds an emphatic reason for considering Almodóvar's films as postmodern. He writes "The free mixing of popular elements of mass culture such as Hollywood movies, advertising and television with the more artistic 'high culture' of auteurist, poetic cinemas has earned Almodóvar the label of postmodernist" (209). In a typical postmodern fashion, most of his movies attempt to challenge the traditional conventions of dominant cinema and also try to break down the difference between high and low art. For instance in *Kika*, (1993) Almodóvar's juxtaposition of Kika's 'damsel in distress' image with the grotesque sensationalist image of mass media provides a perfect amalgamation of the high and low art. The damsel in distress is a classic image which recurs in literature and several art forms. It is the image of a beautiful young woman who is in distress and who needs a hero to arrive at her rescue. In *Kika*, it is the protagonist Kika the damsel in distress who gets humiliated when Paul Bazzo rapes her. She again gets embarrassed when Andrea, a tabloid journalist shows a videotape featuring her rape on a television show 'The Worst of the Day'. Andrea,



Dielectric and optical properties of $\text{Ln}_{0.8}\text{Lu}_{0.2}\text{TiNbO}_6$ (Ln = Ce, Pr, Nd & Sm) ceramics



Fergy John^a, Sam Solomon^{b,*}

^a Department of Physics, St Gregorios College, Kottarakara 691531, India

^b Department of Optoelectronics, University of Kerala, Thiruvananthapuram 695581, India

ARTICLE INFO

Article history:

Received 18 April 2020

Received in revised form 16 June 2020

Accepted 8 July 2020

Available online 13 July 2020

Communicated by J.G. Lu

Keywords:

Ceramic

Microwave

Dielectric

Optical band gap

ABSTRACT

$\text{Ln}_{0.8}\text{Lu}_{0.2}\text{TiNbO}_6$ (Ln = Ce, Pr, Nd & Sm) are synthesized through conventional solid state ceramic route. The XRD, FT Raman and FT IR studies revealed that the samples have aegyrine orthorhombic symmetry. The samples are sintered at 1230 °C. Using SEM technique, microstructure of the sintered samples is analyzed. The dielectric properties of all the samples in the radio as well as microwave frequencies are studied. UV spectra of the samples are recorded and the optical band gap is estimated from the Tauc's plots. The samples are found to be photoluminescent materials with emissions at violet and green regions.

© 2020 Elsevier B.V. All rights reserved.

1. Introduction

Material research is always focused to develop new materials for practical applications. The main properties required for a dielectric resonator in microwave communication systems are low temperature coefficient of resonant frequency (τ_f) for stability, high dielectric constant (ϵ_r) for miniaturization and high quality factor (Q) for selectivity. LnTiTaO_6 and LnTiNbO_6 ceramic materials are potential candidates for communication systems [1,2]. To develop a good quality ceramic material with improved properties, attempts have been made to replace rare earth atom in the LnTiNbO_6 system with another atom of comparable ionic radii. The luminescence and radio frequency dielectric behavior of polycrystalline ceramics are reported for Ln = Ce, Pr and Sm by L. Jacob et al. [3]. Because of good optical properties the LnTiNbO_6 compounds are used as ideal gain media for miniature solid-state lasers [3]. Members with orthorhombic aegyrine structure in LnTiNbO_6 (Ln = Ce, Pr, Nd, Sm, Eu, Gd, Tb, Dy, Y & Yb) ceramic system have positive τ_f and high ϵ_r , but those with euxenite structure have negative τ_f and low ϵ_r [4]. The microwave dielectric properties of LnTiTaO_6 were investigated by Surendran et al. [5]. Hydrothermally synthesized LnTiNbO_6 compounds were studied by Komkov in 1963 [6]. Thorogood et al. have reported the transformation studies from aegyrine to euxenite structure of Ln(TiTa)O_6 [7]. The doping ef-

fect of oxides of molybdenum and tungsten in LnTiTaO_6 and also the partial substitution of Zr in the Ti site were reported [8,9]. John et al. have reported the optical and electrical properties of RE-Ti-Nb-O₆ (RE = Ce, Pr, Nd and Sm) nanoparticles [10]. The dielectric properties of RE-Ti-Nb-O₆ (RE = Dy, Er, Gd, Yb) nanoparticles were reported by John et al. [11]. This paper reports the effect of lutetium substitution on the dielectric and optical properties of LnTiNbO_6 ceramics.

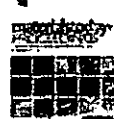
2. Experimental

The polycrystalline samples $\text{Ln}_{0.8}\text{Lu}_{0.2}\text{TiNbO}_6$ (Ln = Ce, Pr, Nd and Sm, abbreviated as CLTN, PLTN, NLTN and SLTN respectively) are prepared through the solid state ceramic route. The high purity (>99.9%) CeO_2 , Pr_6O_{11} , Nd_2O_3 , Sm_2O_3 , Lu_2O_3 , TiO_2 , Nb_2O_5 , weighed according to the stoichiometric ratios and calcined at 1200 °C for 4 hours using acetone as medium. The calcined powder is ground well for 4 hours and 5 wt% polyvinyl alcohol is added to the above mixed dried sample powder. The dried powder sample is converted in the form of cylindrical pellets by applying the pressure of 150 MPa using hydraulic pelletizer. The pellets are then sintered below the melting point of the sample in order to attain maximum density.

Using $\text{CuK}\alpha$ radiation, X-ray diffraction studies (Philips Expert Pro) of powdered sintered samples are done. The FT-IR spectra of the samples are recorded with KBr pellet method using Thermo-Nicolet Avatar 370 Fourier Transform Infrared (FT-IR) Spectrome-

* Corresponding author.

E-mail address: samdmr1@yahoo.com (S. Solomon).



Synthesis and characterization of nano scale YTiNbO_6 - Energy material

Fergy John^a, S. Rinu Sam

^aDepartment of Physics, O. Gopalan College, Rattanakrishnan, Kollam 691332, India

ARTICLE INFO

Article history:

Received 7 November 2019

Revised 10 November 2019

Accepted 7 April 2020

Available online 2020

Keywords:

Energy material
XRD-FTIR spectroscopy
Impedance spectroscopy
Combustion method
Optical band gap
Raman structure
FT Raman Spectroscopy

ABSTRACT

Nano particles of YTiNbO_6 are synthesized through a modified combustion technique. The compound have been studied for their properties and characterized structurally, optically and electrically. Phase purity, crystal structure and particle size of the nano powder are estimated using X-Ray diffraction, FT Raman and transmission electron microscope techniques. The X-Ray diffraction study reveals that the nanoparticles of YTiNbO_6 crystallize in orthorhombic structure. The structure is also confirmed by using FT Raman spectroscopic technique. The samples show a relatively narrow size and no nano size is observed in TEM which is good agreement with the result obtained from the XRD analysis. The absorption coefficient near the fundamental edge depends on the photon energy and it obeys the Tauc's equation. The optical band gap is obtained as 2.43 eV. The sintering temperature of the nanocrystalline powder is found to be reduced by about 120 °C when compared to the other method of preparation. This is due to the high surface to volume ratio of the nano particles. It is also evident from the SEM that the sample has activated high densification with little porosity. The impedance plot can be deconvoluted into three semicircles indicating the contribution of grain and grain boundary conduction. The depressed semicircle suggests that the departure from the ideal Debye behavior. Highest ionic conductivity is observed for the nano scale YTiNbO_6 . These materials can be made useful in solid oxide fuel cells and in opto electronic devices.

© 2020 Elsevier Ltd. All rights reserved.

Selection and peer-review under responsibility of the scientific committee of the International Conference on Photochemistry and Sustainable Energy (ICPSE 2019).

1. Introduction

Many researchers developed complex oxides of titanates, titanates and niobates as dielectric material using different methods. A variety of different applications are being developed successfully using niobium compounds and are used in the electronic and electro-optic markets, including piezoelectric ceramics, dielectric resonator and single crystals. A device that produces electricity directly from oxidizing a fuel is known as Solid Oxide Fuel Cell (SOFC). Metal oxide nanoparticles are the most important and widely used as solid catalysts. The mixed metal oxides can produce new structure with quite different electrical properties than the original oxides. Niobium based materials are used as solid electrolytes in SOFC due to their higher ionic conduction than other oxygen-ion conductors.

Materials with general formula $\text{A}^{n+}\text{B}^{m+}\text{C}^{p+}\text{O}_6$ have been reported by Komkov and Mazanov et al. According to Komkov et al.,

LaTiNbO_6 compounds with lanthanides of atomic numbers in the range 57-63 crystallize in the orthorhombic anorthite structure and those in the range 64-71 have orthorhombic euxenite structure [1]. Mazanov et al. have reported that the LaTiNbO_6 compounds with lanthanides of atomic numbers 57-66 have orthorhombic anorthite structure and those with atomic numbers 67-71 have orthorhombic euxenite structure [2]. SmTiNbO_6 is a good material for applications such as dielectric resonators in microwave circuits due to high dielectric constant, high unloaded quality factor, and small temperature coefficient of resonant frequency [3]. Sebastian et al. have also reported the microwave dielectric properties of LaTiNbO_6 ceramics (La = Lanthanides) [4]. According to Surendran et al. LaTiNbO_6 ceramics with La = Ce, Pr, Nd, Sm, Eu, Tb and Dy crystallize in the orthorhombic anorthite structure with positive temperature coefficient of resonant frequency (τ_f) and that with La = Hf, Y, Er and Yb crystallize in the euxenite orthorhombic structure with negative τ_f [5]. The microwave dielectric properties of YTiNbO_6 improve with an increase in the concentration of Nd atoms [6]. Sam Solomon et al. have reported the effect of ZnO doping on the microwave

* Corresponding author.

E-mail address: feryjohn@opecol.ac.in (F. John).

DOI: 10.1016/j.matpr.2020.04.110

2284-7651/20 © 2020 Elsevier Ltd. All rights reserved.

Selection and peer-review under responsibility of the scientific committee of the International Conference on Photochemistry and Sustainable Energy (ICPSE 2019).

Please cite this article as: F. John and S. R. Sam, Synthesis and characterization of nano scale YTiNbO_6 - Energy material, Materials Today: Proceedings, ISSN: 2284-7651, 2020, pp. 2020-2020.



Optical properties of pure and doped CdS nanoparticles under solvothermal method

S. Rinu Sam^a, Fergy John

^a St Gregorios College, Katturathara, Kerala, India

ARTICLE INFO

Article history

Received 7 November 2019

Received in revised form 28 March 2020

Accepted 3 April 2020

Available online xxxx

Keywords

Solvothermal

XRD

Optoelectronics

Nanocrystalline

Quantum size

ABSTRACT

The synthesis of CdS nano particles have been widely studied for their potential usage in the field of optics. The Semiconductor nanoparticles doped with transition metal ions have attracted a wide attention due to their excellent luminescent properties. The transition metal doped nano particles have different optical properties corresponding to their host counter parts. These nano particles have tremendous applications in the fabrication of optical light emitting diodes and to design a suitable window material in fabrication for solar cells. The microwave assisted solvothermal method is used to prepare the nano particles in this study. The nano structured materials of CdS were characterized by XRD and UV techniques. The size of the crystallite is determined by XRD to be 18.26 nm depending on the amount of the molar ratio of the reactants present in the sample. The nanocrystalline nature of CdS particles and the diffused pattern shows the presence of hexagonal phase in the present system. The quantum size dependent effect and the optical quality of the CdS and Mn doped CdS are studied. The optical absorption and transmittance spectrum of the Pure and Mn doped CdS nanocrystalline synthesized in this work. CdS is a commercially important II-VI semiconductor having wide optical band gap, rendering it a very attractive material for optical application especially in nanocrystalline form. The UV-absorption edge provides a reliable estimate of the band gap of any system. It is found that the band gap of the pure CdS nanocrystalline in the present study is 2.45 eV and this value is found to be larger than that of bulk CdS. This variation of the band gap may be useful to design a suitable window material in fabrication for solar cells, in optoelectronics, it finds use as light emitting diode, reflector, dielectric filter and window material.

© 2020 Elsevier Ltd. All rights reserved.

Selection and peer-review under responsibility of the scientific committee of the International Conference on Photochemistry and Sustainable Energy (ICPSE 2019).

1. Introduction

With excellent physical and chemical properties, Cadmium sulphide (CdS) is an important II-VI group semiconductor, which has numerous important applications in the field of photochemical catalysis, gas sensor, detectors for laser and infrared, solar cells, nonlinear optical materials, luminescence devices, optoelectronic devices, environmental sensors, biological sensors and so on [1-7]. Numerous literatures are reported about Mn²⁺ doped system for developing the optoelectronic devices [8-14]. The ionic radius of Cd is comparable with that of Mn²⁺ ions and Mn²⁺ doped CdS will enhance the optical properties when it is comparing with pure CdS nanoparticles. Due to their strong size-dependent optical properties these semiconductor nanomaterials are very important

in the field of optics. Research on quantum size semiconductor particles has enormously increased due to their exciting novel properties in past two decades. In the transition region between molecules and solids nano sized semiconductor particles belong to a state of matter.

In optoelectronics and photonics these II-VI group semiconductor nano materials have great interest for their practical application such as zero-dimensional quantum confined material. By controlling their sizes and shapes, the possibility of tuning the particles properties can be carried out by the preparation of nanoparticles by microwave assisted solvothermal method [15-17]. Numerous reports are recently published about the synthesis of solvothermal method. Recently the solvothermal method has high potential due to relatively low cost, uniform size, high purity and controlled morphology [18-20]. Normally the elementary sulphur powder was used as the chalcogenide source and in this work we choose thiocetamide as the sulphide source. Because it is much

* Corresponding author.

E-mail address: srinu@stgregorioscollege.edu.in (S.R. Sam).



Electrical and optical properties of pure and zirconium added dysprosium titanates

K. Sandeep¹ · Jijimon K. Thomas¹ · Sam Solomon¹

Received: 22 January 2018 / Accepted: 7 February 2018
© Springer Science+Business Media, LLC, part of Springer Nature 2018

calulation - 0

Abstract

Nanoparticles of $\text{Dy}_2\text{Ti}_2\text{O}_7$ and $\text{Dy}_2\text{Ti}_{1.5}\text{Zr}_{0.5}\text{O}_7$ (abbreviated as DTO and DTZO, respectively) have been prepared through an auto-igniting combustion technique. The structure of the system is analyzed by powder X-ray diffraction and vibrational spectroscopic tools. The samples are crystallized with cubic pyrochlore structure with the space group $Fd\bar{3}m$. The particle size obtained from XRD and TEM analysis shows that the samples are nanocrystalline. The Fourier-transform infrared and Raman spectra of the samples are investigated in detail. The ultraviolet–visible absorption spectra of the samples are also recorded and their optical bandgap energy values are calculated. The photoluminescence spectra of the samples are recorded and the transitions causing emissions are identified. The surface morphology of the sintered pellets were studied by scanning electron microscopy which indicates minimum porosity, and the elemental composition was confirmed by energy-dispersive electron microscopy. Impedance spectroscopic studies of the samples are carried out at different temperatures. The conductivity of the samples increased with temperature, and the highest conductivity of $1.93 \times 10^{-1} \text{ S/m}$ at 850°C is obtained for DTO. The materials are suitable candidates for optoelectronic applications and the fabrication of electrolytes in solid oxide fuel cells at moderate temperatures.

1 Introduction

The properties of nanocrystalline materials are superior to those of conventional polycrystalline coarse-grained materials due to their increased strength, reduced density, higher electrical resistivity, increased specific heat, higher thermal expansion coefficient and lower thermal conductivity [1]. Water-soluble ZnO nanoparticles can be used as biological labeling agent, in biological fluorescent imaging and in drug delivery systems for simultaneous treatment and diagnosis [2]. The ZnO hollow nanospheres show excellent photoluminescence (PL) properties with a strong yellow emission and find application in the field of optoelectronics devices [3]. Pyrochlore oxides have recently undergone extensive studies as potentially attractive dielectric materials, solid electrolytes, catalysts, and radiation absorbers [4]. They have attracted much attention because, they display a large variety of physical and chemical properties, depending on the chemical elements involved and therefore, potential

applications in many areas of technological interest. Oxides with pyrochlore structure have shown ionic and electronic or mixed conductivity [5].

Pyrochlore oxides with general formula $\text{A}_2\text{B}_2\text{O}_6\text{O}'$ have space group $Fd\bar{3}m$, where A is a rare earth element or an element with lone pair of electrons and B is a transition metal or a post transition metal. These pyrochlores can be described as two interpenetrating networks of $\text{A}_2\text{O}'$ tetrahedra and B_2O_6 octahedra, with oxygens in two sublattices represented as O and O' respectively. Pyrochlore lattice is known for their incorporation of dopants, interstitial oxygen and electronic defects by limited doping of A and B sites and these sites form a network of corner sharing tetrahedra. The pyrochlore structure can be considered as being derived from the fluorite structure by removing one-eighth of the anions, so that the newly formed holes constitute a diamond lattice [6]. In the pyrochlore structure the oxide ion vacancies are ordered and these vacancies lead some oxide ions to leave their lattice sites and occupy interstitial positions, creating the intrinsic Frenkel disorder and thus increases the ionic conductivity compared with the disordered fluorite phase of the same composition [7].

Zhang et al. reported that the ultrafine $\text{Dy}_2\text{Ti}_2\text{O}_7$ (abbreviated as DTO) has abundant oxygen deficiency on the

✉ Sam Solomon
samdmrl@yahoo.com

¹ Department of Physics, Mar Ivanios College,
Thiruvananthapuram 695015, India

Structural, Optical and Impedance Spectroscopic Characterizations of Nanocrystalline $A_2Ti_2Zr_5O_{16}$ (A = Mg, Ca, Ba and Sr)

K. SANDEEP,¹ JIJIMON K. THOMAS,¹ and SAM SOLOMON^{1,2}

1.—Department of Physics, Mar Ivanios College, Thiruvananthapuram 695015, India. 2.—e-mail: samdmr1@yahoo.com

A nanocrystalline $A_2Ti_2Zr_5O_{16}$ (A = Mg, Ca, Ba and Sr) system has been synthesized by a modified combustion technique. The cation-deficient calzirtite ($Ca_2Ti_2Zr_5O_{16}$) is found to be a tetragonal structure with the space group $I4(1)/acd$. The average size of the particle from the transmission electron microscopy image is estimated to be 23.30 nm and 20.16 nm for $Ca_2Ti_2Zr_5O_{16}$ and $Ba_2Ti_2Zr_5O_{16}$, respectively. The optical bandgap calculated using a Tauc plot is between 3.01 eV and 3.46 eV. Raman and Fourier transform infrared spectroscopy (FTIR) studies were carried out to confirm the phase purity of the sample. The scanning electron microscopy (SEM) image of a $Ca_2Ti_2Zr_5O_{16}$ sample sintered at 1360°C for 3 h shows minimum porosity with 96% of the theoretical density. The frequency-dependent dielectric study shows that the dielectric constant is maximized at low frequencies and decreases as the frequency increases. The Cole-Cole plot reveals that the material exhibits conduction due to the contributions of grain, grain boundary and electrode effects. The photoluminescence spectra of the samples were recorded and the transitions causing emission have been identified.

[index - 0]

Key words: Nanostructure, combustion synthesis, calzirtite, ionic conduction

INTRODUCTION

$A_2Ti_2Zr_5O_{16}$ (A = Mg, CA, BA and Sr), having an anion-deficient fluorite-related superstructure, is gaining attention due to its high thermodynamic stability and its ability to hold high-level nuclear waste materials for the immobilization of nuclear waste produced from nuclear reactors. $Ca_2Ti_2Zr_5O_{16}$ is found to be stable up to 1673 K; thus this material can be used for high temperature applications.¹

The model structure of the mineral calzirtite was first suggested by Pyatenko and Pudovkina in 1961 as an anion-deficient fluorite-related superstructure with ideal fluorite-derived atomic coordinates, fully ordered anion vacancies and a cation distribution.²

Rossell reported that the refinement of synthetic calzirtite using powder diffraction data resulted in a change in the oxygen position and significant cation ordering at the cation positions and confirmed the space group as $I4(1)/acd$.³ According to him, the diffraction patterns are dominated by reflections corresponding to a sub-cell derived from the fcc Fluorite (MO_2) type. The axes 'a' and 'c' are 3 times and 2 times the formal sub-cell edges, respectively. Rossel and Sinclair suggested the presence of two poly types of calzirtite, tetragonal and orthorhombic.³⁻⁵ However, these forms are distinguishable only by single-crystal x-ray diffraction because the change of these poly-types occurs continuously in small domains. Sinclair et al. reported that the metal atoms surrounding the anion vacancy form a tetrahedron, and the oxygen anion forms an octahedron in calzirtite. They also reported that the cation—cation distances in calzirtite are larger than

(Received July 15, 2017; accepted January 5, 2018)



CLINICAL AND GENETIC STUDY OF SPINOCEREBELLAR ATAXIA TYPE 1 & 2

Sherin John Joseph^a, S. Rinu Sam^b, Sumita Danda^c

^a SRM Arts and Science College, Kattankulathur, Tamil Nadu, India

^b Sivaji College of Engineering and Technology, Manivila, Tamil Nadu, India

^c Clinical Genetics Unit, Christian Medical College and Hospital, India

ABSTRACT

Spinocerebellar ataxias are a heterogeneous group of autosomal dominant genetic disorders. They are caused by the variable degrees of degeneration of the cerebellum, spinocerebellar tracts and brain stem neurons. This study involves the clinical and genetic study of spinocerebellar ataxia type 1 and type 2 affected individuals. Both these types are caused by expansion of CAG repeat in their respective gene beyond a certain threshold. They are caused by dynamic mutation and demonstrate genetic instability and anticipation. The study involves 18 patients and 9 healthy controls from different regions of India. A noninvasive method of sample collection, i.e., buccal wash method is followed and PCR based tests using mutation targeted primers are used to diagnose for SCA1 and SCA2. Clinical features and neuronal history of patients were recorded and analyzed.

Keywords: Heterogenous, Spinocerebellar, Anticipation, PCR, SCA and Neuronal.

1. Introduction

Spinocerebellar ataxias are dominantly inherited, heterogenous group of neurological disorders characterized by variable degrees of degeneration of the cerebellum, spinocerebellar

tracts and brain stem neurons[1]. They are characterized by slowly progressive incoordination of gait and often associated with poor coordination of hands, speech, and eye movements. Frequently, atrophy of the cerebellum occurs. There are several types of SCA and the clinical features shared among these SCAs are ataxia, dysarthria, and eventual bulbar dysfunction but there are variable features that includes ocular dysfunction, extrapyramidal signs, pyramidal signs, peripheral neuropathy, intellectual impairment and seizures. The incidence of SCA is considered to be 3 cases per 100 000 people; [2] with SCA3 as the most common subtype in the world[3]. The prevalence of SCA however varies with geographical regions[4].

In India the most common subtype is SCA 2; but studies done is insufficient to understand the prevalence in Indian population as a whole[5]. Among the different subtypes of SCA, 6 of them (SCA1, SCA2, SCA3, SCA6, SCA7, SCA17) and DRPLA are caused by CAG trinucleotide expansion in the respective genes. These CAG repeats encode polyglutamine tracts and therefore these disorders are also referred to as polyglutamine disorders [6]. Normal SCA1 alleles range from 6 ± 39 , while clinical symptoms have been reported in individuals carrying 39 ± 81 CAG repeats[4]. Intermediate alleles from 36 ± 41 CAG repeats in the SCA1 gene show reduced penetrance[7]. It was found that, the age of onset is inversely correlated to the repeat length with large alleles being predominantly found in juvenile cases [7]. Instability is a major characteristic of mutations caused by trinucleotide repeat expansions resulting in an increase in the mean size of the expansion over successive generations[8].

2. Experimental

The clinical disorders are characterized by wide range of phenotypes depending on the respective locus, size of the repeat and disease duration. These disorders manifest above certain threshold of CAG repeats. Clinical characterization of the SCA type is difficult as symptoms are varied and overlap [9]. However genetic diagnosis and confirmation of the SCA type is possible [10]. Molecular analysis also help to understand CAG instability, anticipation and inverse size correlation between repeat size and age of onset of symptoms.[11] The present investigation aims to confirm patients genetically positive for SCA1 and SCA2. Analyze whether the expanded CAG repeat correlates with earlier age of onset of the disease and greater severity of the disease. Analyze neuronal history of the individual family, through pedigree analysis and study anticipation of the disease gene. The study also aims to utilize non-invasive means of sample collection from patients for genetic testing. Therefore buccal mouth wash sample was taken from

SYNTHESIS, STRUCTURAL AND DIELECTRIC PROPERTIES OF Nb₂O₅ NANO-PARTICLES: A PROMISING FUNCTIONAL MATERIAL

Fergy John

Department of Physics, St Gregorios College, Kottarakara (India)

Abstract

Chemical precipitation technique was employed to synthesize crystalline Nb₂O₅ nanoparticles. The XRD result revealed that the synthesized nanoparticles possess orthorhombic structure as confirmed by Fourier-transform infrared (FTIR) spectroscopy and FT-Raman studies. The average particle size of the as-prepared sample obtained from XRD analysis confirmed their nano crystalline nature. The prepared nanopowders were sintered at relatively low temperature of 1350 °C to high density. SEM images of sintered samples indicated high densification of the nanomaterials. The variations of dielectric constant (ϵ_r), conductance (G) and loss factor ($\tan \delta$) of the samples were studied in the radio frequency range.

Keywords: Nano particles, Chemical precipitation method, X-ray diffraction, FT- Raman studies, FT-IR studies, Dielectric studies.

1. INTRODUCTION

Niobium pentoxide (Nb₂O₅) is one of the most studied materials because of its wide range of applications include batteries, solar cells, sensors, electrolytes, semiconductors and optical materials [1-3]. Niobium oxides have been prepared by different methods such as oxidation of metallic niobium in air, by hydrolyzing alkali-metal niobates, niobium alkoxides and niobium pentachloride or by precipitation from solution in hydrofluoric acid with alkali-metal hydroxide or ammonia [4]. Sayama *et al.* [5], Kominami *et al.* [6] have reported that the properties of Nb₂O₅ prepared by various methods. This paper reports the synthesis of phase pure nano sized Nb₂O₅ by Chemical precipitation technique and their structural and dielectric characterizations.

2 EXPERIMENTAL

Niobium oxide nano particles were prepared by the chemical precipitation method. Nb₂O₅ nano particles can be obtained by a precipitation of niobate oxylate hydrate with ammonia in water/ethanol at room temperature. The entire process was carried out in deionized water for its inherent advantages of being simple and environment friendly. 20 ml of niobium oxalate was taken in a burette. 20 ml NH₄CO₃ from the stock solution taken in the conical flask along with 70 ml of de-ionized water and 10 ml of EDTA solution. The niobium oxalate solution from the burette was added drop wise at constant rate to the contents in the beaker under vigorous stirring using a magnetic stirrer. By employing a magnetic stirrer the homogeneity of the nano sized crystals formed were maintained. The precipitate was collected in

Spectral Studies of Transition Metal Ions (Mn²⁺, Cu²⁺, Zn²⁺) Doped CdS Nanoparticles Under Solvothermal Method

S.Rinu Sam

Sivaji College of Engineering and Technology, Manivila, Tamil Nadu, India.

Abstract

The microwave assisted solvothermal method was employed for the preparation of pure and doped CdS nanoparticles. The cadmium acetate and thioacetamide were used as the cadmium source and sulfide source with the solvent ethylene glycol. The transition metal ions doped CdS nanoparticles have tremendous applications in optical light emitting diodes. The prepared pure and doped CdS nanocrystals were characterized by XRD, UV-VIS Absorbance, UV-VIS Transmittance and FTIR are recorded and discussed briefly.

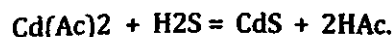
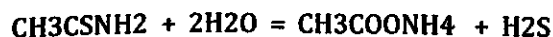
Key words: Solvothermal, Thioacetamide, Nanoparticles, UV-VIS.

1. Introduction

The Cadmium Sulphide (CdS) is an important II–VI group semiconductor ($E_g = 2.42$ eV) with excellent physical and chemical properties, which has promising applications in multiple technical fields such as photochemical catalysis, gas sensors, detectors for fast laser and infrared, solar cells, nonlinear optical materials, various luminescence devices, optoelectronic devices etc. [1-7]. CdS is the most promising compound among II–VI group semiconductor for detecting visible radiation [8]. Using various methods CdS nanoparticles can be obtained [9-12]. Many papers are recently published about the synthesis of chalcogenides with the solvothermal method [12-24]. The elementary sulphur powder was normally used as the chalcogenide source and here we choose thioacetamide as the sulphide source. Because it is much easier for thioacetamide to release sulphide ions and it will be beneficial to lower the reaction temperature and shorten the reaction period. With all these compounds we choose the nontoxic, in corrosive ethylene glycol as the solvent and this is more favourable to the environment.

2. Experimental

The chemicals including Cadmium acetate ($\text{Cd}(\text{CH}_3\text{COO})_2 \cdot 2\text{H}_2\text{O}$), Thioacetamide (CH_3CSNH_2) and Ethylene glycol ($\text{HOCH}_2\text{CH}_2\text{OH}$) are the analytical reagents. In this present study ethylene glycol was used as the solvent. Cadmium acetate and Thioacetamide are mixed with ethylene glycol are added to an autoclave and the precursor materials were reacted with 800W domestic microwave oven for 20 minutes. During the process of synthesis, Thioacetamide (TAA) can react with the trace water containing in ethylene glycol and also the de-ionized water in cadmium acetate ($\text{Cd}(\text{Ac})_2$), and release H_2S gradually. It undergo thermal decomposition under microwave irradiation to produce Cadmium Sulphide (CdS).



In this microwave synthesis, ethylene glycol and microwave irradiation play the key role for the preparation of CdS nanoparticles. Ethylene glycol acting as both reaction media and dispersion



STUDIES OF Mn^{2+} DOPED CDS NANOPARTICLES UNDER OPTIMIZED ANNEALING CONDITION

S. Rinu Sam

Sivaji College of Engineering and Technology, Manivila, Tamil Nadu, India.

ABSTRACT

The synthesis of CdSnano particles was widely studied for their potential usage in the field of optics. Semi conductor nanoparticles doped with transition metal ions have attracted wide attention due to their excellent luminescent properties. The transition metal doped nanoparticles shows different optical properties corresponding to their host counter parts. These nano particles have tremendous applications in optical light emitting diodes. The synthesis of pureCdSnano particles and CdS with transition metal ion(Mn^{2+})doping was done by microwave assisted solvothermal method. The prepared nanocrystals were characterized by XRD,SEM,EDAX andICP-AES of the samples are recorded and discussed briefly.

Key words:nanoparticles; solvothermal; doping; XRD; SEM; EDAX; AES

1. Introduction

Nanometer sized semiconductor particles belong to a state of matter in the transition region between molecules and solids. During the past two decades, research on quantum size semiconductor particles has increased enormously due to their exciting novel properties [1-4]. II-VI group semiconductor nano materials arepresently of great interest for their practical applications such as zero-dimensional quantum confined materials and for their applications in optoelectronics and photonics. Numerous reports are available in the literature on synthetic techniques chalcogenides with solvothermal method[5-15]. Recently, the solvothermal process as a powerful method for the synthesis of materials has attracted tremendous

STRUCTURAL, OPTICAL STUDIES OF ZINC MAGNESIUM OXIDE AND ZINC COPPER OXIDE NANOCOMPOSITES

C R Indulal¹, R Biju², Deepak Nand³, R Raveendran⁴

¹ Department of Physics, S.G. College, Kottarakara, Kerala, India

² Nanoscience Research laboratory, S.N. College, Kollam, Kerala, India

Abstract

Nanocomposites of Zinc Magnesium Oxide (ZnMgO) and Zinc Copper Oxide (ZnCuO) were synthesized by chemical co-precipitation method. The nanocomposites annealed at 500°C were used for further structural and optical studies. The Scherrer equation was used to calculate the average particle sizes of the prepared nanocomposites. The optical characterizations of the metal oxide nanocomposites were carried out by UV/Visible analysis. From the analysis of the absorption spectra, the optical bandgaps of the nanocomposites were calculated.

Keywords: Nanocomposite, XRD, Optical bandgap

1 INTRODUCTION

Metal oxide nano composites with large surface to volume ratio acquire unique magnetic, electronic, optical and chemical applications. Zinc oxide is a wide bandgap semiconducting material with a lot of applications including light emitting diodes, piezoelectric transducers, photocatalysts etc¹⁻³.

Nanomaterials exhibit large surface to volume ratio and thereby most of their properties are selectively controlled by engineering the size, morphology and composition. Such nano crystalline metal oxides exhibiting this large surface area can be applied to devices including sensors for which a better surface effect is required. These new nanomaterials can have enhanced properties from their parent bulk materials⁴. The metal oxide nanocomposites exhibit exceptional UV absorbing ability, high stability at high temperatures and reactivity as catalyst⁵⁻⁶.

2 EXPERIMENTAL

Nanocomposite of Zinc Magnesium Oxide (ZnMgO) was prepared by arrested precipitation using analytical grade 0.1M Zinc Nitrate, 0.1M Magnesium Nitrate, 0.02M citric acid and 0.5M sodium hydroxide as the reagents. However in the synthesis of Zinc Copper Oxide (ZnCuO), instead of Magnesium nitrate, 0.1 M copper nitrate was used. Among the reagents, citric acid was used as a stabilizer to prevent agglomeration. The precipitates so formed by stirring were separated from the reaction combination and washed with distilled water to remove all impurities. The dried precipitates at room temperature were thoroughly grounded using an agate mortar to obtain its fine powder. On heating to 500°C, their corresponding nanocomposites were formed.

2.1 CHARACTERIZATION

XRD analysis is a finger print tool for the structural analysis of nanocomposites. The XRD patterns of the powdered samples were recorded using XPERT-PRO powder diffractometer using Cu- K_{α} radiation in the 2θ range 10° to 80° at 30mA, 40kV. The UV spectra were recorded using Shimadzu UV-2550 UV visible spectrophotometer.

3 RESULTS AND DISCUSSIONS

3.1 XRD STUDIES

The nano crystalline natures of ZnMgO and ZnCuO are verified using XRD analysis. There is a definite line broadening of the XRD peaks indicates the synthesized materials consist of particles in nanometer scale. The peak intensity, position and full width at half maximum data are obtained from the XRD pattern. The nanoparticle sizes are calculated using Debye-Scherrer equation, $t = k\lambda/(\beta\cos\theta)$; where k is the Scherrer constant and its value is taken as 0.9, β is the full width at half maximum of XRD peaks, θ is the Bragg diffraction angle and λ is wavelength of X-rays used in XRD analysis, $\lambda = 1.54060$ [Å]. The XRD patterns of ZnMgO and ZnCuO sintered at 500°C are shown in fig 1A and 1B respectively. The average particle sizes for ZnMgO and ZnCuO nanocomposites are found to be 32 and 23nm respectively. The XRD peaks of ZnMgO and ZnCuO confirms that they are almost free from impurities.

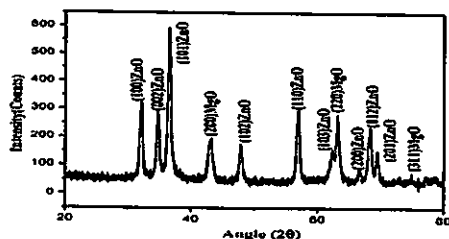


Fig. 1A XRD Patterns of ZnMgO

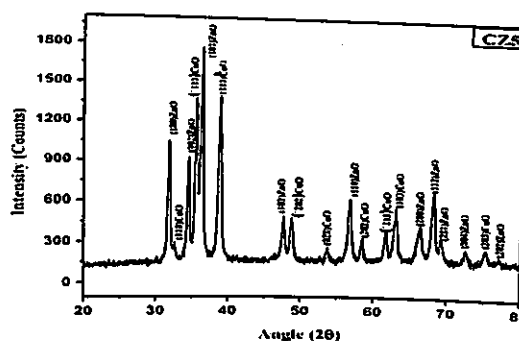


Fig. 1B XRD Patterns of ZnCuO

3.2 UV-SPECTRAL STUDIES

The UV spectra of ZnMgO and ZnCuO nanocomposites sintered at 500°C taken in the wavelength range of 210 to 870 nm are shown in fig 2A and 2B respectively. The optical bandgap details of the nanocomposites can be directly calculated using UV absorption spectra. The decrease in absorbance with increase in wavelength from the UV spectra is due to the presence of optical bandgap in the nanomaterials. Using Tauc's relation, the direct optical bandgaps of the nanomaterials are calculated⁸. The value of direct optical bandgaps of ZnMgO and ZnCuO nanocomposites are 3.29eV and 3.95eV respectively and are depicted in the figures 3A and 3B respectively.

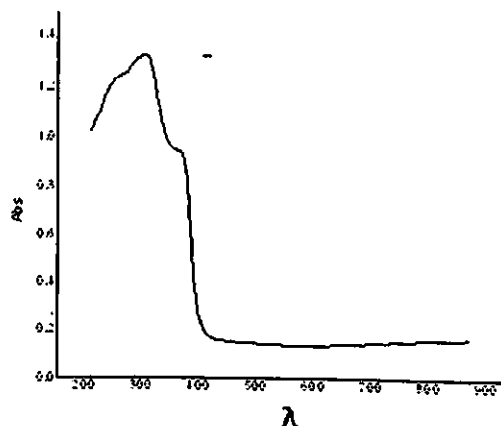


Fig. 2A UV spectrum of ZnMgO



Optical and Antibacterial Studies of Zinc Magnesium Oxide Nanocomposite

C R INDULAL¹, R BIJU²,
DEEPAK NAND² and R RAVEENDRAN²

¹Department of Physics, S.G. College, Kottarakara, Kerala, India.

²Nanoscience Research laboratory, S.N. College, Kollam, Kerala, India.

*Corresponding author E-mail: lldrindulal@gmail.com

<http://dx.doi.org/10.13005/ojc/330359>

(Received: April 08, 2017; Accepted: May 11, 2017)

ABSTRACT

Through the microwave assisted fast synthesis method, Zinc Magnesium Oxide nanocomposite was prepared. Zinc Magnesium Oxide nanocomposite heated at 500°C was used for further structural, optical and antibacterial studies. The Debye Scherrer equation was used to calculate the average particle size of the nanocomposite. The optical characterization of the oxide nanocomposite was carried out by UV analysis. From the analysis of the absorption spectra, the optical direct band gap of the Zinc Magnesium Oxide nanocomposite was calculated and the result was compared with Zinc Oxide and Magnesium Oxide nanocomposites. Antibacterial studies were done in detail.

Keywords: Nanocomposites, XRD, Optical band gap, Antibacterial studies

INTRODUCTION

Nanooxide materials with large surface to volume ratio acquire unique magnetic, electronic, optical, antibacterial properties and potential applications. In the early 1950s, scientists had already started the research on Zinc related materials as antibacterial agents¹. In the areas related with textile industries, water disinfection, medicine, food packaging etc. these antibacterial agents have a major role. Instead of organic compounds, inorganic disinfectants like metal oxide nanocomposites have several advantages, including

their non toxicity to the human body. Zinc oxide is a wide band gap semiconducting material with a lot of applications including light emitting diodes, piezoelectric transducers, photocatalysts etc²⁻⁴.

Nanomaterials exhibit large surface to volume ratio and most of their properties are selectively controlled by engineering the size, morphology and composition. Such nano crystalline metal oxides exhibiting this large surface area can be applied to devices including sensors for which a better surface effect is required. These new nanomaterials can have enhanced properties from their parent bulk

materials⁵. The metal oxide nanocomposites exhibit exceptional UV absorbing ability, high stability at high temperatures and reactivity as catalyst⁶⁻⁷.

Experimental procedure

Zinc Magnesium Oxide nanocomposite was prepared by microwave assisted fast synthesis method using analytical grade Magnesium Nitrate and Zinc Nitrate as the reagents. When compared with other methods, this method has revealed several advantages. It was already reported that molecules undergo excitations due to electromagnetic radiations. By converting microwave radiation into heat energy with high efficiency, superheating becomes possible at ambient pressure. Zinc Nitrate, Magnesium Nitrate and Sodium hydroxide were used as starting materials. Citric acid was used as stabilizer. Aqueous solutions of 0.1M Zinc Nitrate, 0.1 M Magnesium Nitrate and 0.5 M Sodium hydroxide were mixed drop wise and stirred simultaneously into a beaker containing aqueous solution of 0.02 M Citric acid. The process was carried out in few minutes. Then the beaker was kept in a microwave oven. The stabilizer is used to prevent growth/agglomeration of the particles.

CHARACTERIZATION

XRD studies are ideal for the of nanocomposites size determination of powder samples. The XRD patterns of the powdered samples were recorded using XPERT-PRO powder diffractometer using Cu- K_{α} radiation in the 2θ range 10° to 80° at 30 mA, 40 kV. Based on the line broadening, few techniques involving Scherrer equation, integral breadth analysis or Hall-Williamson approach and Fourier method of Warren-Averbach have been developed⁸⁻¹⁰. The UV spectrum were recorded using Shimadzu UV-2550 UV visible spectrophotometer. Antibacterial activity of the sample was carried out using diffusion disk method.

RESULTS AND DISCUSSIONS

XRD Studies

The nano crystalline nature of Zinc Magnesium Oxide is verified using XRD analysis. There is a definite line broadening of the XRD peaks which indicates the synthesized materials consist of particles in nanometer scale. The peak intensity,

position and full width at half maximum data are obtained from the XRD pattern. The nanoparticle sizes are calculated using Debye-Scherrer formula, $d = 0.9\lambda/\beta\cos\theta^{11}$, where 0.9 is the Scherrer constant,

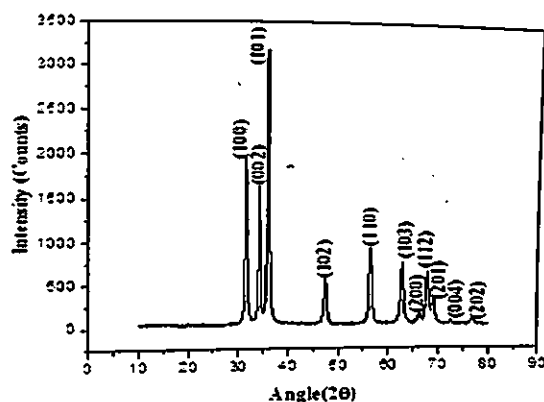


Fig. 1A: XRD Pattern of ZnO

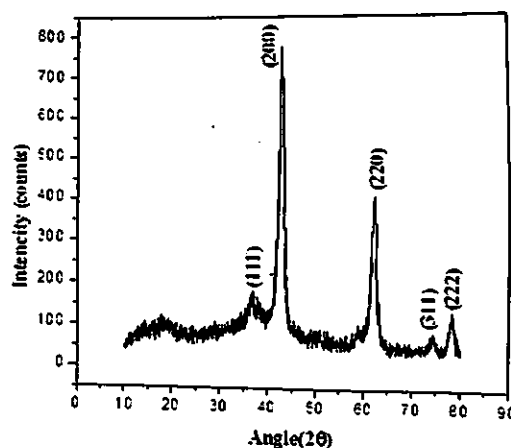


Fig. 1B: XRD Pattern of MgO

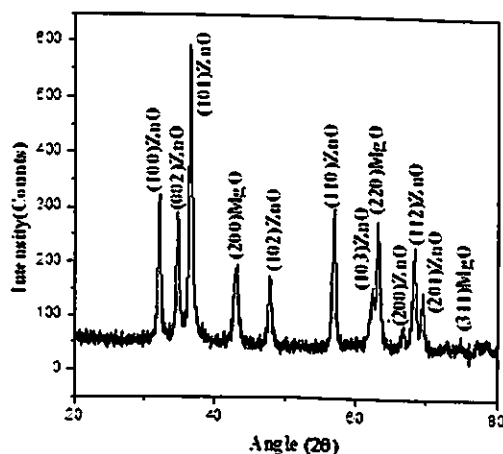


Fig. 1C: XRD Pattern of ZnMgO



Dielectric and Optical Band Gap Studies of Nanostructured Manganese Nickel Oxide and Cobalt Nickel Oxide

C R INDULAL¹, R BIJU²,
DEEPAK NAND² and R RAVEENDRAN²

¹Department of Physics, S.G. College, Kottarakara, Kerala, India.

²Nanoscience Research laboratory, S.N. College, Kollam, Kerala, India.

*Corresponding author E-mail: ltrindulal@gmail.com

<http://dx.doi.org/10.13005/ojc/330365>

(Received: April 08, 2017; Accepted: May 06, 2017)

ABSTRACT

Nano oxides of Manganese Nickel and Cobalt Nickel were synthesized by chemical co-precipitation method from the reaction of respective metal sulfides of manganese, nickel, cobalt and sodium carbonate using ethylene diamene tetra acetic acid as an effective capping agent. The carbonate precursors were heated at different temperatures so as to form their oxides. Through the X-ray line broadening technique, the mean particle sizes were calculated at different temperatures. The elastic micro strains versus particle size variations were thoroughly studied. The metal oxide formations of Manganese Nickel and Cobalt Nickel were confirmed with the help of FTIR spectra. EDX spectra of Manganese Nickel oxide and Cobalt Nickel oxide provide chemical composition of the samples. The crystallite shapes were studied using the scanning electron microscopy images. The optical direct band gap values of both Manganese Nickel and Cobalt Nickel oxides were calculated using Tauc's relation.

Keywords: Nanoparticles, SEM, EDX, Optical band gap, Dielectric properties

INTRODUCTION

Oxides of cobalt are stable and are available in abundance which are cheaper than other noble metals. In the recent past, oxide nanomaterials have been drawing wide attention due to their comparatively excellent electrical, optical¹⁻² or magnetic³ properties. Generally nanoparticles have large surface to volume ratio. So their properties such as electrical, optical, etc. can be tuned by engineering size, morphology or composition. Nano

oxides of Manganese Nickel and Cobalt Nickel with large surface area can be used in gas sensors. These nano oxide systems may have entirely different properties compared to their parent bulk materials⁴. The ultra fine oxide nanoparticles exhibit unique UV absorbing ability, excellent stability at elevated temperatures, very high hardness and reactivity as catalyst⁵⁻⁶. Manganese-Nickel oxide and Cobalt-Nickel oxide systems can be considered as potential candidates for electrodes in batteries, in super capacitor, in sensors, switches etc.

MATERIALS AND METHODS

The nano particles of both Manganese-Nickel oxide (MnNiO) and Cobalt-Nickel oxide (CoNiO) were synthesized by arrested precipitation from AR grade 0.4 M cobalt sulphate, 0.4 M nickel sulphate, 0.4 M manganese sulphate and 0.6 M sodium carbonate using ethylene diamene tetra acetic acid as an effective capping agent. The carbonate precipitates so formed were separated from the reaction combination and were washed with distilled water and ethanol to remove all impurities. The dried precipitates at room temperature were thoroughly grounded using an agate mortar to obtain their metal carbonate precursor in the form of fine powder. On heating to sufficient temperatures (400, 600 and 800 °C), these carbonate precursor decomposes to their corresponding metal oxides.

Characterization

XRD is one of the ideal techniques used for the determination of crystallite size of the nano powders. Based on the broadening of diffraction peaks, a few techniques involving Scherrer equation, Integral breadth analysis or Hall-Williamson approach and Fourier method of Warren-Averbach etc. were developed⁷⁻⁹. Warren and Averbach proposed the first theory related with the broadening of diffraction peaks. XRD studies were done on XPERT-PRO

powder diffractometer with Cu- K_α radiation in the 2θ range 10° to 70° at 30mA, 40 kV. The surface morphological studies of the powder samples were evaluated by a scanning electron microscope. The energy dispersive analyses of X- rays were carried out on the nano samples to ascertain its precise composition. The ultra violet spectroscopic studies were carried out using Shimadzu UV-2550 UV visible spectrophotometer.

RESULTS AND DISCUSSION

XRD Studies

The nano crystallinity of the powder samples are verified using XRD analysis. The nano particle sizes are calculated using Debye-Scherrer equation, $d = 0.97/\beta \cos \theta^{10}$, where β represents the full width at half maximum of XRD lines, $\lambda = 1.54060$ [Å]. Figure 1A and 1B represents the XRD patterns of MnNiO and CoNiO sintered at 600 °C. The most intense peaks are obtained from the (311) planes. The crystallite sizes of MnNiO and CoNiO at 400, 600 and 800 °C using Debye-Scherrer equation are as recorded in Table 1A and 1B respectively. On analyzing the table, it is confirmed that when the temperature increases, the particle size also increases. So temperature of the reaction can be considered as one of the prime parameters on the crystallites size¹¹. The reason for increasing

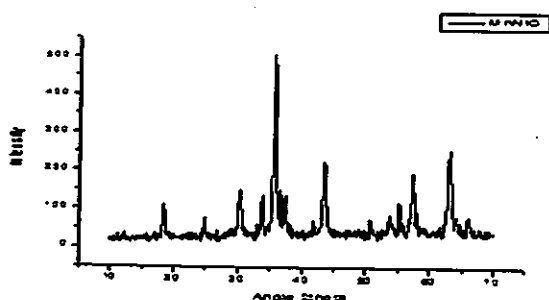


Fig. 1A: XRD pattern of MnNiO sintered at 600°C

Table 1A

Sintering temp °C	Particle size (nm)	Elastic strains	Band gap (eV)
400	8	0.002620	1.44
600	17	0.001313	1.41
800	41	0.000562	1.37

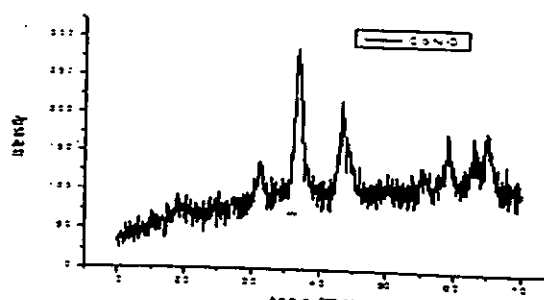


Fig. 1B: XRD pattern of CoNiO sintered at 600°C

Table 1B

Sintering temp °C	Grain size (nm)	Elastic strains	Band gap (eV)
400	6	0.003820	1.43
600	20	0.001159	1.39
800	42	0.000689	1.33



THERMAL STUDIES OF PURE AND DOPED CDS NANOPARTICLES

S. Rinu Sam

Sivaji College of Engineering and Technology, Manivila (Tamil Nadu), India.

E-mail : r.sam0003@yahoo.co.in

Abstract

Semiconductor nanoparticles doped with transition metal ions have attracted wide attention due to their excellent luminescent properties. The transition metal ions doped nanoparticles show different optical properties corresponding to their host counter parts. These nanoparticles have found tremendous applications in optical light emitting diodes. Among the family of II-VI semiconductor CdS is the foremost candidates because of their favourable electronic and optical properties for optoelectronic applications. The synthesis of pure CdS nano particles and CdS doped with transition metal ions (Zn^{2+} , Mn^{2+} , Cu^{2+}) were done by microwave assisted solvothermal method. XRD studies reveals that CdS nanocrystals in cubic as well as hexagonal phase. The obtained nanomaterials have been characterised by Scanning Electron Microscopy (SEM) and the thermal analysis of DSC and TGA.

Key words: Nanoparticles, solvothermal, doped, XRD, SEM, DSC, TGA.

Introduction

Nanocrystalline semiconductor have been intensively investigated over the past years due to their specific optic, electronic and catalytic properties (1-6). All these properties attributed from the high surface to volume ratio and the size quantization effect. II-VI group semiconductor nanomaterials are great interest in the field of optics due to their strongly size dependent optical properties (7). Numerous methods have been developed for the fabrication of such semiconductor nanomaterials (8-12) including chemical reduction, liquid reaction method, sacrificial template method, hydro thermal and solvothermal method. (13-19) among all these methods, recently the solvothermal method has potential advantages of relatively low cost, uniform size, high purity and controlled morphology. (17-19) In this method, solvents are the key issue for the preparation of CdS nanoparticles under solvothermal condition. Mixed solutions are used in order to obtain excellent semiconductor CdS nanoparticles.

Experimental

Ethylene glycol ($HOCH_2CH_2OH$), thioacetamide (CH_3CSNH_2) and cadmium acetate ($Cd(CH_3COO)_2$).

$2H_2O$] are the analytical reagents. In this present investigation ethylene glycol was used as the solvent. Thioacetamide and cadmium acetate were added 1:1 ratio mixed with 30 ml of ethylene glycol and to get a clear transparent solution, the above mixture is stirred well at room temperature. The solution was subjected to microwave irradiation of 800 W for 20 minutes. Thioacetamide can react with the trace water containing in ethylene glycol and also with cadmium acetate, and releases H_2S gradually. From the productive mixture The precipitate of orange coloured CdS nanocrystallites were separated out and washed with de-ionized water for four times and then with alcohol twice. The CdS nanoparticles were annealed at $200^\circ C$ for 12 minutes and 20 minutes and let these samples are called as sample 1 and 2. The sample was annealed at about $100^\circ C$ for 2 hours to get phase-pure nanoparticles of CdS and the sample is known as sample A. Similarly, sample B is annealed at about $200^\circ C$ for 2 hours and sample C is annealed at about $300^\circ C$ for 2 hours. The structural and morphological characteristics of the CdS nanocrystals were studied with X-ray diffractometer and Scanning Electron Microscopy.

In order to synthesize the nanoparticles of doped CdS : Tm (Tm = Zn^{2+} , Mn^{2+} , Cu^{2+}) chemicals such as zinc



Full Length Article

Electrical and optical properties of nano-crystalline RE-Ti-Nb-O₆ (RE = Dy, Er, Gd, Yb) synthesized through a modified combustion method

Fergy John^{a,b}, John Jacob^b, Jijimon K. Thomas^b, Sam Solomon^{b,*}

^a Department of Physics, St. Gregorios College, Kottarakara 691531, India

^b Department of Physics, Mar Ivanias College, Thiruvananthapuram 695015, India

ARTICLE INFO

Article history:

Received 11 October 2016

Received in revised form

30 December 2016

Accepted 31 March 2017

Available online xxx

1. Introduction

Current material research is exploring new strategies by tailoring the properties of the dielectric ceramic materials. Dramatic alteration can be done on the most of the properties of micro crystalline ceramics by reducing the size to nano scale. Nano crystalline oxide ceramic is the key functional material for many advanced applications. With reduction in size, the structural features of the matter lies between bulk material and that of isolated atom giving rise to number of interesting properties due to increased surface to volume ratio, which is to be surface and quantum confinement effects. Niobium oxide materials can be used as structural materials in a wide range of uses covering advanced engineering applications such as aircraft and automotive technologies as well as electronics, computation and material sciences.

Reports are available on the preparation of RETiNbO₆ by the solid-state ceramic route [1,2], microwave hydrothermal method [3,4]. The orthorhombic ternary oxides of the type RE(AB)O₆ [A = Ti, Hf; B = Ta, Nb] has been studied by several investigators [5–12]. RETiNbO₆ is reported as a useful material for electric resonator applications [13]. However, most of these methods involve high temperature annealing with intermediate grindings in order to obtain an appreciable phase purity which yields large coarse-grained micron sized powders. Combustion technique is capable of producing nano-crystalline powders of oxide material, at a lower calcination temperature in a surprisingly short time. In this paper, we report for the first time the synthe-

sis of phase pure nano-particles of RETiNbO₆ (RE = Dy, Er, Gd and Yb) without any calcination by a modified combustion technique.

2. Experimental

RETiNbO₆ (RE = Dy, Er, Gd and Yb) (hereby abbreviated as DTN, ETN, GTN, YbTN, respectively) is prepared by modified combustion technique using the corresponding metal nitrate as oxidizing agent and suitable fuel as reducing agent [14]. Calculations are based on the principles used in propellant chemistry, keeping fuel to oxidant ratio unity in order to produce maximum energy [15]. In this synthesis, high-purity niobium pentachloride (NbCl₅, 99.9%), titanium isopropoxide (Ti(OCH(CH₃)₂)₄, 98%) and the respective rare earth oxides are used as cation sources (oxidizing agent), and urea (NH₂CONH₂) is used as fuel (reducing agent). Dhak et al. [16] used Nb₂O₅ in tartaric acid solution after heating in hot water bath for 10 h to prepare niobium based ceramic. NbCl₅ dissolved in oxalic acid solution without any heat treatment. Citric acid is used as complexing agent to get precursor complex [17]. Stoichiometric amount of oxidizing agents and reducing agents are dissolved in a minimum volume of deionized water to obtain transparent aqueous solutions in a glass beaker and it is heated using a hot plate at 250 °C in a ventilated fume hood to get a viscous gel. The gel thus formed undergoes dehydration on further heating and self-ignites with the evolution of huge quantity of gases. Hence the residual ash that is formed after combustion has a fluffy nature. This ash is further heated up to 600 °C to get the pure phase nano powder of the samples.

* Corresponding author.

E-mail address: samdmr1@yahoo.com (S. Solomon).

Electrical and Optical Properties of Nanocrystalline $A_8ZnNb_6O_{24}$ (A = Ba, Sr, Ca, Mg) Ceramics

FERGY JOHN,^{1,2} LJIMON K. THOMAS,² JOHN JACOB,²
and SAM SOLOMON^{2,3}

1.—Department of Physics, St Gregorios College, Kottarakara 691531, India. 2.—Department of Physics, Mar Ivanios College, Thiruvananthapuram 695015, India. 3.—e-mail: samdmr@yahoo.com

Nanoparticles of $A_8ZnNb_6O_{24}$ (A = Ba, Sr, Ca, and Mg, abbreviated as BZN, SZN, CZN, and MZN) have been synthesized by an auto-igniting combustion technique and their structural and optical properties characterized. The phase purity, crystal structure, and particle size of the prepared nanopowders were examined by x-ray diffraction (XRD) analysis and transmission electron microscopy. The XRD results revealed that all the samples crystallized with hexagonal perovskite structure in space group $P6_3cm$. The Fourier-transform infrared and Raman (FT-Raman) spectra of the samples were investigated in detail. The ultraviolet-visible (UV-Vis) absorption spectra of the samples were also recorded and their optical bandgap energy values calculated. The nanopowders synthesized by the combustion technique were sintered to 95% of theoretical density at temperature of 1250°C for 2 h. The surface morphology of the sintered pellets was studied by scanning electron microscopy. The photoluminescence spectra of the samples showed intense emission in the blue-green region. Complex impedance analysis was used to determine the grain and grain boundary effects on the dielectric behavior of the ceramics.

Key words: Nanomaterial, FTIR spectroscopy, FT-Raman spectroscopy, UV-Vis spectroscopy, optical properties, complex impedance analysis

INTRODUCTION

Nanoscale ceramics can be used for various applications due to their electronic and optical properties. Due to the presence of mixed cubic and hexagonal perovskite subunits, $A_8B(Ta/Nb)_6O_{24}$ (where A is an alkaline-earth cation and B is a transition metal or lanthanide) materials are used as essential components in numerous optoelectronic applications. Moussa et al.¹ prepared $Ba_8ZnTa_6O_{24}$ and characterized its crystallographic properties by Rietveld refinement. Davies et al.² synthesized a densified single-phase sample of $Ba_8ZnTa_6O_{24}$ and found it to be isostructural with $Ba_8NiTa_6O_{24}$, a structure based on 8H (cchc)₂ close-packed arrangement of the BaO_3 stacking sequence. $Ba_8Ta_6NiO_{24}$ ceramic has hexagonal perovskite structure in space

group $P6_3cm$, in which Ta and Ni cations have sixfold-symmetric oxygen coordination in TaO_6 and NiO_6 octahedra.³ Hughes et al.⁴ reported observation of two major secondary phases, viz. $Ba_5Nb_4O_{15}$ and $Ba_8ZnNb_6O_{24}$, on the surface of sintered $Ba(Zn_{1/3}Nb_{2/3})O_3$ - $Ba(Ga_{1/2}Ta_{1/2})O_3$ ceramics as a result of Zn evaporation. Suresh et al.⁵ reported structural and spectroscopic study of $Ba_8Zn(Nb_{6-x}Sb_x)O_{24}$ microwave ceramics synthesized by a combustion method. The conductivity, dielectric loss, and electrical properties of eight-layered twinned hexagonal perovskite $Ba_8CuTa_6O_{24-\delta}$ ceramics with heterogeneous microstructure were reported by Yu et al.⁶ Lu et al.⁷ reported nanometer-scale separation of $d^{10}Zn^{2+}$ layers and twin-shift competition in $Ba_8ZnNb_6O_{24}$ based eight-layered hexagonal perovskites. Murugan et al.⁸ used Nb_2O_5 solution in hydrogen fluoride to prepare $Sr_{0.5}Ba_{0.5}Nb_2O_6$, and Dhak et al.⁹ used

(Received October 15, 2016; accepted April 17, 2017)

Published online: 27 April 2017

Electrical and optical properties of nanocrystalline RE–Ti–Nb–O₆ (RE = Ce, Pr, Nd and Sm) electronic material

Fergy John^{1,2} · Annamma John² · Jijimon K. Thomas² · Sam Solomon²

Received: 7 October 2016 / Accepted: 21 December 2016 / Published online: 24 January 2017
© Springer Science+Business Media New York 2017

Abstract Nano-crystalline RETiNbO₆ (RE = Ce, Pr, Nd and Sm) is successfully synthesized through the solution combustion technique. The XRD analysis revealed that the materials have orthorhombic aeschynite structure with space group Pnma. The particle size determined from XRD and TEM shows that the samples are nanocrystalline. Structure is confirmed by the analysis of FT-Raman, the fourier transform infrared spectra and surface morphology by SEM micrograph. The optical properties, dielectric characteristics at radio frequency range and complex impedance of the system are also studied. Percentage of rare earth in each compound, sintering temperature and density achieved are calculated. The UV–Vis spectra show that the materials can be used as a protective material from UV radiation due to high absorbance in that region. These compounds show strong emission in violet and green regions in the photoluminescence spectrum. The compounds are useful in communication systems due to low dielectric loss and high dielectric constant. The high ionic conductivity suggests that the material can be used as electrolyte in solid oxide fuel cells.

1 Introduction

Nano-materials have wide technological applications, because they exhibit enhanced properties than bulk

materials. They have better sinterability, high surface to volume ratio, superior phase homogeneity, low sintering temperature, greater chemical activity etc. Niobium based materials are frequently used as additives and main components to increase the capacitance of multilayer ceramic capacitors. Lin et al. have reported that the excellent microwave dielectric properties of Ba[Mg_{1/3}(Nb_{x/4}Ta_{(4-x)/4})_{2/3}]O₃ are due to the improvement in sintering by an appropriate Nb atom substitution in the Ba(Mg_{1/3}Ta_{2/3})O₃ ceramic [1].

Many niobium based dielectric resonator materials have been reported which find application in the communication systems. Sebastian et al. have reported the microwave dielectric properties of micro sized RETiNbO₆ (RE = Ce, Pr, Nd, Sm, Eu, Gd, Tb, Y and Yb) ceramics by solid state ceramic route [2]. Hydrothermally synthesized RETiNbO₆ is reported by Komkov et al. [3]. Solomon et al. have reported that the addition of ZnO reduced the sintering temperature by 100 °C in micro-sized NdTiNbO₆ [4]. Dhak et al. have reported that the nano-sized ABi₂Nb₂O₉ (A = Ca²⁺, Sr²⁺, Ba²⁺) showed enhanced properties as compared to the same sample prepared by others methods [5]. Jacob et al. have reported the photoluminescence studies of certain polycrystalline lanthanide titanium tantalates [6]. The effect of yttrium substitution for Nd on the microwave dielectric properties of NdTiTaO₆ ceramics were reported by Kumar et al. [7]. Dechakupt et al. have reported the microstructure and electrical properties of niobium doped barium titanate ceramics [8]. Effect of ionic substitution on the structural, dielectric and electrical properties of bismuth zinc niobate ceramics were investigated by Qasrawi et al. [9]. Sahu et al. have reported that the Dielectric properties of PbNb₂O₆ up to 700 °C, using impedance spectroscopy [10]. Fisher et al. have studied the effect of niobium doping on the electrical properties of 0.4(Bi_{0.5}K_{0.5})TiO₃–0.6BiFeO₃ lead-free piezoelectric ceramics [11].

✉ Sam Solomon
samdmri@yahoo.com

¹ Department of Physics, St Gregorios College, Kottarakara 691531, India

² Department of Physics, Mar Ivanios College, Thiruvananthapuram 695015, India



Research Article

ISSN : 0975-7384
CODEN(USA) : JCPRC5

Effect of annealing and dopants on the physical properties of CdS nanoparticles

S. Rinu Sam^{a*}, S. L. Rayar^b and P. Selvarajan^c

^aSivaji College of Engineering and Technology, Manilvila, Tamil Nadu, India

^bSt. Jude's College, Thoothoor, Tamil Nadu, India

^cAditanar College of Arts and Science, Tiruchendur, India

ABSTRACT

For the synthesis of cadmium sulfide (CdS) nanoparticles, microwave assisted solvothermal method with ethylene glycol as the solvent was used in this work. The cadmium acetate and thioacetamide were used as the cadmium source and sulphide source. Semiconductor nano particles doped with transition metal ions have attracted wide attention due to their excellent luminescent properties. The nano-structured materials of CdS prepared with different annealing periods were characterized by XRD method. The size of the crystallites were determined by XRD method to be 10 nm depending on the amount of the molar ratio of the reactants. The effect of different annealing temperature, concentration of dopants and ionic radii of dopants are also studied.

Key words: Nanoparticles; semiconductor; microwave-assisted method; ethylene glycol; XRD; annealing; doping

INTRODUCTION

Cadmium sulfide (CdS) is an important II-VI group semiconductor with many excellent physical and chemical properties, which has numerous applications in the field of photochemical catalysis, gas sensor, detectors for laser and infrared, solar cells, nonlinear optical materials, luminescence devices, optoelectronic devices, environmental sensors, biological sensors and so on [1-14]. There are various methods developed for the fabrication of nanoparticles [15-19]. Recently, the solvothermal process as a powerful method for the synthesis of materials has attracted tremendous attentions [20, 21]. Comparing with the synthesis route based on colloid chemistry, solvothermal method takes the advantage of obtaining pure and clean nanoparticles in high degree of crystallinity. Efforts have been devoted to the preparation of high quality CdS nanoparticles and the investigation of optical properties [22]. The possibility of tuning the properties of particles by controlling their sizes and shapes can be carried out by the preparation of nanoparticles by solvothermal method. Many papers have been reported by the synthesis of chalcogenides with solvothermal method [23-33]. In this paper, We choose thioacetamide as the sulphide source and it is much easier for thioacetamide to release sulphide ions. A microwave oven has been used for heating the solution containing the reactants and the effects of annealing and dopants on the physical properties of CdS nanoparticles have been analyzed.

EXPERIMENTAL SECTION

In this study, thioacetamide and cadmium acetate were added in the ratio 1:1 molar ratio and were mixed with 30 ml of ethylene glycol and stirred well at room temperature to get a clear transparent solution. The solution was subjected to microwave irradiation of 800 W for 20 minutes. The orange coloured CdS nanocrystallites were separated out from the productive mixtures and washed with de-ionized water for four times and then with alcohol twice.

Optical properties of cirrus clouds in the tropical tropopause region during two contrasting seasons

G S Motty^{1,5,*}, Malladi Satyanarayana^{1,3}, G S Jayeshlal¹, V Krishnakumar² & V P Mahadevan Pillai¹

¹Department of Optoelectronics, University of Kerala, Kariavattom, Trivandrum 695 581, Kerala, India

²Department of Physics, St Gregorios College, Kottarakara 691 531, Kerala, India

³Geethanjali College of Engineering & Technology, Cheeryal (V), Keesara (M), R R Dist Hyderabad 501 301, India

⁵E-mail: mottygs@gmail.com

Received 16 June 2015; revised 24 December 2015; accepted 29 December 2015

Radiation budget of Earth's atmospheric system is largely impacted by the presence of cirrus clouds. In order to quantify the effect of cirrus clouds, particularly in tropics, it is important to characterise its vertical structure and optical properties. The variation of the optical and microphysical properties along with the structure and dynamics of the cirrus during two contrasting seasons, the summer and the southwest monsoon over the period 2006 - 2010 were studied using the ground-based lidar measurements made at the tropical station, Gadanki (13.5°N, 79.2°E), India. The related meteorological indicators derived from radiosonde data available with Wyoming Atmospheric Data Centre were analysed. The results were compared with the data obtained from the CALIOP on board the CALIPSO satellite. Both the observations show similar pattern of seasonal variation. In most of the cirrus clouds, the top height observed was 0.8 km above and below the tropopause and top height was maximum during monsoon season. The seasonal variation of optical depth showed that most of cirrus clouds were thin and the optical depth showed highest value during monsoon period.

Keywords: Cirrus clouds, Depolarization ratio, Optical depth

PACS Nos: 42.68.Ge; 92.60.Nv

1 Introduction

Cirrus clouds are one of the most important and yet uncertain components in weather and climate studies. These high altitude clouds cover about 30% of the Earth's surface at any time¹. Optically thin cirrus clouds usually cause positive radiative forcing at the top of the atmosphere, whereas optically thick cirrus clouds produce cooling². The cloud particles show various non-spherical shapes based on their occurrence height and temperature³ and affect the radiation budget of the Earth-atmosphere system through two opposite phenomena. Cirrus clouds scatter and reflect incoming solar radiation back to space leading to cooling of the system, which is known as the albedo effect; inversely, they absorb and partly re-emit terrestrial infrared radiation leading to warming of the system, which is known as the greenhouse effect⁴. The basic microphysical conditions, in addition to their dissimilar temperatures and altitudes in the troposphere, have fundamental implications in terms of radiative transfer⁵. Deep convection transports moist air from the ground to the upper troposphere and the air is hydrated to form

cirrus clouds⁶. Thus, they play an important role in the dehydration in the tropical tropopause layer (TTL) and hence, on stratospheric humidity⁶⁻⁸. So, in order to quantify their effects on the atmosphere, the vertical structure and optical properties of these cirrus clouds are to be characterized.

The Lidar technique has become a quantitative tool for detecting and characterizing cirrus clouds and its various properties⁹. Ground-based lidar system offers an excellent way to obtain characteristic values on cirrus formations and their properties¹⁰. Also, the microphysical and optical properties of cirrus clouds are obtained by the lidar observations from the earth-orbiting Cloud-Aerosol Lidar with Orthogonal Polarization (CALIOP) instrument on board the Cloud Aerosol Lidar and Infrared Pathfinder Satellite Observations (CALIPSO) satellite¹¹. The ground-based lidar observations could provide intensive measurements on continuous basis with high spatial and temporal resolutions, compared to the satellite observations of cirrus meant for global coverage. Utilising observations from both ground and satellite based lidars, the statistical characteristics, physical

and optical properties of cirrus clouds can be retrieved more precisely. During the last few years, significant efforts have been pursued to study the properties of cirrus clouds using the ground based lidar system over the tropical station Gadanki by Sivakumar *et al.*¹², Parameswaran *et al.*¹³, and Krishnakumar *et al.*¹⁴, but mainly for deriving the general features and their variations in different periods of the year. Sivakumar *et al.*¹² found that the thin and thick cirrus formations are closely related to the minimum tropospheric temperature. Parameswaran *et al.*¹³ stated that for the cirrus covered region, the decrease in the environmental lapse rate could possibly be attributed to the cloud induced IR heating. Also, according to Krishnakumar *et al.*¹⁴, there is a clear correlation between the crystal morphology in the clouds and the dynamical conditions of the prevailing atmosphere. Thus, the ice composition and the microphysics of cirrus can be understood using the lidar data on their scattering properties.

In the present work, these parameters are studied at the tropical station, Gadanki (13.5°N, 79.2°E), India during two different seasons, namely the summer (March, April, May) and the southwest monsoon (June, July, August) during 2006-2010, utilising the data from both the ground and satellite based lidars and are compared with the previously reported results.

2 Instrumentation

2.1 Ground-based lidar

A pulsed monostatic lidar system was set up at the National Atmospheric Research Laboratory (NARL), Gadanki (13.5°N, 79.2°E), India in 1998 in collaboration with Communication Research Laboratory, Japan for the study of atmospheric aerosols and thermal structure of stratosphere and mesosphere¹⁰. The lidar transmitter at NARL employs an Nd:YAG laser, which emits the laser radiation (frequency doubled) at wavelength 532 nm with an energy of 550 mJ per pulse (pulse-width 7 ns and repetition rate 20 Hz). The laser beam is expanded using a 10x beam expander, which makes the beam divergence < 0.1 mrad. The receiver optics consists of a Schmidt-Cassegrain type telescope with 350 mm diameter and FOV of 1 mrad. The data obtained from the receiver, which operates in the altitude range of 8-20 km, is used for this study. Main technical parameters of this Lidar system are depicted in Table 1.

2.2 Satellite-based lidar

Cloud-Aerosol Lidar and Infrared Pathfinder Satellite Observations (CALIPSO) is a joint NASA-CNES satellite mission designed to provide insight into understanding the role of aerosols and clouds in the climate system on a global scale¹⁵. The space borne lidar CALIOP on-board the CALIPSO satellite provides high resolution observations, which furnish information on the vertical distribution of aerosols and clouds as well as their optical properties over the globe with high spatial resolution, since June 2006 (Ref. 16). The appropriate inversion algorithms are used to analyse the optical and physical properties of clouds by analysing the dual wavelength and depolarized lidar signals from CALIOP¹⁶. More about the inversion methods, feature detection, determination of layer properties and the associated uncertainties are detailed in the CALIOP algorithm theoretical basis document¹⁷. Validation of CALIPSO data with ground-based lidar measurements is essential to the production of a high quality dataset¹⁵. The technical parameters of CALIOP lidar system are shown in Table 2. For the present study, level 2, 5 km cloud layer and cloud profile (version 3) data products obtained from CALIOP on-board CALIPSO for a grid (5°N - 20°N; 60°E - 85°E) during June 2006 - December 2010 are used. This data consist of layer data with horizontal resolution of 5 km and a vertical

Table 1 — Specifications of ground-based Lidar system

Transmitter	
Laser Type	Nd:YAG
Wavelength	532 nm
Average energy per pulse	600 mJ
Average output power	30 W
Pulse width	7 ns
Pulse repetition rate	50 Hz
Beam divergence	0.1 mRad
Beam size	8 mm
Line width	1 cm ⁻¹
Receiver	
Telescope	Schmidt Cassegrain
Diameter	350 mm
Field of view	1 m rad
Filter	1.13 nm
Filter Transmission	100 %
Detector	
PMT	Hamamstu R3234.01
Data acquisition system	
Hardware	Multi Channel Scaler Card
	1024channels
Range resolution	300 m
Integration time	250 s

Citations - 0
Citation index

Journal of Atmospheric and Solar-Terrestrial Physics 179 (2018) 167–177

2018 - Impact - 1.79
H-Index - 79

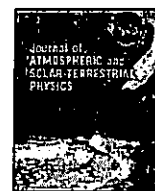
Impact 1.79



Contents lists available at ScienceDirect

Journal of Atmospheric and Solar-Terrestrial Physics

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



Lidar observed structural characteristics of higher altitude cirrus clouds over a tropical site in Indian subcontinent region

G.S. Motty^a, Malladi Satyanarayana^{a,b,*}, G.S. Jayeshlal^a, V. Krishnakumar^c,
V.P. Mahadevan Pillai^a

^a Department of Optoelectronics, University of Kerala, Kariavattom, Trivandrum, 695 581, Kerala, India

^b VNR Vignana Jyothi Institute of Engineering & Technology, Bachupally, Hyderabad-500090, India

^c Department of Physics, St. Gregorios College, Kollam, 691531, Kerala, India

ARTICLE INFO

Keywords:

Cirrus clouds
Lidar
CALIPSO
Extinction coefficient
Optical depth
Mid cloud temperature
Lidar ratio
Depolarisation ratio
Crystal shape
Fall velocity

ABSTRACT

In this study, the structure and dynamics of tropical cirrus clouds were characterized based on their microphysical properties. The altitude and temperature dependence of the microphysical properties, their interdependence and the most probable shape of the crystals in cirrus clouds were investigated. Studies on the effective size distribution of ice particles, which decides the lifetime of the cirrus clouds is important to understand the radiative properties of the clouds. The small sized crystals having low fall velocities undergo homogeneous nucleation processes resulting in cirrus with longer life time. The microphysical properties of these tropical cirrus, and the role of fall velocity in radiative transfer are discussed from the data obtained using the ground based lidar system over the tropical site Gadanki (13.5° N, 79.2° E), India over a period of 5 years from 2006 to 2010. The CALIPSO satellite based CALIOP lidar observations are used to fortify the ground based observation. It is noted that the life time of the cirrus is enhanced due to the decrease in cloud temperature.

1. Introduction

High altitude cirrus clouds in the range between 8 and 20 km, have an important place in sustaining the energy budget (Liou, 1986; McFarquhar et al., 2000) of the earth atmospheric system by interacting with the solar radiation (Stephens et al., 1990). Ice clouds reflect solar radiation effectively back to space, which is called the albedo effect and absorb thermal emission from the ground and lower atmosphere, through the greenhouse effect (Stephens et al., 1990). The microphysical conditions of these clouds have primary responsibility in radiative transfer (Liou and Takano, 2002). Many extensive experimental studies have analysed the importance of cirrus clouds in the radiation budget using various techniques including lidar (Liou, 1986; Prabhakara et al., 1988; Ramanathan et al., 1989; Sassen and Dodd, 1989; Wang et al., 1996; Hartmann et al., 2001; Stubenrauch et al., 2010). Heymsfield and McFarquhar (1996) reported that the cirrus clouds distributed in the tropics play a major role in radiative effects. Prabhakara et al. (1993) suggested that the greenhouse effect produced by the optically thin cirrus act as a significant factor in maintaining the warm pool. Wang et al. (1994) and Stubenrauch et al. (2010) stated that tropical cirrus clouds have strong potential to impact the tropical and global climate. Thus, it is important to analyse the microphysical

properties of cirrus clouds including their structure for estimating their radiative properties accurately.

The vertical profiles on cirrus cloud formations over a local station can be obtained from the ground based lidar system while for global coverage observations, using the Cloud Aerosol Lidar with Orthogonal Polarisation (CALIOP) onboard the Cloud Aerosol Lidar and Infrared Pathfinder Satellite Observation (CALIPSO) satellite, are widely used (Dessler, 2009; Meenu et al., 2011). During the last few years, significant efforts are being pursued to study the cirrus characteristics using the ground based lidar system over the tropical station Gadanki (Sivakumar et al., 2003; Parameswaran et al., 2003; Krishnakumar et al., 2014; Pandit et al., 2015), but mainly for deriving the general features and their variations in different periods of the year. Sivakumar et al. (2003) found that the various cirrus cloud formations are closely related to the tropospheric temperature. Also, according to Krishnakumar et al. (2014), a notable dependence is observed between the ice crystal morphology in the clouds and the various dynamical conditions of the prevailing atmosphere. Pandit et al. (2015) reported the long term trend observed in the macrophysical and optical properties of cirrus clouds using the ground based lidar observations over Gadanki.

Study based on the cirrus cloud properties such as extinction

* Corresponding author. Department of Optoelectronics, University of Kerala, Kariavattom, Trivandrum, 695 581, Kerala, India.

E-mail address: gsmotty.opto@keralauniversity.ac.in (M. Satyanarayana).

coefficient, optical depth, depolarisation ratio, lidar ratio, and crystal morphology of the ice crystals, derived from the ground based lidar observations are insufficient to study the radiative effects in tropics. So the major objective of this paper is to contribute towards improving the understanding of the radiative effects of cirrus clouds in terms of their crystal size, fall velocity and morphology over the Indian tropical station, Gadanki [13.5°N, 79.2°E], using the ground based lidar observations on a seasonal mean basis along with their interdependence and the same is validated by the satellite based lidar observations.

2. Instruments and data used

2.1. Ground based lidar (GBL)

The ground based data obtained for the period (2006–2010) from the lidar system installed at the National Atmospheric Research Laboratory (NARL), Gadanki (13.5° N, 79.2°E) is used comprehensively in the study. The lidar system at NARL transmits Nd: YAG laser pulses of wavelength 532 nm in a monostatic, biaxial dual polarised manner at a rate of 20 Hz (50 Hz from 2007) with an energy of 550 mJ (600 mJ from 2007) in 7 ns duration (Pandit et al., 2015). The emerging laser beam has a divergence of 0.45 mrad which is reduced to < 0.1 mrad before being transmitted into the atmosphere using a 10× beam expander. The backscattered photons from the atmosphere are collected by two independent telescopes in which one is designed to collect the backscattered photons from the air molecules above 30 km in the atmosphere, is called the Rayleigh receiver and the other is designed to collect the backscattered photons from altitude below 30 km to study aerosols and clouds, is called the Mie-receiver. The Mie-receiver contains a Schmidt-Cassegrain telescope of 35.5 cm diameter with a field of view of 1 mrad. In order to eliminate the unwanted background noise from the received signal, a narrow band interference filter with wavelength centered at 532 nm and a full-width at half-maximum of 1.1 nm is placed in front of a polarizing beam-splitter. The polarizing-beam splitter splits the beam into parallel (P channel) and perpendicularly (S channel) polarised beams which are then detected by two identical orthogonally aligned photomultiplier tube channels. In principle it is possible that the specular reflection from ice crystals inside the crystals contributes to the lidar backscattered signals. However, in the NARL lidar systems the receiver field is kept slightly larger than the transmitter divergence. A part of the dataset contains specular contribution from ice crystals because the NARL lidar is operated at a fixed-off zenith angle, pointing vertically. Having known about this, the measurements are always made vertical (within the alignment error) to reduce the uncertainties in the measured values of the backscattered signals. The counting system consists of a Multi-Channel Scalar card in which the photon counts measured with 300 m resolution bins range and 4-min time integrated. Night time lidar data were collected in order to avoid low level clouds and also rainy days are avoided.

2.2. Satellite based lidar (SBL)

The CALIOP onboard the CALIPSO satellite provides high-resolution observations of the vertical distribution of clouds and aerosols and their optical properties along the satellite track (Winker et al., 2007). For comparing the NARL lidar observations, CALIOP level-2, version 3 of 5 km cloud layer and cloud profile data product obtained for a grid selected (5° N – 20°N; 60° E – 85° E) for Indian subcontinent region during the period of June 2006–December 2010 were used. The satellite exactly repeats in a particular point once in 16 days. In this study the distribution of averaged physical properties inside the grid 5° N to 20° N and 60° E to 85° E is studied which constitute the Indian subcontinent region. The physical properties of the grid 13.5° N and 79.2°E is compared with the ground based observation of the same station. The CALIPSO data with respect to a small grid is few and proper comparison cannot be done. In order to accommodate more cloud data a larger grid

is selected. With a larger grid cloud characteristic can be studied in and around the station with a greater perspective. CALIOP is a dual wavelength, near-nadir, dual-polarised, three channel elastic backscatter lidar that transmits Nd: YAG laser pulses of energy of 110 mJ both at first (1064 nm) and second harmonic (532 nm) wavelengths in linearly polarised manner (Winker, 2003; Winker et al., 2009; Hunt et al., 2009; Pandit et al., 2015). The receiver system has a 1 m diameter telescope with two parallel and perpendicularly polarised channels at 532 nm wavelengths and one parallel channel at 1064 nm (Winker et al., 2007). The data used in this work have a vertical and horizontal resolution of 60 m and 5000 m respectively in the altitude region between 8.2 and 20.2 km. In order to obtain the accurate observations with opposite viewing geometry, night time data collected for the overpasses of CALIOP over the nearby regions of Gadanki were only considered. The cirrus clouds will usually occur over the tropics within an altitude region from 8 to 20 km (Wang et al., 1996). So in this study the CALIPSO observations with cloud top altitude greater than 8 km with optical depth values less than 2 and those with CAD score in the range of 80–100 were only considered.

During the selected observation period a total number of 152 data files from the NARL lidar system and 116 data files (CALIOP observations are available from 2006 June onwards) from CALIOP system over the nearby regions of Gadanki were collected and the seasonal averages of optical properties were obtained for each year of observation. The four prominent seasons of the observed station Gadanki are the south west monsoon (June to August), north east monsoon (September to November), summer (March to May) and winter (December to February). Also the multiple scattering is not considered for the present analysis.

2.3. Method of analysis

The Lidar system was operated for 3 h in the pre-midnight period regularly since 1998 subject to sky conditions and system integrity. It was aligned to an over-lap height of greater than 4 km so as to avoid the intense backscattered signals from the low altitude clouds and aerosols. Since the high altitude cirrus clouds are mostly thin, their optical attenuation is weak.

We start with the fundamental Lidar equation,

$$P(r) = P_0 \frac{c}{2} \frac{\beta(r)}{r^2} A \exp \left\{ - \int_0^r \alpha(r) dr \right\} \quad (1)$$

where, P_0 is the transmitted laser power; c , the velocity of light; r , the laser pulse width; r , the range of the scattering volume from the lidar; A , the effective area of the receiving telescope; $\beta(r)$, the integrated volume backscatter function (expressed in $\text{m}^{-1} \text{sr}^{-1}$); and $\alpha(r)$, the integrated volume extinction function (expressed in m^{-1}) of the atmosphere.

The extinction coefficient and the backscatter coefficient are the two basic parameters in the lidar equation. Deriving the optical properties of aerosols and clouds from the experimentally obtained lidar data is one of the most interesting and challenging tasks for atmospheric scientists. The extinction coefficient and the backscattering coefficient are the two important variables to be extracted from the received energy. All other information from the scattering by the atmospheric constituents can be calculated from these two variables. Making use of the lidar system constants from the measured back scattered signal power the extinction coefficient of the clouds is determined by inverting the lidar signals as described by Fernald (1984) by assuming uniform lidar ratio (LR) of 20 sr (Liu et al., 2000; Sunilkumar and Parameswaran, 2005; Satyanarayana et al., 2010). And for CALIOP extinction algorithm, constant lidar ratio value of 25 sr is used (Young and Vaughan, 2009; Young et al., 2013). Cloud extinction is a parameter which describes the macrophysical and microphysical properties and as such it is derived from both the physical extent of the

Sampled Data
e 1.1865
H index - 43

Deriving aerosol scattering ratio using range-resolved lidar ratio

REJI K DHAMAN¹, V KRISHNAKUMAR¹, V P MAHADEVAN PILLAI^{1,*},
M SATYANARAYANA¹ and K RAGHUNATH²

¹Department of Optoelectronics, University of Kerala, Kariavattom, Trivandrum 695 581, India

²National Atmospheric Research Laboratory, Gadanki, Tirupati 517 502, India

*Corresponding author. E-mail: vmpillai9@gmail.com

DOI: 10.1007/s12043-014-0697-6; ePublication: 13 February 2014

Abstract. The study on the optical characteristics of aerosol is carried out using the dual polarization lidar observations from the tropical inland station Gadanki (13.5°N, 79.2°E) for the period of observation during the year 2010. The summer and monsoon observation days show high scattering ratio at the tropical tropopause layer (TTL) and at the lower stratosphere region. The depolarization ratio is also high at this altitude due to the transport of particulates to the TTL layer by the active convection prevailing at the period. The study reveals more dependable values of scattering ratio that are seasonal and range-dependent.

Keywords. Aerosols; lidar; extinction; circulation.

PACS Nos 92.60.-e; 92.60.h-; 92.60.Mt; 92.70.Cp

1. Introduction

The extinction-to-backscatter ratio, usually called as lidar ratio (LR) is an important parameter to obtain the nature of the scatters while studying the optical properties of clouds and aerosols using lidar. The LR values in combination with linear depolarization ratio (LDR) are used to suggest the type of aerosols. The altitude-dependent LR value was calculated from the method described in detail by Satyanarayana *et al* [1]. It can be seen that the variation of aerosol extinction coefficient with uniform LR is relatively high in the lower altitudes (up to 15 km). This clearly indicates that the nature and composition of aerosols in the lower altitudes are different from those of higher altitudes. At lower altitudes, the sources of the aerosols are more of local or regional origin and the particles are relatively large in size. Generally, it is known that the lower tropospheric aerosols are a mix of local or regional aerosols combined with those transported from far off regions due to atmospheric circulation, particularly during dust storm episodes [2,3]. Thus, it is appropriate to select a range-dependent LR to derive more accurate extinction

Intt.
Physics

profiles. Moreover, the method of classification of cloud days from cloud-free days have been widely done by using the derived scattering ratio (SR). Background SR is typically reported to be in the range 1.0–1.5 during any normal day [4]. These values are normally predicted by taking a LR value common for all periods. As said the LR value is a range-dependent and season-dependent entity and range-resolved LR values can give more accurate SR and backscattering values. Here we have used the range-resolved LR calculated by the method developed by Satyanarayana *et al* [1], to derive the SR and backscattering values. The monthly averaged range-dependent LR values are used to determine the aerosol extinction, backscattering and scattering ratio.

2. Experimental methods

The experiments are carried out using the elastic backscatter lidar system operational on a regular basis at NARL Gadanki. The lidar transmitter employs an Nd:YAG laser, operating at 532 nm, with an energy of 550 mJ per pulse (Model: Powerlite 8020: of Continuum, USA). The lidar system is aligned to make complete overlapping between the transmitter and receiver at a height of about 4 km to avoid the intense backscattered signals

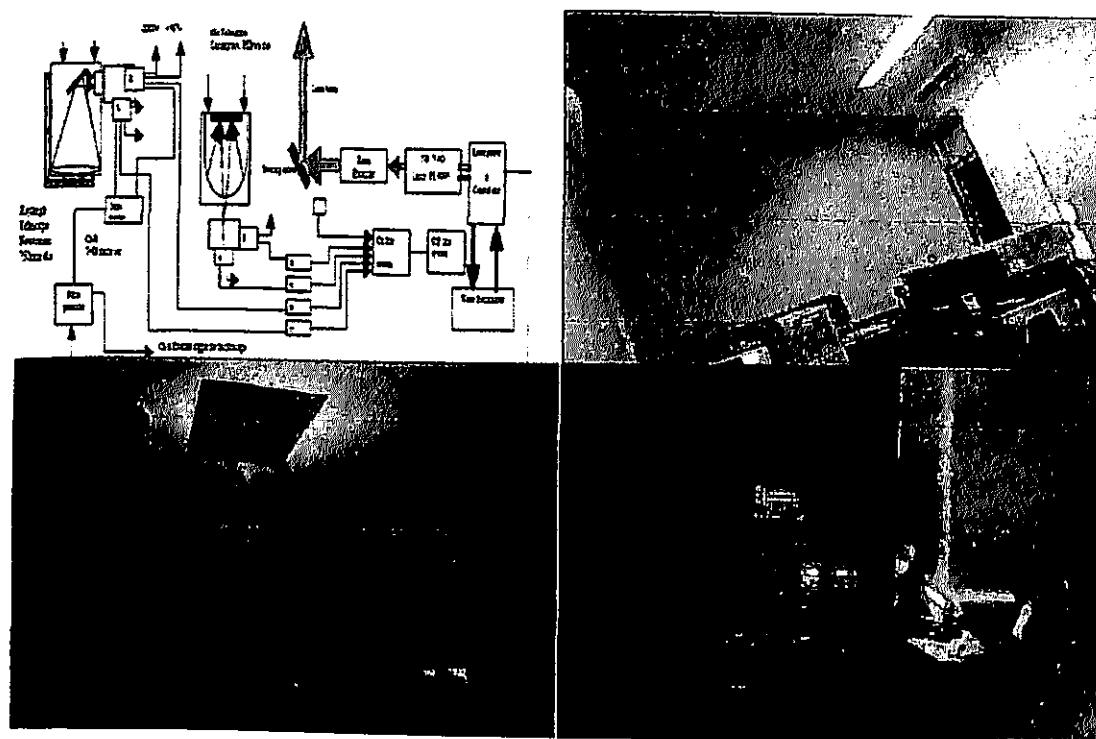


Figure 1. Block diagram of the Nd:YAG lidar system at NARL Gadanki, showing the laser, transmitter system and data accumulation system along with pictures of the laser system and telescope.

Journal of
Applied Remote Sensing

$2.5 = 1.107$
Hindern - 30

- Lidar investigations on the optical and dynamical properties of cirrus clouds in the upper troposphere and lower stratosphere regions at a tropical station, Gadanki, India (13.5°N, 79.2°E)**

Vasudevannair Krishnakumar ⁽³⁾

Malladi Satyanarayana

Soman R. Radhakrishnan

Reji K. Dhaman

Glory Selvan Jayeshlal

Gopinathan Nair S. Motty

Vellara P. Mahadevan Pillai

Karnam Raghunath

Madineni Venkat Ratnam

Duggirala Ramakrishna Rao

Pindlodi Sudhakar



INTL
physics

Lidar investigations on the optical and dynamical properties of cirrus clouds in the upper troposphere and lower stratosphere regions at a tropical station, Gadanki, India (13.5°N, 79.2°E)

Vasudevannair Krishnakumar,^{a,b} Malladi Satyanarayana,^{a,*}
Soman R. Radhakrishnan,^c Reji K. Dhaman,^a Glory Selvan Jayeshlal,^a
Gopinathan Nair S. Motty,^a Vellara P. Mahadevan Pillai,^a
Karnam Raghunath,^d Madineni Venkat Ratnam,^d
Duggirala Ramakrishna Rao,^e and Pindlodi Sudhakar^e

^aUniversity of Kerala, Department of Optoelectronics, Kariavattom,
Trivandrum 695581, Kerala, India

^bMohandas College of Engineering and Technology, Anad, Thiruvananthapuram 695544, India

^cCSIR-National Physical Laboratory, Radio and Atmospheric Sciences Division, Dr. K. S.
Krishnan Road, New Delhi 110012, India

^dNational Atmospheric Research Laboratory, Gadanki, Tirupati 517502, India

^eGeetanjali College of Engineering and Technology, Cheeryal, Keesara,
Hyderabad 501301, Andhra Pradesh, India

Abstract. High altitude cirrus clouds are composed mainly of ice crystals with a variety of sizes and shapes. They have a large influence on Earth's energy balance and global climate. Recent studies indicate that the formation, dissipation, life time, optical, and micro-physical properties are influenced by the dynamical conditions of the surrounding atmosphere like background aerosol, turbulence, etc. In this work, an attempt has been made to quantify some of these characteristics by using lidar and mesosphere-stratosphere-troposphere (MST) radar. Mie lidar and 53 MHz MST radar measurements made over 41 nights during the period 2009 to 2010 from the tropical station, Gadanki, India (13.5°N, 79.2°E). The optical and microphysical properties along with the structure and dynamics of the cirrus are presented as observed under different atmospheric conditions. The study reveals the manifestation of different forms of cirrus with a preferred altitude of formation in the 13 to 14 km altitude. There are considerable differences in the properties obtained among 2009 and 2010 showing significant anomalous behavior in 2010. The clouds observed during 2010 show relatively high asymmetry and large multiple scattering effects. The anomalies found during 2010 may be attributed to the turbulence noticed in the surrounding atmosphere. The results show a clear correlation between the crystal morphology in the clouds and the dynamical conditions of the prevailing atmosphere during the observational period. © 2014 Society of Photo-Optical Instrumentation Engineers (SPIE) [DOI: 10.1117/1.JRS.8.083659]

Keywords: lidar; cirrus optical properties; cirrus symmetry; lasers remote sensing.

Paper 13395 received Oct. 18, 2013; revised manuscript received Jan. 23, 2014; accepted for publication Feb. 18, 2014; published online Mar. 26, 2014.

1 Introduction

Clouds play a crucial role in maintaining the hydrological and radiative balances that are necessary for the existence of life on Earth. Among these, cirrus clouds are major regulators of Earth's radiation budget and they act like greenhouse gasses. Typically, they reflect short-wave radiation of solar spectrum back to space and also the long-wave radiation emitted

*Address all correspondence to: Malladi Satyanarayana, E-mail: drsatyanarayana.malladi@gmail.com

0091-3286/2014/\$25.00 © 2014 SPIE

by Earth back toward the ground. The composition and structure of cirrus clouds play an important role in the radiative forcing offered by them. These upper tropospheric ice phase clouds (cirrus clouds) are characterized by their extensive lateral and vertical coverage.¹ Cirrus clouds can impose a large-scale radiative effect on the Earth's climate system, as 1/5th of the global tropics are regularly covered by extensive cirrus systems.²

It is known that the formation, life-span, decay, and the optical properties of the clouds are influenced by the anthropogenic and nonanthropogenic contents and dynamics of the surrounding atmosphere. The role of the prevailing atmospheric conditions on the macroscopic properties of the clouds, their extent, precipitation efficiency, radiative properties, and life time is of great interest in the cloud-climate study. Moreover, the short time dynamical behavior of the atmosphere alters the optical properties and time history of the clouds considerably. Thus the radiative properties of the clouds get modified because of the dynamical conditions of the atmosphere. However, the experimental data on some of these aspects are sparse. For example, the effect of the turbulence on the cloud properties is not well understood, at least in the tropics. Turbulence is important because it mixes and churns the atmosphere and causes water vapor, smoke, and other substances, as well as energy, to become distributed both vertically and horizontally. As such it is desirable to measure the turbulence characteristics of the surrounding atmosphere simultaneously along with the optical properties of the cirrus clouds with a view to understanding the basic mechanisms of the formation and dissipation of the clouds. In this study, we present the results on these aspects making use of the lidar and radar measurements at a tropical station Gadanki, India (13.5°N, 79.2°E). Lidar measurements are used to derive the optical properties of the cirrus. The atmospheric turbulence is obtained by using the refractive index profile derived from a static Hufnagel model.^{3,4} The 53 MHz MST radar operational at the site is used to derive the vertical wind velocity component to give the turbulence in the upper troposphere and lower stratosphere (UTLS) regions.

Periodic variation of cirrus cloud geometry, depolarization ratio, lidar ratio (LR), and cloud asymmetry observed from the station is been thoroughly investigated for the period 2009 to 2010 in Secs. 2–4.2. It is hypothesized from the findings of the work that the cloud geometry and its microphysical properties vary significantly with respect to the dynamical variability like turbulence, etc. The effect of turbulence on cloud symmetry and LR is discussed in Secs. 4.3 and 5. Here, turbulence is assimilated by using Hufnagel-Valley model and MST radar velocity component profiles. The Hufnagel-Valley model is discussed in line with MST radar wind velocity component derived from the radar signal in Sec. 4.2. The main objective of this work is to establish the relationship between the dynamical variability turbulence and cloud physical properties like cloud symmetry and LR.

2 Experimental Methods

2.1 Lidar Description

The experiments are carried out using the elastic back scatter lidar system operational on a regular basis at NARL, Gadanki.⁵ The lidar transmitter employs a Nd:YAG laser which emits the laser radiation (frequency doubled) at a wavelength of 532 nm and with an energy of 550 mJ/pulse (pulse-width—7 ns and repetition rate—20 Hz). The laser beam is expanded using a 10× beam expander, which makes the beam divergence <0.1 mrad. The receiver telescope is a 350-mm diameter Schmidt-Cassegrain-type telescope with an FOV of 1 mrad. This is used to study the vertical structure of atmospheric aerosols by receiving the Mie scattered signal.

A narrow-band interference filter with center wavelength of 532 nm is used to minimize the noise from the sky background radiation. The receiver has the depolarization measurement capability. A polarized beam splitter splits the beam into parallel and perpendicular components and are recorded separately using two independent and identical photomultiplier tube (PMT) channels, which are referred to as parallel (P) and cross (S) channels, respectively. PMT saturation is avoided by introducing the variable attenuators in the channels. The optical power received by these two PMTs is recorded separately by two photon counters. Recording of data is achieved with a four-channel-PC based data acquisition system, out of which two

LIDAR STUDIES ON THE OPTICAL CHARACTERISTICS OF HIGH ALTITUDE CIRRUS CLOUDS AT A LOW LATITUDE STATION, GADANKI (13.5°N, 79.2°E) INDIA

Gloryselvan S Jayeshlal^a, Malladi Satyanarayana^{a,b}, Gopinathannair S Moty^a, Reji k Dhaman^a, Vasudevannair Krishnakumar^b, Vellara P Mahadevan Pillai^a, Duggirala Ramakrishna Rao^c, Pindodi. Sudhakar^c and Parapatla. kalavathi^c

^aDepartment of Optoelectronics, University of Kerala, Karyavattom, Trivandrum-695 581, Kerala, India. (jayeshlalgs, motygs, rejikdhaman2007, vmpillai9@gmail.com)

^bSt. Gregorios college, pulamon P.O. Kottarakara, Kollam-691 531, Kerala, India. krishnakumar.vasudevannair@gmail.com

^cGeetanjali College of Engineering and Technology, Cheeryal, Keesara, Hyderabad-501 301, Andhra Pradesh, India. (dramkrao, pillodisudhakar, kalavathimtech@gmail.com)

KEY WORDS: Lidar, Cirrus Clouds, Optical Depth, Lidar ratio, Depolarization.

ABSTRACT

Light Detection and Ranging (LIDAR) which is analogous to Radio Detection And Ranging (RADAR), has become an important and unique technology for atmospheric research and applications. The technology is widely used for the remote sensing of the Earth's atmosphere, oceans, vegetation and the characteristics of Earth's topography. Remote sensing of atmosphere, for its structure, composition and dynamics, is one of the proven applications of the lidar systems. More importantly the lidar technique is applied for the study of clouds, aerosols and minor constituents in the atmosphere. It provides the information on the above with good spatial and temporal resolutions and accuracy. The high altitude cirrus clouds which play an important role in the Earth's radiative budget and global climate can be studied by using the LIDAR system. These clouds absorb long-wave outgoing radiation from Earth's surface while reflecting part of the incoming short-wave solar radiation. Lidar measurements are useful in deriving the altitude, top height, bottom height and the optical properties of cirrus clouds, which are essential in understanding the cloud-radiation effects. The optical depth, the effective lidar ratio and the depolarization of the clouds are also derived by inverting the lidar signals from the cirrus clouds. In this paper we present the results on the lidar derived optical and microphysical properties of the cirrus clouds at a tropical station Gadanki (13.5°N, 79.2°E) India during two year period from 2009 to 2010. The seasonal variations of the cloud properties during the observation period are presented and discussed with reference to earlier period.

*Corresponding author E-mail: -drsatanarayana.malladi@gmail.com.

INTRODUCTION

The impact of cirrus clouds is very complex due to their influence on both incoming solar radiations and outgoing radiation from the Earth. The high altitude cirrus clouds absorb long-wave outgoing radiation from Earth's surface while reflecting short-wave incoming solar radiation and thereby altering the radiative budget of atmosphere. The radiative and optical properties of cirrus clouds often vary causing either warming or cooling of earth's atmosphere indifferent periods (Ramanathan and Collins, 1991). Also cirrus clouds play a key role in the physical and chemical properties of upper troposphere and lower stratosphere by regulating the upper tropospheric humidity. Cirrus cloud measurements at tropics are receiving much attention due to their role in Earth's radiation budget. The aerosols, water vapor and temperature in the troposphere and lower stratosphere together play a key role in the formation of cirrus and their properties. As such simultaneous study of aerosols, clouds along with meteorological parameters is important to understand the characteristics of the clouds during a typical monsoon period. Indian Ocean and the Indian sub-continent are the regions where cirrus occurrence is maximum particularly during the monsoon periods. Here we present the lidar derived optical and

microphysical properties of the cirrus clouds at a tropical station Gadanki (13.5°N, 79.2°E) India during the two year period in 2009-2010. The seasonal variations of the cloud properties during the observation period are presented and discussed with reference to earlier period.

Experimental Methods

The experiments are carried out using the elastic backscatter lidar system operational on a regular basis at NARL Gadanki. The lidar transmitter employs an Nd:YAG laser, operating at 532 nm, with an energy of 550 mJ per pulse (Model: Powerlite 8020: of Continuum, USA). The lidar system is aligned to make the complete overlapping between the transmitter and receiver at a height of about 4 km, so as to avoid the intense backscattered signals from the low altitude clouds and aerosols. 17 days of cirrus cloud observation data covering the winter, summer and monsoon periods are used for the investigations. Simultaneous data on temperature are taken from radiosonde experiments conducted at the station during the same period. The back scattered lidar signal received from the cirrus clouds by the lidar system is used to characterize the cirrus clouds.

Cloud Extinction and Backscattering Coefficient

The cloud extinction coefficient may be obtained, in general by following the widely used Fernald and Klett, (F. G. Fernald et al., 1984; J. D. Klett et al., 1981) lidar inversion methods. A range independent lidar ratio (LR) is used in these techniques for deriving the extinction coefficients. The altitude dependent LR value was calculated from the method described in detail by Satyanarayana et al.2010. Making use of the lidar system constants and from the measured back scattered signal power the extinction coefficient of the clouds is determined by inverting the lidar signals as described by Fernald. The aerosol backscattering coefficient can be calculated using Fernald's algorithm (1984).

Cloud Optical Depth

Optical properties, which are essential in understanding cloud-radiation effects, can be derived from lidar observations. The optical depth (τ_c) and the two way transmittance (T) of the cloud can be obtained from lidar data using the equations

$$\tau_{\text{cirrus}} = \int_{h_{\text{base}}}^{h_{\text{top}}} \sigma(h) dr \quad (2)$$

Where $\sigma(h)$ is the extinction within the cloud, which extends from cloud base (h_{base}) to cloud top (h_{top}). Based on optical depth cirrus clouds are classified into sub-visual $\tau_c < 0.03$, optically thin (τ_c between 0.03 and 0.3) and thick or opaque ($\tau_c > 0.3$).

Depolarisation Ratio (δ)

The depolarisation measurements can provide insight into the distribution of ice and water within clouds and help in the investigation of cloud formation and dynamics. The lidar signals from P and S channels are processed separately and the depolarization factor $\delta(h)$ is estimated as

$$\delta(h) = \frac{\beta_s(h)}{\beta_p(h)} \quad (5)$$

Where $\beta_s(h)$ and $\beta_p(h)$ are the backscattering coefficients of P and S channels (SunilKumar.etal.,2003). The depolarisation ratio is a function of altitude of the cloud and the temperature, and humidity distribution within the cloud.

RESULT AND DISCUSSION

Two year Lidar data are used to understand the seasonal variations of cirrus clouds in three prominent seasons such as winter (December, January, and February), summer

(March, April, May) and monsoon (south-west and north-east). The percentage of occurrence of cirrus clouds as a function of altitude at the same station were reported earlier (Sunilkumar2003). The optical depth of cirrus clouds gives the information about the radiative behavior and determines whether the cloud causes greenhouse (warming) effect or albedo (cooling) effect (Tekano et.al., 1995). Another important parameter is Lidar ratio (LR). Its variations can reveal the physical parameters of the cloud particles such as phase, size, shape and orientation.

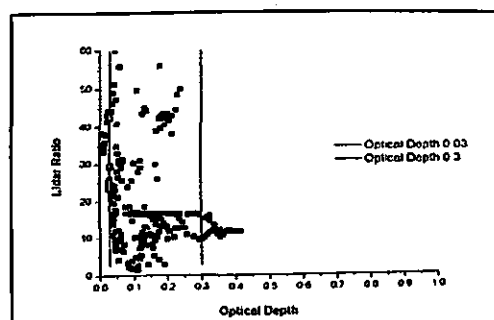


Figure.1: Lidar ratio and Optical depth relationship of cirrus clouds during 2009, 2010 winter season.

The optical depth values as a function of LR are shown in Fig1, Fig.2 and Fig.3 for the three seasons. The optical depth varied generally in the range between 0.038 and 1.2 with a high probability value between 0.1 and 0.2. The probability of occurrence of cirrus with low values of τ_c was high and decreases with increasing τ_c . The following division of cirrus based on the value of τ_c can be made from their visual appearance: $\tau_c < 0.03$ for sub-visual, $0.03 < \tau_c < 0.3$ for thin, and $0.3 < \tau_c < 3.0$ for opaque cirrus clouds (Sassen.etal. 1992). It is noted that in about 50% of the cirrus observed days in all the three seasons together, the average value of τ_c was below 0.3.

In winter season the upward convection and aerosol loading are very low resulting low optical depth and high LR values. From Fig.1 it can be seen that even though the cirrus formed in winter is very thin they have large extinction values. This shows that the clouds are relatively of absorbing type and cause positive radiative forcing. The depolarization study shows that during winter the cloud composition consists ice crystals of predominantly horizontally oriented plates and columns.

From Fig.2 it is noted that in the summer season the clouds are optically thick with relatively high optical depth values.



Dielectric and optical properties of $\text{Ln}_{0.8}\text{Lu}_{0.2}\text{TiNbO}_6$ (Ln = Ce, Pr, Nd & Sm) ceramics

Fergy John^a, Sam Solomon^{b,*}

^a Department of Physics, St Gregorios College, Kottarakara 691531, India

^b Department of Optoelectronics, University of Kerala, Thiruvananthapuram 695581, India

ARTICLE INFO

Article history:

Received 18 April 2020

Received in revised form 16 June 2020

Accepted 8 July 2020

Available online 13 July 2020

Communicated by J.G. Lu

Keywords:

Ceramic

Microwave

Dielectric

Optical band gap

ABSTRACT

$\text{Ln}_{0.8}\text{Lu}_{0.2}\text{TiNbO}_6$ (Ln = Ce, Pr, Nd & Sm) are synthesized through conventional solid state ceramic route. The XRD, FT Raman and FT IR studies revealed that the samples have aegyrine orthorhombic symmetry. The samples are sintered at 1230 °C. Using SEM technique, microstructure of the sintered samples is analyzed. The dielectric properties of all the samples in the radio as well as microwave frequencies are studied. UV spectra of the samples are recorded and the optical band gap is estimated from the Tauc's plots. The samples are found to be photoluminescent materials with emissions at violet and green regions.

© 2020 Elsevier B.V. All rights reserved.

1. Introduction

Material research is always focused to develop new materials for practical applications. The main properties required for a dielectric resonator in microwave communication systems are low temperature coefficient of resonant frequency (τ_f) for stability, high dielectric constant (ϵ_r) for miniaturization and high quality factor (Q) for selectivity. LnTiTaO_6 and LnTiNbO_6 ceramic materials are potential candidates for communication systems [1,2]. To develop a good quality ceramic material with improved properties, attempts have been made to replace rare earth atom in the LnTiNbO_6 system with another atom of comparable ionic radii. The luminescence and radio frequency dielectric behavior of polycrystalline ceramics are reported for Ln = Ce, Pr and Sm by L. Jacob et al. [3]. Because of good optical properties the LnTiNbO_6 compounds are used as ideal gain media for miniature solid-state lasers [3]. Members with orthorhombic aegyrine structure in LnTiNbO_6 (Ln = Ce, Pr, Nd, Sm, Eu, Gd, Tb, Dy, Y & Yb) ceramic system have positive τ_f and high ϵ_r , but those with euxenite structure have negative τ_f and low ϵ_r [4]. The microwave dielectric properties of LnTiTaO_6 were investigated by Surendran et al. [5]. Hydrothermally synthesized LnTiNbO_6 compounds were studied by Komkov in 1963 [6]. Thorogood et al. have reported the transformation studies from aegyrine to euxenite structure of $\text{Ln}(\text{TiTa})\text{O}_6$ [7]. The doping ef-

fect of oxides of molybdenum and tungsten in LnTiTaO_6 and also the partial substitution of Zr in the Ti site were reported [8,9]. John et al. have reported the optical and electrical properties of RE-Ti-Nb-O_6 (RE = Ce, Pr, Nd and Sm) nanoparticles [10]. The dielectric properties of RE-Ti-Nb-O_6 (RE = Dy, Er, Gd, Yb) nanoparticles were reported by John et al. [11]. This paper reports the effect of lutetium substitution on the dielectric and optical properties of LnTiNbO_6 ceramics.

2. Experimental

The polycrystalline samples $\text{Ln}_{0.8}\text{Lu}_{0.2}\text{TiNbO}_6$ (Ln = Ce, Pr, Nd and Sm, abbreviated as CLTN, PLTN, NLTN and SLTN respectively) are prepared through the solid state ceramic route. The high purity (>99.9%) CeO_2 , Pr_6O_{11} , Nd_2O_3 , Sm_2O_3 , Lu_2O_3 , TiO_2 , Nb_2O_5 , weighed according to the stoichiometric ratios and calcined at 1200 °C for 4 hours using acetone as medium. The calcined powder is ground well for 4 hours and 5 wt% polyvinyl alcohol is added to the above mixed dried sample powder. The dried powder sample is converted in the form of cylindrical pellets by applying the pressure of 150 MPa using hydraulic pelletizer. The pellets are then sintered below the melting point of the sample in order to attain maximum density.

Using $\text{CuK}\alpha$ radiation, X-ray diffraction studies (Philips Expert Pro) of powdered sintered samples are done. The FT-IR spectra of the samples are recorded with KBr pellet method using Thermo-Nicolet Avatar 370 Fourier Transform Infrared (FT-IR) Spectrome-

* Corresponding author.

E-mail address: samdmr@yahoo.com (S. Solomon).

Review

An Overview of the Pathway Idea and Its Applications in Statistical and Physical Sciences

Nicy Sebastian ^{1,*}, Seema S. Nair ² and Dhannya P. Joseph ³

¹ St. Thomas' College, Thrissur P.O., Kerala 680001, India

² St. Gregorios College, Pulamon P.O., Kottarakara, Kerala 691531, India;

E-Mail: seema.cms@gmail.com

³ Kuriakose Elias College, Mannanam P.O., Kottayam, Kerala 686561, India;

E-Mail: dhannyapj@gmail.com

* Author to whom correspondence should be addressed; E-Mail: nicyseb@yahoo.com;
Tel.: +91-949-525-4050.

Academic Editor: Hans J. Haubold

Received: 18 October 2015 / Accepted: 7 December 2015 / Published: 19 December 2015

Abstract: Pathway idea is a switching mechanism by which one can go from one functional form to another, and to yet another. It is shown that through a parameter α , called the pathway parameter, one can connect generalized type-1 beta family of densities, generalized type-2 beta family of densities, and generalized gamma family of densities, in the scalar as well as the matrix cases, also in the real and complex domains. It is shown that when the model is applied to physical situations then the current hot topics of Tsallis statistics and superstatistics in statistical mechanics become special cases of the pathway model, and the model is capable of capturing many stable situations as well as the unstable or chaotic neighborhoods of the stable situations and transitional stages. The pathway model is shown to be connected to generalized information measures or entropies, power law, likelihood ratio criterion or λ -criterion in multivariate statistical analysis, generalized Dirichlet densities, fractional calculus, Mittag-Leffler stochastic process, Krätzel integral in applied analysis, and many other topics in different disciplines. The pathway model enables one to extend the current results on quadratic and bilinear forms, when the samples come from Gaussian populations, to wider classes of populations.

Keywords: pathway model; entropy measure; superstatistics; Tsallis statistics; beta family; generalized gamma; Dirichlet densities; λ -criterion; H -function; quadratic forms

MSC classifications: 85A99; 82B31; 60E05; 62C10; 33C60; 44A15

1. Introduction

The pathway idea was originally prepared by Mathai in the 1970's in connection with population models, and later rephrased and extended, Mathai [1], to cover scalar as well as matrix cases as made suitable for modelling data from statistical and physical situations. For practical purposes of analyzing data of physical experiments and in building up models in statistics, we frequently select a member from a parametric family of distributions. But it is often found that the model requires a distribution with a thicker or thinner tail than the ones available from the parametric family, or a situation of right tail cut-off. The experimental data reveal that the underlying distribution is in between two parametric families of distributions. In order to create a pathway from one functional form to another, a pathway parameter is introduced and a pathway model is created in Mathai [1]. The main idea behind the derivation of this model is the switching properties of going from one family of functions to another and yet another family of functions. The model enables one to proceed from a generalized type-1 beta model to a generalized type-2 beta model to a generalized gamma model when the variable is restricted to be positive. Thus the pathway parameter α takes one to three different functional forms. This is the distributional pathway. More families are available when the variable is allowed to vary over the real line. Mathai [1] deals mainly with rectangular matrix-variate distributions and the scalar case is a particular case there. For the real scalar case the pathway model is the following:

$$f_1(x) = c_1 x^{\gamma-1} [1 - a(1 - \alpha)x^\delta]^{-\frac{\eta}{1-\alpha}} \quad (1)$$

$a > 0$, $\delta > 0$, $1 - a(1 - \alpha)x^\delta > 0$, $\gamma > 0$, $\eta > 0$ where $c_1 = \frac{\delta(a(1-\alpha))^{\frac{1}{\delta}} \Gamma(\frac{\eta}{1-\alpha} + 1 + \frac{1}{\delta})}{\Gamma(\frac{\gamma}{\delta}) \Gamma(\frac{\eta}{1-\alpha} + 1)}$ for $\alpha < 1$, is the normalizing constant if a statistical density is needed and α is the pathway parameter. For $\alpha < 1$ the model remains as a generalized type-1 beta model in the real case. Other cases available are the regular type-1 beta density, Pareto density, power function, triangular and related models. Observe that Equation (1) is a model with the right tail cut off. When $\alpha > 1$ we may write $1 - \alpha = -(\alpha - 1)$, $\alpha > 1$ so that $f(x)$ assumes the form,

$$f_2(x) = c_2 x^{\gamma-1} [1 + a(\alpha - 1)x^\delta]^{-\frac{\eta}{\alpha-1}}, \quad x > 0 \quad (2)$$

which is a generalized type-2 beta model for real x and $c_2 = \frac{\delta(a(\alpha-1))^{\frac{1}{\delta}} \Gamma(\frac{\eta}{\alpha-1})}{\Gamma(\frac{\gamma}{\delta}) \Gamma(\frac{\eta}{\alpha-1} - \frac{1}{\delta})}$ for $\alpha > 1$, is the normalizing constant, if a statistical density is required. Beck and Cohen's superstatistics belong to this case Equation (2) (for more details see, [2,3]). Again, dozens of published papers are available on the topic of superstatistics in statistical mechanics. For $\gamma = 1$, $a = 1$, $\delta = 1$ we have Tsallis statistics for $\alpha > 1$ from Equation (2) (for more details [4,5]). Other standard distributions coming from this model

Article

An Overview of Generalized Gamma Mittag–Leffler Model and Its Applications

Seema S. Nair

St. Gregorios College, Kottarakara, Kerala 691531, India; E-Mail: seema.cms@gmail.com;
Tel.: +91-4692611138

Academic Editor: Hans J. Haubold

Received: 6 May 2015 / Accepted: 27 July 2015 / Published: 26 August 2015

Abstract: Recently, probability models with thicker or thinner tails have gained more importance among statisticians and physicists because of their vast applications in random walks, Lévi flights, financial modeling, *etc.* In this connection, we introduce here a new family of generalized probability distributions associated with the Mittag–Leffler function. This family gives an extension to the generalized gamma family, opens up a vast area of potential applications and establishes connections to the topics of fractional calculus, nonextensive statistical mechanics, Tsallis statistics, superstatistics, the Mittag–Leffler stochastic process, the Lévi process and time series. Apart from examining the properties, the matrix-variate analogue and the connection to fractional calculus are also explained. By using the pathway model of Mathai, the model is further generalized. Connections to Mittag–Leffler distributions and corresponding autoregressive processes are also discussed.

Keywords: generalized Mittag–Leffler density and process; gamma density; Lévi density; pathway model; Tsallis statistics; superstatistics

1. Introduction

In model building situations in physical, biological, social and engineering sciences, the usual procedure is to select a probability model from a parametric family of distributions. In many practical problems, it is often found that the selected model is not a good fit for the experimental data, because it requires a model with a thicker or thinner tail than the ones available from the parametric family of distributions. In order to make the tail thicker or thinner, a technique is introduced here by augmenting a series to the original density. Our first step is to construct the thicker or thinner tailed distribution

associated with the Mittag–Leffler function, because this function is connected to fractional calculus, the Mittag–Leffler stochastic process, non-Gaussian time series, Lévi flights and in a limiting process to the topics of Tsallis statistics, superstatistics, as well as to statistical distribution theory.

In reaction rate theory, input-output type situations and reaction-diffusion problems in physics and chemistry, when the integer derivatives are replaced by fractional derivatives, the solutions automatically go in terms of Mittag–Leffler functions and their generalizations; see Haubold and Mathai (2000) [1]. The ordinary and generalized Mittag–Leffler functions interpolate between a purely exponential law and power-law-like behavior of phenomena governed by ordinary kinetic equations and their fractional counterparts; see Kilbas *et al.* (2004) [2], Kiryakova (2000) [3], Mathai (2010) [4] and Mathai *et al.* (2010) [5]. This paper examines a new family of statistical distributions associated with Mittag–Leffler functions, which gives an extension to the gamma family, which will then connect to fractional calculus and statistical distribution theory through the theory of special functions. The model investigated in this paper is useful in the study of life testing problems, reliability analysis, in physical situations to describe stable solutions, as well as unstable and chaotic neighborhoods, *etc.* We will start with the definition of the Mittag–Leffler function.

A two-parameter Mittag–Leffler function is defined as follows:

$$E_{\alpha,\beta}(x^\alpha) = \sum_{k=0}^{\infty} \frac{x^{\alpha k}}{\Gamma(\alpha k + \beta)}, \quad \Re(\alpha) > 0, \Re(\beta) > 0, \quad (1)$$

where $\Re(\cdot)$ denotes the real part of (\cdot) . Observe that the Mittag–Leffler function is an extension of the exponential function. When $\alpha = 1$, $\beta = 1$, Equation (1) reduces to e^x . In statistical model building, usually, the parameters are real, but since the results to be discussed hold for complex parameters, as well, we will state the corresponding relevant conditions. Various properties, generalizations and applications of the Mittag–Leffler function can be seen from Kilbas *et al.* (2004) [2].

Consider a probability density of the form:

$$f(x) = \begin{cases} a^\beta [1 + \frac{\delta}{a^\alpha}] x^{\beta-1} e^{-ax} E_{\alpha,\beta}(-\delta x^\alpha), & \beta > 0, \alpha > 0, a > 0, x \geq 0 \\ 0, & \text{elsewhere,} \end{cases} \quad (2)$$

where C is the normalizing constant and $E_{\alpha,\beta}(-\delta x^\alpha)$ is the Mittag–Leffler function. Some interesting special cases of Equation (2) are the following: The density in Equation (2) includes two-parameter gamma, exponential, chi square, noncentral chi square and the like. When $\delta = 0$, Equation (2) reduces to the two-parameter gamma density:

$$f_1(x) = C_1 x^{\beta-1} e^{-ax}, \quad x \geq 0. \quad (3)$$

For $\alpha = \beta = 1$ in Equation (2), we have the exponential density. For $\beta = \frac{n}{2}$ and $a = \frac{1}{2}$ in $f_1(x)$, we have the chi square density with n degrees of freedom. For $\beta = p$, $p = 2, 3, \dots$ in Equation (3), we have the Erlang density. For $p = 1$ in Erlang density, we have the exponential density. For fixed values of a , β and for various values of δ , we can look at the graphs that give a suitable interpretation to the model in Equation (2).

The above figures show a comparison between gamma density and gamma Mittag–Leffler density for different values of δ . Observe that $\delta = 0$ corresponds to the gamma density. In Figure 1, as the value of

FIRST RECORD OF THE PIRAPITINGA *PIARACTUS BRACHYPOMUS*, CUVIER, 1818 (ACTINOPTERYGII: SERRASALMIDAE) IN PAMBA RIVER KERALA, INDIA

RANI S. DHARAN* AND E. SHERLY WILLIAMS

PG and Research Department of Zoology, Environmental sciences,
Aquaculture and Fish biotechnology lab, Fatima mata National College (Autonomous), Kollam - 691 001
e-mail: plrrani4@gmail.com

KEYWORDS

Pamba River
Piranha
Threat
Piaractusbrachypomus
Ecosystem

Received on :
19.08.2015

Accepted on :
26.12.2016

*Corresponding
author

ABSTRACT

Pamba River in Kerala, India, is known for its inland fishery resources and great biodiversity. The present investigation has conducted to compare the ichthyofaunal diversity along the lower reaches of Pamba River. During the study two *Piaractus brachypomus* were caught in the gill net from the open waters of river at Muttar, upper Kuttanad, Kerala. The *Piaractus brachypomus* is a tropical fish native to the Amazon and Orinoco basins, which has many similarities with the carnivorous *Piranha natterrius* reported for the first time from the Pamba River, Kerala, India. *Piaractus brachypomus* are not aggressive carnivore like the piranha, but its aggressiveness towards the native fauna was evident from the interactions with local fishermen. The basic reason behind the presence of this fish in this water medium may be because of the inundation of nearby culture farms. If a large population of *Piaractus brachypomus* enters an eco-system to which it isn't native, the fish can have a very adverse effect on the indigenous ecosystem. The present study showed the importance of monitoring further proliferation of this aggressive species in the Pamba River for the healthy existence of the ecosystem.

INTRODUCTION

Invasion of species is the main reason for global change as it will modify the indigenous environment in various ways. Invasion of exotic fishes and related issues has been gaining attention worldwide. Bhat, et al. (2013) studied the distribution pattern and density of exotic brown trout, *Salmo trutta fario* and Ahmed, H. (2011) studied the mortality in a hybrid tilapia (*Oreochromis niloticus* X *O. aureus*) due to a monogenic trematode (*Dactylogyrus* sp.) that was found in the fish gills. Invasion of exotic fishes may also results in community disassembly and will affect species interactions which may ultimately leads to biodiversity loss and species homogenization. The introduction of exotic species is vogue in India, mainly for increasing fish production, but many times the exotic fishes pose a threat to indigenous fishes. Many fishes are carnivorous, which actively prey on juveniles and adults of indigenous species or compete with them for food and habitat also negatively affect native fish populations. The *Piaractus brachypomus* a tropical fish native to the Amazon and Orinoco basins, here it inhabits large flooded rivers and lakes. This is the one of the largest species of scaled fish found in the Amazon basin. It is very valued as an aquaculture species, and is considered to be one of the most significant and prized species in aquarium trade (Saint-Paul, 1992; Jégu, 2003). Outside of its natural distribution range, the *Piaractus brachypomus* is most common in the open waters of the US, due to aquarium related releases and fish farms escapes (Nico and Fuller, 2012). Recently three red bellied

Paccu, *Piaractus brachypomus* were caught from the Vembanat Lake, Kerala, India (Roshni et al., 2014). *Piaractus brachypomus* has many similarities with piranha but have many differences in the form of teeth and jaw alignment. Piranha has pointed, razor-sharp teeth in a pronounced underbite, whereas *Piaractus brachypomus* have squarer, straighter teeth, like a human and a less severe under bite, or a slight overbite. Additionally, full-grown *Piaractus brachypomus* are much larger than piranha, reaching up to 0.9 m (3 feet) and 25 kg (55 pounds) in the wild. When the large fish of the *Colossoma* genus introduced to the aquarium trade in the U.S. and other countries, they were erroneously labeled pacu. The *Colossoma macropomum* fish are known, astambaqui whereas *Piaractus brachypomus* is known as pirapitinga.

If a large population of pacu enters an eco-system to which it is not native, the fish can have a very adverse effect (Magallanes, Frank, 2006). Most UK dealers are now refusing to stock this species due to the large size and expensive aquarium requirements. Many suspicious reports of illegal release of over sized pacu were reported worldwide (Nico et al., 2012). As it is a tropical fish, *Piaractus brachypomus* will die in cold weather; if it can survive, as newcomers to an ecosystem, it will out-compete native species for available food, habitat, and other resources, or displace them by introducing exotic parasites or diseases (Todd Crowl et al., 2008). Incidental finds of individual pirapitinga have also been recorded in Spain (Leunda, 2010), in Slovakia (Hensel, 2004), in British Columbia (Hanke et al., 2006) and in Poland (Nowak

et al., 2008). All these individuals are assumed to have been released by aquarists. The aim of this paper is to present the first records of an ornamental, aquarium species *Piaractus brachypomus* in the open waters of upper Kuttanad at Muttar where Manimala river meets with Pamba river.

MATERIALS AND METHODS

In July 2013 the sports fisherman caught two piranha like fish with gill net from the open waters of upper Kuttanad at Muttar where Manimala river meets with Pamba river (9°26'00"N 76°32'20"E) (Fig. 1). The captured fish was identified as pirapitinga or red-bellied pacu (*Piaractus brachypomus*) according to Ross (2001) and Marko, C et al. (2011) (Fig 2.a). Body measures were taken using digital calliper (Mitutoyo) with an accuracy of 0.1 mm. Meristic traits like fin rays, scales in lateral line, ventral scales and gill rays were counted using a binocular microscope.

RESULTS AND DISCUSSION

The captured specimen is compared with that reported in Croatia, (Marko, et al., 2011) and in US (Ross, 2001) for its meristic counts and morphometric measurements and are presented in Tables I and II.

According to Ross (2001) this is a large, silvery deep bodied characin with numerous, small, cycloid scales. Scales lack posterior projections and accessory scales are also absent. The mouth is terminal with molar like teeth on the lower jaw are hidden behind a fleshy lower lip (Fig. 2.b). The body is almost circular in juveniles, becoming more elongate in older fish. The nares are large and anterior to the eyes. The opercle is much deeper than wide (which goes into depth about 2 times). The anal fin is long and an adipose fin is present may be reduced or even absent in large fish. There is a serrated keel running along the belly to the anus. The lateral line is decurved. Counts from three specimen collected in Mississippi are 97-102 SC, 17 GR lower, 13-17 dorsal rays, 23-26 anal rays, 13-16 pectoral rays, 8 pelvic rays, and 58-62 ventral scutes. Counts from Amazonian specimen are 79-89 SC, 15-18 dorsal rays, 24-28 anal rays 16-19 pectoral rays, 8 pelvic rays and 46-63 ventral scutes.

Piaractus brachy pomus is recorded for the first time from the open waters of Pamba River, upper Kuttanad at Muttar, Kerala. The local fisherman reported that three *Piaractus brachy pomus* were caught with gill net. One was big, weighed about 1 kg that he didn't saved. *Piaractus brachypomus* is an edible fish. This fish is oftenly mistaken as *Pygocentrus nattereri*

due to its resemblance in body colour pattern. A possible reason for the occurrence may be a result of fish outgrowing hobbyists' and the indeterminate release into local waters. Red-bellied pacu were introduced to India sometime between 2003 and 2004 from Bangladesh and indicates that the high water levels of the Drava River and its tributaries in spring 2010 lead to flooding of fish-ponds (in Hungary) where pirapitinga were kept, thus sweeping them into the river course (Marko, et al. (2011).

In the present study the local fisher men confirmed the attack of *Piaractus brachypomus* on other fish populations, and so its existence can be a threat to other fish species. Froese and Pauly (2010) reported that "*Piaractus brachy pomus* started attacking other fishes in the Sepik and Ramu rivers in 1999 when their main food, insects became

scarce. There are also reports on human attacks. It also causes ecological imbalance by killing local fish and wiping out eggs and fry. According to Robert (2006) even if *Piaractus brachycomus* is omnivorous, when its normal food become scarce it may prey on other fish and will attack people. There is also chances for the introduction of exotic parasites or diseases to the native fauna (Todd Crowl et al., 2008). Quite accidentally some type of routing off disease also reported in some fish species like *Labeodissumeri* and *Channa striata* from the same station and same month (Fig.3). So it has to find out whether there is any relationship between the occurrence of this fish and the outbreak of this disease.

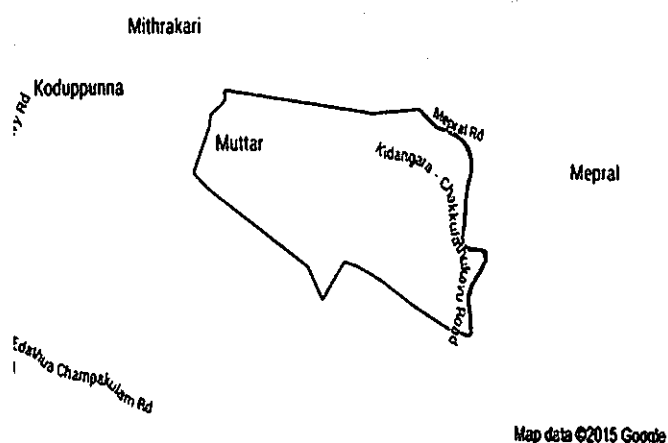


Figure 1: Map of upper Kuttanad and the location where *Piaractus brachypomus* was captured.

Table 1: The meristic counts of the *Piaractus brachypomus* from the open waters of upper Kuttanad at Muttar, Kerala is compared with the literary data

	Present study Specimen 1	Specimen 2	Marko, et al. (2011) Specimen 1	Specimen 2	Ross (2001)
D ray	16	16	III + 14	(III + 14) 17	15-17
A ray	23	23	III + 24	(III + 22) 25	23-26
V ray	8	8	I + 7	I + 7	8
P ray	13	13	I + 16	I + 14	15-16
Ventral scutes	54	45	57	61	58-62
Lateral line scales	106	102	96	99	97-102

Population genetics of *Oithona similis* Claus, 1866 (Crustacea: Cyclopoida) in Arabian Sea: Preliminary evidence of haplotype sharing in two populations

Jean Jose J^{1*}, Thanagaraj M², Lincy Alex³ & Lipton A P⁴

^{1,3}Department of Zoology, St. Gregorios College, Kottarakara-691531, Kerala, India

²Centre for Advanced Studies in Marine Biology, Faculty of Marine Sciences,
Annamalai University, Parangipettai, Tamilnadu, India- 608 502

⁴Marine Biotechnology Laboratory, Central Marine Fisheries Research Institute,
Vizhinjam-695 521, Kerala, India

(Presently: Centre for Marine Science and Technology, MS University, Rajakkamangalam, Tamil Nadu, India)

[*Email: jeanlincv@gmail.com]

Received 25 May 2014; revised 27 June 2014

Present study examined two populations (Vizhinjam and Calicut) of *O. similis* distributed in the Arabian Sea based on the comparative analysis of the 28S rDNA sequence variation and to know the population variation between two large marine ecosystems, Atlantic Ocean and Arabian Sea population. The data's were compared in detail. DNA sequence variation clearly resolved and discriminated the populations, and revealed low levels of intrapopulation variation among Atlantic Ocean and Arabian Sea. The 28S rDNA region was thus shown to provide an accurate and reliable means of identifying the species throughout the sampled domain.

[Keywords: Copepod, *Oithona similis*, population genetics, Arabian Sea]

Introduction

Molecular genetic analyses have revealed the prevalence of cryptic speciation in marine invertebrates, resulting in excessive lumping in systematic classifications¹. The advent of molecular genetic technologies in the last decade makes it possible to differentiate morphologically similar species with greater accuracy and arrange them to a phylogenetic tree. Currently, very few nuclear and mitochondrial markers have been successfully employed to resolve phylogenetic relationships in copepods^{2,3}. For marine copepods, mitochondrial 16S rRNA gene sequences have been used most extensively to reveal intraspecific or interspecific variations^{4,5,6}. Other than 16S rDNA, internal transcribed spacer region⁷, cytochrome oxidase I

(COI)⁸ and nuclear 28S rRNA gene⁶ have also been used. The 18S and 28S nuclear ribosomal RNA genes have been used to resolve relationships at the ordinal, familial, or generic levels^{8,6,9,10,11}. Phylogenetic analyses of crustaceans have been made based on nucleotide sequence data of the nuclear 18S rDNA^{12,13,8}.

Cyclopoid family, Oithonidae is often the most abundant group of pelagic copepods in estuarine, coastal and oceanic waters throughout the world^{14,15,16}. In this study, the nucleotide sequences of the nuclear 28S rRNA gene of *O. similis* pooled from Southwest Coast of India and examined the molecular diversity among the populations. In an earlier study, both morphology and molecular markers were used to infer

the ordinal status of the Copepod¹¹. The relationship among *Oithona* species, including *O. similis*, *O. atlantica* and *O. nana*, have been studied in Pacific and Indian Oceans². These morphological analyses included forty five structural characters and suggested that *O. atlantica* and *O. similis* are more closely related to each other than *O. nana*². In an earlier finding within and among three *Oithona* species occurring in the South and North Atlantic Oceans, analyzed the 28S rRNA gene sequence and characterized the patterns of variation³. In India, only very few works are available on molecular taxonomy/identification of marine copepods using very preliminary molecular tools^{17,18,19}. In the study we analyze DNA sequences for a 577 base-pair (bp) region of the 28S rRNA gene and characterize patterns of variation within Arabian Sea and Atlantic Ocean populations of *O. similis*.

Materials and Methods

For the present study, two stations such as Vizhinjam (8°21'56"N; 76°59'39"E), and Calicut (11°13'33"N; 75°46'30"E) (Fig. 1) from Southwest Coast of India were selected. Zooplankton collection was done by horizontal hauling using a Bongo net (mouth diameter 40 cm, mesh size: 60µm) equipped with a calibrated flow meter (General Oceanics, Model-2030) to quantify the volume of water filtered. The net was operated from the deck of a purse seiner for 10 minutes at a speed of 2 knots/hour. Concentrated zooplankton was preserved in 95 % ethanol

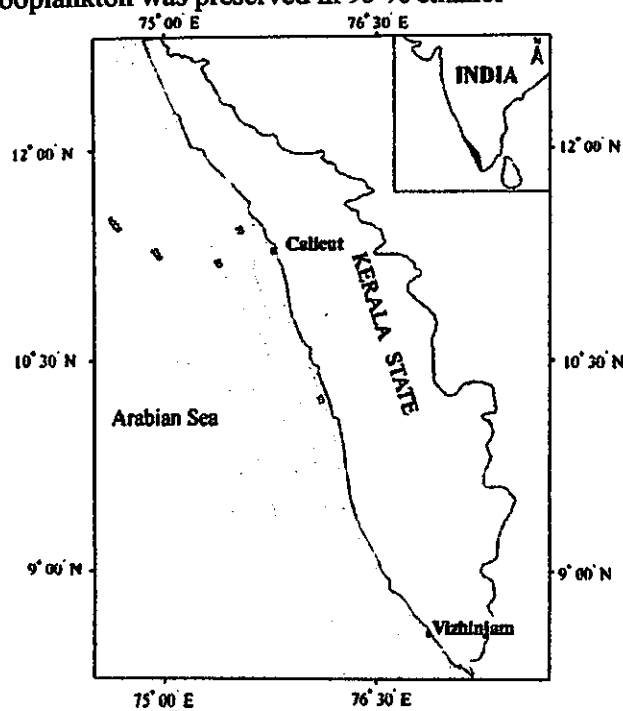


Fig. 1 Area of Investigation

immediately after collection. At each collection, the pre adult and adult *O. similis* were sorted on the same day and kept in 95% ethanol. Species level confirmation of the sorted copepod specimens of *O. similis* was performed according to^{20,21,16}.

Genomic DNA was extracted from ethanol stored specimens by the standard protocol²². DNA samples from each individual was diluted to about 25 ng/µl with deionized distilled water and used for Polymerase chain reaction (PCR) amplification. PCR was used to amplify about 800 bp fragment of the large subunit (28S) ribosomal RNA (rRNA) gene using primers 28SF1: 5'-GCGGAGGAAAAGAACTAAC-3' and 28SR1: 5'-GCATAGTTTCACCATCTTTCGGG-3'. PCR amplifications were performed in a total volume of 25 µl including 19 µl of double distilled water, 2.5 µl Taq buffer (10 mM Tris-HCl, 10 mM KCl, 15 mM MgCl₂, pH 8.0) 1 µl of dNTP mix (0.2 mM each), 1 µl of primer mix (10 pM), 0.75 units of Taq DNA Polymerase (Merck) and 1 µl of the DNA template solution. PCR protocol was: 4 min initial denaturation step at 94°C; 35 cycles of 40s denaturation step at 94°C, 40s annealing at 50°C, and 90s extension at 72°C; and a final extension step of 15 min at 72°C. Approximately 2 µl of each PCR product was electrophoresed on a 1.5% TBE agarose gel and visualized by UV light with ethidium bromide staining. Both strands of the template DNA were sequenced using the PCR primers in an ABI automated capillary DNA sequencer in a commercial laboratory (Ramachandra Innovis, India).

The 28S rDNA sequences obtained were manually edited, with comparison of aligned sequences for both strands. The DNA sequences of *O. similis* from the two populations were aligned using the default parameters by Clustal W²³, using MEGA Ver. 5.05²⁴. The DNA sequences were submitted to the molecular database, GenBank (<http://www.nlm.nih.ncbi.org>) and were assigned a GenBank Accession Numbers: KC136272-84. Twelve sequences of 28rDNA of *O. similis* of Atlantic Ocean were retrieved from NCBI GenBank (JF419529-40) and were used for comparative analysis.

Molecular analysis was done using a final aligned length of 577 bp of the 28S rRNA gene. Numbers of haplotype sequence and sequence diversities (h) were calculated for each population sampled for the studied populations by DnaSP Ver. 5.10²⁵. Haplotype network between Atlantic Ocean and Arabian Sea populations were drawn by Network Ver. 6.1 software²⁶. Neighbor-Joining method²⁷ analysis implemented in MEGA Ver 5.05²⁴ was used

Developmental stages observed during experimental culture of the egg bearing cyclopoid copepod *Oithona similis* (Claus, 1866)

Jean Jose J^{1*}, Lincy Alex², Lipton A P³ & Chandran A⁴

^{1,2}Department of Zoology, St. Gregorios College, Kottarakkara-691531, Kerala, India

³Marine Biotechnology Laboratory, Central Marine Fisheries Research Institute, Vizhinjam-695 521, Kerala, India

⁴School of Applied Life Sciences, Mahatma Gandhi University Regional Centre, Pathanamthitta-689645, Kerala, India.

*[Email: jeanlincoy@gmail.com]

Received 18 July 2014; revised 30 September 2014

Experimental culture of the marine cyclopoid copepod *Oithona similis* were made to assess their different developmental stages and developmental time in laboratory conditions. Cost-effective techniques for breeding, growth, development of *O. similis* and relevant micro algal feed production were ascertained by suitable experiments. The results revealed that the span of life cycle stages of *O. similis* after fertilization lasted for 23 days. The life cycle had five naupliar stages such as: N₁ – 1st day; N₂ – 3rd day; N₃ – 5th day; N₄ – 8th day and N₅ – 10th day. The naupliar stage was followed by six copepodid stages (C₁ – 12th day; C₂ – 14th day; C₃ – 16th day; C₄ – 19th day; C₅ – 21st day; C₆ – 23rd day) and a single pre-adult stage in the laboratory conditions. Maximum survival of 30% copepodids was attained during 23 days of rearing in culture flasks of 1 l capacity provided with micro algal diet size <5µ.

[Keywords: Experimental culture, *Oithona similis*, developmental stages, larval morphometry]

Introduction

Culturing copepods have become increasingly more reliable since the 1960s and approximately 60 copepod species have been successfully raised¹. The oldest copepod culture of *Acartia tonsa* was reported from the Danish Technical University of Denmark². It was in 2006, The World Copepod Culture Database was initiated at Roskilde University (<http://copepod.ruc.dk/main.htm>) in an attempt to supply and share knowledge between copepod scientists, aquaculturists, and the public at large. The database contains details on various cultures and up-to-date recent knowledge on cultivation procedures. As copepods form an important component in the food chain especially in fish and crustacean larvae, culture trials aimed at establishing a reliable mass production system attempted by several earlier workers^{2,3,4,5,6,7}. One of the keys to successful larval finfish rearing is the high nutritional quality of copepods compared to other traditionally used live prey⁸. Extensive culture of copepods has already been achieved in order to supply aquaculture industries and aquarium trade needs requiring high quality live feed⁹.

Information on the mass culture of copepod from India is limited to the harpacticoid copepod *Euterpina aculifrons* and calanoid copepod

*Pseudodiaptomus serricaudatus*¹⁰ and cyclopoid copepod *Oithona rigida*¹¹.

The main objectives of this study were experimental culture of *Oithona similis* in laboratory conditions and to observe their different developmental stages, feeding regimens, growth and survival. The study also focused on the cost-effective techniques for breeding, growth, development of *O. similis* and relevant micro algal feed production.

Materials and Methods

Microalgae such as *Nannochloropsis oculata* with 6µ and *Isochrysis galbana* of size 4µ were grown at 25.0±3.0°C using an improvised and cost effective method. Inoculums for the microalgae cultures were procured from the Marine Hatchery and Aquarium of Central Marine Fisheries Research Institute, Vizhinjam. For the cost effective method, prior importance was given in choosing low cost culture flask and light source with repeated trials, the micro algal culture was standardized using Polyethylene terephthalate (PET) bottles. The cultures of *N. oculata* and *I. galbana* were maintained in used transparent PET bottles of 1.5 l capacity. Light source was provided with two cool-white Compact Fluorescent Lamp (CFL) of 15W, fixed at the centre of the culture bottles. In the earlier trials carried out in the laboratory revealed that

CFL lamps could save electrical energy, have long life than other commercially available lamps and noted uniform dispersal of light to the culture flasks. Accordingly four PET bottles were arranged in such a way surrounding one CFL bulb. The bottles were filled with 0.2 μ filtered, sterilized and cooled seawater of 35ppt salinity. Walne's medium were added and mixed uniformly in each PET bottle.

Zooplankton samples were collected from Vizhinjam, southwest coast of India by horizontal hauling using a bongo net (mouth diameter 40 cm, mesh size: 60 μ m) equipped with a calibrated flow meter (General Oceanics, Model-2030). The collected samples were transported to the laboratory in live condition by providing continuous supply of air using a portable aerator. Wild collection of zooplankton were transferred to a glass petriplate (9cm ϕ) up to $\frac{1}{4}$ level and diluted using same quantity of filtered chilled seawater (10 \pm 2 $^{\circ}$ C) for immobilizing them prior to sorting¹². The immobilized copepods were carefully examined using a binocular dissection microscope (Labomed - CSM 2), identified and lifted from the group using fine brush, handled in such a way to clasp the copepod 1st antennae with brush bristles. About 250 numbers of egg-bearing *O. similis* thus segregated were stocked in transparent light green tinted PET bottles of 1l capacity. The PET bottles were arranged specially for their stocking, feeding experiments and retaining the stock for further experiments. The micro algae such as *N. oculata* and *I. galbana* were harvested from continuous cultures and provided as feed twice a day at a cell concentration of 10³ cell ml⁻¹. The microalgal cell concentration was determined daily using a phase contrast microscope (Olympus - CX 20i). Experiments were done at an ambient temperature ranging from 25 \pm 2 $^{\circ}$ C and the cultures of micro algae and copepods were kept in well air circulated room.

Developmental stages of *O. similis* such as: nauplii, copepodids and pre-adults were recorded and measurements were taken according to previous methods^{13,14}. The microscopic measurements were taken after arresting their movement using chilled seawater. Body length was measured from the anterior tip of the cephalosome to the posterior end of the body in lateral view. Body height was the maximum thickness of the dorso-ventral axis in its lateral view. A calibrated ocular micrometer was used for measurements. Naupliar and copepodid stages were designated as N₁ to N₆ and C₁ to C₆. The

size and shape were chosen as characteristics to identify the different naupliar stages. In the copepodid stages, the identification characters such as: body length, development of pleopods, setal development in antennae, genital segment and appearance of cephalosome, metasome and urosome were used to record the stages. All the observations were carried out using a binocular dissection microscope (Labomed CSM 2) and phase contrast microscope (Olympus CX 20i).

Results

Culture of microalgae

The present study measured the growth of the two microalgal species - *N. oculata* and *I. galbana* in a cost effective culture method at a temperature range of 25 to 27 $^{\circ}$ C. The results showed that a maximum cell concentration of 5 x 10⁶ and 5 x 10⁸ cells. ml⁻¹ was recorded on 6th and 10th day of culture respectively. In addition it was observed, continuous aeration by means of slow bubbling of air from bottom to top also promoted the uniform growth of micro algae in the culture bottles. The study also suggested that agitation of the micro algal cultures by providing mild aeration could increase the yield by equal distribution of algal cells in the culture medium. The present finding contrasts with those of previous studies suggesting that temperature and continuous mild aeration in algal cultures at laboratory conditions increases the algal yield.

Growth and development of *O. similis*

The present results divulged that the span of life cycle stages of *O. similis* after fertilization lasted for 23 days comprising 5 nauplius and 6 copepodid stages (Fig. 1).

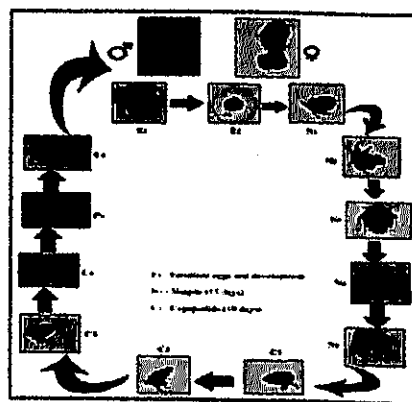


Fig. 1- Egg production, growth and developmental stages of *Oithona similis* in experimental culture

0.4

ISSN 0367-827 X

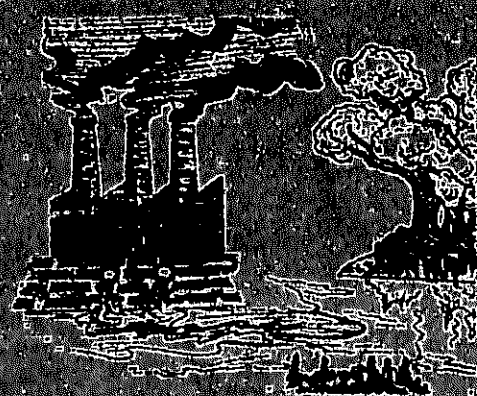
VOLUME 57 NO. 1

JANUARY 2015

Journal of Environmental Science & Engineering



CSIR-National
Environmental
Engineering
Research
Institute
Nagpur 440 020
INDIA



Relationships Between the Hydrochemical Characteristics, Phytoplankton Chlorophyll and Phaeophytin in the Southwest Coast of India

JEAN JOSE J^{1*}, LIPTON A P¹, UDAYAKUMAR P², RAJESH B R³,
LINCY ALEX⁴ AND CHANDRAN A.⁵

The relationship between the hydrochemical characteristics and phytoplankton chlorophyll in coastal pollution monitoring surveys, establishes a basis for understanding the trophic state of coastal waters in accordance with nutrient enrichment routing to progress in capture fishery. On the other hand, the zooplankton (including ichthyoplankton) grazing and its abundance can be understood from the quantification of detrital chlorophyll/phaeophytin. A collection of datasets for three years seasonal sampling (January 2008 to 2011) along Cochin and Mangalore (Southwest coast of India) was analyzed to find out the relationship between hydrochemical factors, chlorophyll *a* and phaeophytin contents. Principal component analysis (PCA) was used to analyze these ecological parameters interrelationship. In both the sampling sites, the nutrient factors statistically predict that nitrite is influenced by the concentration of chlorophyll *a* and its significant positive correlation to phaeophytin indicates the strength of micro zooplankton grazing. We infer that micro zooplankton grazing is an important factor in keeping a balanced coastal ecosystem at Cochin and Mangalore. The nutrient factors are totally utilized by the phytoplankton community. The PCA study confirms about assimilation of the dissolved inorganic nitrogen (DIN) in the form of NH_4^+ formed by the zooplankton excreta (detrital chlorophyll/phaeophytin) in Mangalore coastal waters.

Key words: *Chlorophyll, Phaeophytin, trophic state, hydrochemical characteristics, Arabian Sea*

Introduction

Variation in environmental factors caused by atmospheric forcing has led to fundamental differences in the pelagic marine ecosystem in terms of production¹⁻². The west coast of India (Arabian Sea) is a region of intense upwelling associated with southwest monsoon (May to September) whereas the east coast experiences only a weak upwelling associated with the northeast monsoon (October to January), resulting in marked differences in hydrographic regimes, productivity patterns and

qualitative and quantitative composition of fisheries³. Productivity reasons explicated by the researchers concentrated in this region include the inflow of a network of rivers, backwaters, rocky shores and the intense upwelling associated with southwest monsoon influenced upon the improved nutrient composition⁴. Naturally occurring seasonal nutrient enrichment in the waters along the west coast resulted by the upwelling during the southwest monsoon period trigger high primary production and the stock of phytoplankton in terms of Chlorophyll *a*⁵.

¹ Marine Biotechnology Laboratory, Central Marine Fisheries Research Institute, Vizhinjam - 695 521, Kerala, India.

² Marine Biology and Chemistry Laboratory, Chemical Sciences Division, Centre for Earth Science Studies, Thiruvananthapuram-695 031, Kerala, India.

³ Marine Biology Laboratory, Department of Zoology, Fatima Mata National College, Kollam - 691 001, Kerala, India.

⁴ Department of Zoology, St. Gregorios College, Kottarakkara - 691 531, Kerala, India

⁵ Department of Fisheries Biology and Aquaculture, University College of Applied Life Sciences, Mahatma Gandhi University Regional Centre, Pathanamthitta-689 645, Kerala, India.

* Corresponding author: jeanlincy@gmail.com (J. Jean Jose); Fax: +91 471-2442280; Tel: +91 9447696739

1.3

Heavy metal accumulation in the surficial sediments along southwest coast of India

12

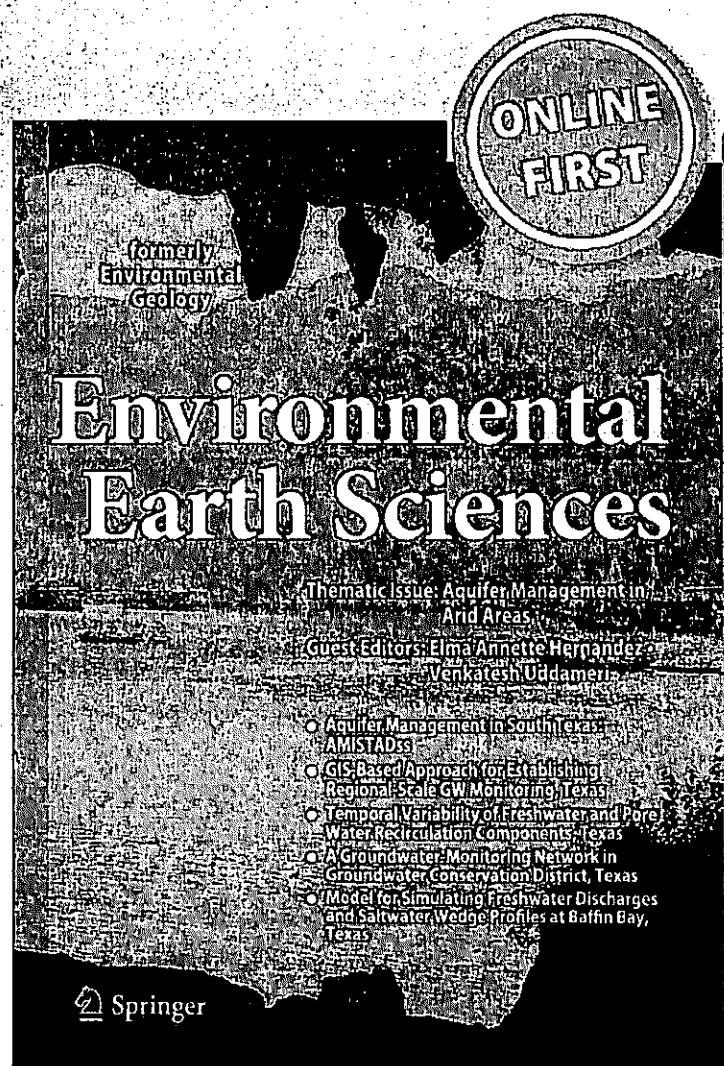
P. Udayakumar, J. Jean Jose, K. Anoop
Krishnan, C. S. Ratheesh Kumar,
M. N. Manju & P. M. Salas

Environmental Earth Sciences

ISSN 1866-6280

Environ Earth Sci

DOI 10.1007/s12665-014-3097-9



Heavy metal accumulation in the surficial sediments along southwest coast of India

P. Udayakumar · J. Jean Jose · K. Anoop Krishnan ·
C. S. Ratheesh Kumar · M. N. Manju · P. M. Salas

Received: 15 May 2013 / Accepted: 25 January 2014
© Springer-Verlag Berlin Heidelberg 2014

Abstract Concentration and distribution of heavy metals (Cd, Cr, Cu, Hg, Ni, Pb and Zn) in surface sediments collected from five stations located along the southwest coast of India were investigated seasonally to assess whether there is insidious buildup of heavy metals. Spatial variation was in accordance with textural characteristics and organic matter content. The concentration of the metals in sediments of the study area followed the order: $Zn > Cr > Ni > Cu > Pb > Cd > Hg$. The use of geochemical tools and sediment quality guidelines to account for the magnitude of heavy metal contamination revealed high contamination in monsoon and impoverishment during post-monsoon. Estimated total metal concentrations in the present investigation were comparable with other studies; however, concentrations of Ni and Zn were higher than that of other coastal regions. Concentrations of metals in sediment largely exceed NOAA effects range: low (e.g., Cu, Cr, Hg) or effects range: median (e.g., Ni) values. This means that adverse effects for benthic organisms are highly probable.

Keywords Heavy metals · Coastal sediments · Contamination · Pollution indices · Principal component analysis

P. Udayakumar (✉) · J. J. Jose · K. A. Krishnan
Chemistry and Marine Biology Laboratory,
Chemical Sciences Division, Centre for Earth Science Studies,
Thiruvananthapuram 695031, Kerala, India
e-mail: drudaypalakkad@gmail.com

C. S. R. Kumar · M. N. Manju · P. M. Salas
Department of Chemical Oceanography, School of Marine
Sciences, Cochin University of Science and Technology,
Kochi 682016, Kerala, India

Introduction

Heavy metals in sediments have natural or anthropogenic origin and the relative importance of these two sources depends on the metal and the geographical location. Coastal ecosystems are often vulnerable to anthropogenic metal inputs from a wide range of chemical compounds released from various sources. Environmental pollution by heavy metals is a major concern worldwide on account of urbanization and industrial development (Heyvaert 2000; Alemdaroglu et al. 2003). The ecological impact of metals can be substantial on account of their toxicity, persistence, and non-degradability in the environment (Tam and Wong 2000). Once released into the water column, metals are quickly adsorbed on to particulate matter and eventually removed to bottom sediments (Groot et al. 1982; Santschi et al. 1984; Blake et al. 2004), thereby producing conspicuous enrichment. The fate and behavior of the metals are regulated by the characteristics of the sediment, such as mineralogical composition, redox state, sorption processes and physical transport. Although sediments are the main sink for various pollutants including metals, which are discharged into the environment (Balls et al. 1997; Dassenakis et al. 1997; Bettinetti et al. 2003), they can also play a significant role in the remobilization of contaminants to the overlying water column under favorable conditions. Furthermore, the burrowing activity of macro invertebrate organisms in sediments can result in the fluxes of solutes and particles from sediment to water. In foraging, they inadvertently ingest sediments, which account for the metal body burden in several deposit feeding invertebrates. The combined effects of all these processes make heavy metals available to marine organisms and can undergo biomagnification.



Research Article

A SCITECHNOLOGICAL JOURNAL

Nutrient - Characteristics, Stoichiometry and Response Stimulus of Phytoplankton Biomass along the Southwest Coastal Waters of India

Udaya Kumar P^{1*}, Chandran A², Joan Jose J³, Shibu R¹ and Anoop Krishnan K¹

Abstract

The study was aimed at how anthropogenic influences have shaped the nutrient dynamics and phytoplankton biomass in the coastal waters of southwest India. Coastal surface water samples were collected seasonally, from five transects in the southwest coast of India during the year 2008. The samples were analyzed for physical, chemical and biological parameters. Significant seasonal and spatial variation was observed in the hydrographic characteristics. Among the nutrients, dissolved inorganic phosphate concentration was higher than dissolved inorganic nitrogen forms leading to N: P ratios of an average of less than 10, while Si: N ratios were greater than unity indicating that Si(OH)₄ is not a limiting nutrient in the surface coastal water. A comparison of ambient nutrient ratios with the Redfield ratio (N: P: Si=16:1:16) showed "potential stoichiometric N limitation" in the factors that regulate phytoplankton biomass. Most plankton variability along the coast appears to be driven by species of diatoms, Si supply being a driving force. The effect of external nutrient inputs has made the coastal waters biologically productive in terms of Chlorophyll concentration. Principal component analyses applied to the dataset, revealed 75% variations in the coastal system produced by riverine, phosphorus, upwelling and aeration factors.

Keywords

Nutrients; Monitoring; Anthropogenic inflow; Diatoms; Primary production; Southwest coastal water; Multivariate analysis.

Introduction

Over the last several decades coastal regions throughout the world have experienced increased incidence of harmful or toxic algal blooms. These blooms occur as a result of key nutrients such as nitrogen (N) and phosphorus (P), because the supply rates of these nutrients most often control or "limit" aquatic plant primary production and biomass formation [1]. The direct influences of human population growth, urbanization, agricultural and industrial expansion have accelerated nutrient over-enrichment in receiving waters [2]. Increased nutrient supply in coastal waters can cause several environmental modifications, such as increase in productivity and fishery potential

[3]. However, continual nutrient enrichment promotes accelerated production of plant-based organic matter (i.e., eutrophication) to the extent that excessive production; including noxious algal blooms, shift in species composition, zones of bottom water hypoxia which is highly detrimental for biological diversity [4,5]. The interplay of nutrients, expressed as the stoichiometric ratio of their supply and subsequent shifts in this ratio during uptake by the biota, has become an important topic in contemporary biogeochemical studies [6]. In many urbanized coastal regions, anthropogenic inputs have altered the composition of nutrient stoichiometry, which may, in turn, exacerbate certain toxic species to proliferate [7]. This is particularly true in the coastal waters of Kerala, southwest coast of India where nutrient availability is strongly influenced from riverine flux, domestic sewage effluents, seasonal upwelling and increasing cultural eutrophication. Though, the coastal waters are heavily impacted by human nutrient inputs, they are mostly understudied. The present study therefore discusses the seasonal and spatial variability in the nutrient distribution, stoichiometry, and phytoplankton biomass in the coastal waters of southwest India.

Materials and Methods

Geographical and environmental background of the study area

The Kerala coastline extending up to 570 km in length consists of beaches, ridges, riverine deposits, backwaters and coastline. The coastal land is characterized by farmlands, coconut plantations and extensive network of backwaters inter-connected with rivers and canals in the landside with most of them open into the coastal region.

Winds in this region are stronger (8-10 m/s) north easterlies during post monsoon (October - January) and pre monsoon (February - May), while south westerly during monsoon (June - September). The current direction is from south to north during November - January, and it reverses in February with strong north to south currents from May to October [8].

The coastal towns and villages generate about 351 MLD (million litres per day) of untreated sewage and it is disposed in the backwaters which ultimately impinge into the coastal environment. An estimated 17,104 m³/day of treated effluents from the industries are also discharged into the coastal waters.

Sampling and analytical methods

For the present study five different transects from central (Cochin, Chettuva) and northern (Ponnani, Calicut and Kasargod) Kerala coastal waters of southwest India were selected (Figure 1). Seasonal sampling representing post monsoon, pre monsoon and monsoon were carried out onboard CRV Sagar Purvi/Paschimi during the year 2008. Surface water samples from a distance of 0.5, 1.0, 3.0, 5.0, 7.5 & 10.0 km from the shoreline were taken for chlorophyll *a* (Chlorophyll *a*) and nutrient analysis using PVC Niskin Sampler (5L). The samples were filtered on board (Whatmann GF/C (0.45 µm), stored in polyethylene bottles under freezing conditions for subsequent nutrient analysis. Hydrographical parameters such as salinity (psu) and temperature (°C) were measured *in situ* using standard probes. pH was recorded using a portable pH meter WTW Multi Line P4,

*Corresponding author: Udaya Kumar P, Chemistry and Marine Biology Laboratory, Chemical Sciences Division, Centre for Earth Science Studies, Thiruvananthapuram-31 Kerala, India. Tel: +91-471-2511698; Fax: 0471-2442280, E-mail: udayannair@yahoo.com

Received: October 14, 2013 Accepted: May 19, 2014 Published: May 26, 2014

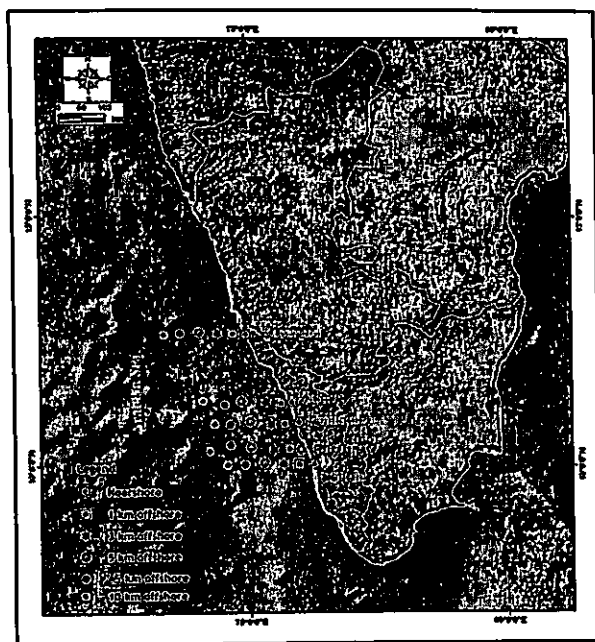


Figure 1: Area of Investigation along the southwest coast of India.

having a pH range of 0 – 14, possessing resolution of 0.01 and an accuracy of + 0.05 pH. The chemical estimation of dissolved oxygen was done onboard by Winkler's method. BOD₅ was determined after 5 days of incubation at 20 °C on board as well as at the shore laboratory. Nitrate-N (NO₃-N), Nitrite-N (NO₂-N), Ammonium (NH₄-N), Inorganic Phosphate (PO₄-P), Inorganic silicate (Si(OH)₄-Si) in filtered samples and Total Nitrogen (TN), Total Phosphorus (TP) in unfiltered samples were analysed spectrophotometrically by standard methods [9]. The data quality was ensured through careful standardization, procedural blank measurements, spike and duplicate samples. For Chlorophyll *a* determination water samples are filtered through glass fiber filter (GF/C; Whatman) with a gentle vacuum (of less than 100 mm Hg). The actual sample volume can range from 100 mL to 4 L, as long as the filter is distinctively green. The sample is then wrapped in aluminum foil and frozen for later analysis. The filter is extracted in 90% acetone, centrifuged, refrigerated in dark for about 20 – 24 hrs and the light absorbance at particular wavelengths (750, 664, 647 and 630 nm) is recorded in a spectrophotometer [10]. Dissolved Inorganic Nitrogen [(DIN)=(NO₃-N + NH₄-N + NO₂-N)] and PO₄-P, Si(OH)₄-Si concentrations were used to calculate atomic ratios of N:P, Si:P and Si:N.

Phytoplankton samples were collected by filtering 1l of surface water through a 50µm sieve in order to yield maximum counts of log phase group. The filtrate was preserved in 4% formaldehyde. The abundance of phytoplankton was expressed as% [11]. Primary production was estimated as described by Strickland and Parsons [12].

Statistical analyses

Principal component analysis (PCA) is one of the best statistical tools for extracting linear relationships among a set of variables [13]. This can be a valuable tool for resource managers for it can provide

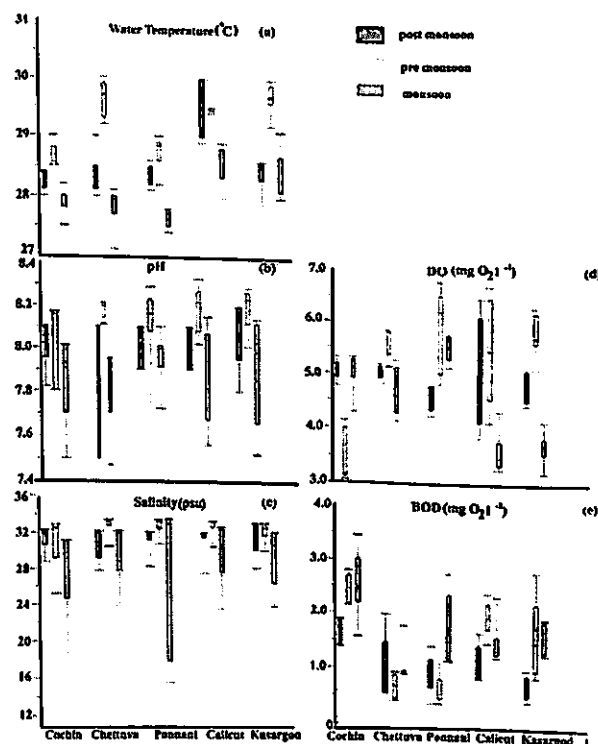


Figure 2: Seasonal variability of hydrographic parameters of the surface coastal water at sampling transects along the southwest coast of India shown through box-whisker plot.

information regarding the driving environmental variables effect on ecologic response variables [14]. The coastal water quality data were processed by applying PCA. The PCA was carried out with factors having eigen vectors greater than one (Kaiser criterion). Correlation matrix was used in PCA. The principal components were extracted in decreasing order of importance so that the first PC accounts for as much of the variation as possible and each successive component accounts are lesser. The most significant variables in the components represented by high loadings (> 0.6) are taken into consideration for evaluating the components [15]. During PCA the loadings were suppressed to less than 0.1 in absolute value and thus small values are replaced with blanks. The quality of data for factor analysis is confirmed with Kaiser-Meyer-Olkin (KMO) test. The Principal Component loading of water quality variables obtained for each seasons were combined and analyzed. Pearson correlation was also performed to find out the significant relation between hydrographic - nutrient variables and towards the phytoplankton biomass. Multivariate statistical approaches such as PCA and Regression Analysis (Pearson correlation) have been used by researchers for deriving the significance of specific parameters among the data generated [8,16]. The statistical package, SPSS 11.0 was employed for doing the PCA and Regression analysis.

Results and Discussion

Hydrographic characteristics

Temperature of the surface water followed seasonal changes in

തൂടി



2019



തൂടി

റിഡർഷൻ

ISSN 2320-8980

26

2019 ഏപ്രിൽ - ജൂൺ

വാല്യം -7 ലക്കം -2



മലയാളവിഭാഗം, കണ്ണൂർ സർവ്വകലാശാല,
ഡോ.പി.കെ.ശാജൻ മെമ്മോറിയൽ ക്യാമ്പസ്, നീലംവരം
കാസറഗോഡ് ജില്ല, കേരളം - 671 314
ഇമെയിൽ: thudipknnu@gmail.com

20. അതിഥിവനത്തിന്റെ ഗാഥ കെ.ആർ.മീരയുടെ 241
ആത്മരൂപം എന്ന കഥയിൽ
ശ്രീയ പി.പി.
21. കൃഷ്ണശ്ലീ കവിത : സംസ്കാരം 252
പാമസര്യം ആധുനികത
വിനോദ് കെ.എസ്.
22. വിവർത്തനവും സംസ്കാരവും : പരിമിതികൾ 260
ശാലിനി രാമചന്ദ്രൻ
23. സാഹിത്യചരിത്രത്തിൽ തമസ്ക്കരിക്കപ്പെട്ട 267
ഇടയനാടകങ്ങൾ
ടെജി കെ.രതോമസ്
24. പുരാതനഭാര്യയുടെ അടയാളങ്ങൾ ആൽകെമിസ്റ്റിൽ 271
അഡം ജൂബിൽ മറ്റപ്പള്ളിൽ

2019

APPLICATION AND USES OF INFORMATION COMMUNICATION TECHNOLOGY (ICT) IN ACADEMIC LIBRARIES WITH REFERENCE TO ARTS AND SCIENCE COLLEGES IN TIRUNELVELI DISTRICT, TAMIL NADU : A STUDY


Dr. Paul John

College Librarian, St. Gregorios College, Kottarakkara, Kollam District, Kerala, India.

Dr. P. Balasubramanian

*University Librarian, Manonmaniam Sundaranar University, Abishekapatti, Tirunelveli - 627012, Tamil Nadu, India,
bala_phd2010@yahoo.com*

Follow this and additional works at: <https://digitalcommons.unl.edu/libphilprac>

 Part of the [Library and Information Science Commons](#)

John, Dr. Paul and Balasubramanian, Dr. P., "APPLICATION AND USES OF INFORMATION COMMUNICATION TECHNOLOGY (ICT) IN ACADEMIC LIBRARIES WITH REFERENCE TO ARTS AND SCIENCE COLLEGES IN TIRUNELVELI DISTRICT, TAMIL NADU : A STUDY" (2019). *Library Philosophy and Practice (e-journal)*. 2809.
<https://digitalcommons.unl.edu/libphilprac/2809>

**APPLICATION AND USES OF INFORMATION COMMUNICATION TECHNOLOGY
(ICT) IN ACADEMIC LIBRARIES WITH REFERENCE TO ARTS AND SCIENCE
COLLEGES IN TIRUNELVELI DISTRICT, TAMIL NADU : A STUDY**

Dr. Paul John

College Librarian,

St. Gregorios College, Kottarakkara, Kollam District, Kerala, India.

Dr.P.Balasubramanian

University Librarian, Manonmaniam Sundaranar University, Abishekapatti,

Tirunelveli - 627012, Tamil Nadu, India. E.mail id: bala_phd2010@yahoo.com

ABSTRACT

Information and Communication Technology (ICT) is an important resource of a Modern Library or Information centre. The ICT is the electronic means of capturing, processing, storing and communicating information. It encompasses an array of hardware, software services and networks that enables access to digital information. Hence, this study deals with the application and uses of Information Communication Technology (ICT) in Academic Libraries with reference to Arts and Science Colleges in Tirunelveli. The researcher had employed a well structured close - ended questionnaire for collecting the required data from PG students, Research scholars and Faculty members of six colleges that are serving within the corporation area of Tirunelveli and affiliated to Manonmaniam Sundaranar University, Tirunelveli. Survey method was used for collecting primary data. The findings of the study of the respondents are adequacy of using ICT based resources. The study reveals that 781 (56.44%) respondents always using ICT based resources, 632 (40.49%) sometimes using ICT based resources.

Key words: Information, Communication, Technology, E-resources, ICT, Internet.