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National Conference on Recent Trends and Developments in Environmental and Basic Sciences (RTDEBS-2018)

Organised by
Faculty of Science
In collaboration with
Internal Quality Assurance Cell (IQAC)
Dr. S. D. D. Arts College & Commerce & Science College, Wada
Wada, Dist: Palghar - 421303, , Maharashtra, India

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I, Principal N.K. Phadke declare that all the information given above is correct to best of my knowledge.

Principal N. K. Phadke
Publisher

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Shri. Omprakash Ishwardas Arora
Working President
Shikshak Sanchalit Shikshan Sanstha

On behalf of Shikshak Sanchalit Shikshan Sanstha , I am very happy to welcome you all from various colleges and institutes of Maharashtra and other states to participate in One Day National Conference on “Recent Trends and Developments In Environmental and Basic Sciences” (RTDEBS-2018) organized by faculty of Science. The focus of the College is mainly on teaching-learning and research development for tribal students. We strive for promotion of research culture for which all kinds of facilities are provided to teachers and students.
I appreciate the initiative taken by faculty of Science the college in arranging this in One Day National Conference providing wide scope for researchers, teachers and students to interact on a single platform. I hope there will be sincere and fruitful discussion on Recent Trends and Developments In Environmental and Basic Sciences.

Wish you all the best for grand success of the conference.

Prin. N.K. Phadke
Principal
Dr. S. D. D. Arts College & Commerce
& Science College, Wada.

It is great pleasure for me that faculty of Science, Dr. S. D. D. Arts College & Commerce & Science College, Wada is hosting the One Day National Conference on “Recent Trends and Developments in Environmental and Basic Sciences” (RTDEBS-2018). This Conference will be useful for professors, young researchers and students from universities, colleges, academic institutions and industries to participate in and discuss the Recent Trends and Developments in Environmental and Basic Sciences, promote the exchange of ideas and create an opportunity for building young scientists to get exposed to the excitement of research in Sciences. We encourage the staff for research projects from university, UGC, DST, SERB etc., and publication in UGC approved academic journals and participation in conferences, workshops and symposia.

On behalf of the college and Shikshak Sanchalit Shikshan Sanstha. I extend my warm welcome to all the delegates and participants of this conference.

I hope the outcome of the conference will have a universal application. I extend my warm wishes for the success of the conference.

Regards

Prof. Dr. A.D. Sawant

M.Sc. Ph.D (Chem)
Prof. of Chemistry & Environmental Science
Former : Head Environment Science Dept., Sectional Head , Inorganic Chemistry Division
(Founder of M.Sc. Environmental Science discipline University of Mumbai)
Vice Chancellor University of Rajasthan
Pro. Vice Chancellor University of Mumbai
Joint Director Higher Education

Professor of Chemistry (Rtd), Institute of Science, Mumbai .Guided 26 students for Ph.D. of which 10 in Environmental Science .Published over 150 papers in national and international journals of Chemistry and Environmental Science.Executed 17 Reaserch Projects of which one was from IAEA, Vienna. Fields of research: Inorganic, Nuclear, Analytical, Environmental and Solid State Chemistry. Developed nuclear science techniques for toxic trace elements separation for chemical and the environmental analysis. Was first to disclose Pb pollution at Dadra Nagar Haveli where 400 cattle head perished and resident people were found to be at great risk resulting into closure of factory. Handled Vaitarna river pollution due to fertilizer and acid plant. Carried out extensive studies of fresh water rivers i.eMula, Mutha, Kalu, Vaitarna and Savitri rivers. Carried out extensive studies of toxicity to benthicorganism (Prawn & Crab) Fish. In creek of Mithi – Mahim, Thane, Varsova, Navi Mumbai. Worked as an adviser to many environmental issues, committees and many Institutions. Developed the technologies on wastewater, air pollution control techniques.

As an academic administrator contributed to: Committee for Shikshan shulk and Admission Committee. Was member of Committees for B.Ed Admissions, Private University Act, Law University Act and Amendment to Maharashtra University Act.Was a Member of delegation of Mumbai university to USA and Canada. Was invited to Denmark, UK, Belgium, Turkey for an academic assignments.

- ✓ Published an article in encyclopaedia of analytical science of Cambridge University.
- ✓ President of Society for Clean Environment (SOCLEAN)
- ✓ Vice President, National Society of The Friends of Trees
- ✓ Ex. President, Mumbai Rose Society
- ✓ Chief Trustee, Institute of Science Golden Jubilee Trust Fund
- ✓ Presently working as Director, WTERT – India (Waste to Energy Research & Technology Council) Global Council of Columbia University.
- ✓ Member of Academic bodies of various universities: ICT, University of Rajasthan, Ramaiya University, Bangalore, SVNIT, Surat and Environmental Advisor to Surat Municipal Corporation.
- ✓ Member of Environmental Committees of State and Central Govt.

Professor Dr. B. P. Bandgar
M.Sc. M.Phil. Ph.D. (Vienna, Austria)
Former Vice Chancellor, Solapur University, Solapur.

Teaching Experience: 33 years
18 Years in Rayat Shikshan Sanstha, Satara (M.S.).
10Years in Swami Ramanand Teerth Marathwada University, Nanded (M.S.).
05 Years at Solapur University, Solapur (M.S.).

Research Experience: 27 years

Research Publications: More than **400** (All International)

Citation Index = More than **5000** **Impact Factor** = More than **4000**

H – Index= 35

No. of Ph. D. Students produced : 50 **No. of Students Working for Ph. D.** : 05

No. of Ph. D. Thesis Submitted : 02

Active participation in development of School of Chemical Sciences and University Campus of SRTM University, Nanded(MH) since inception.

Research Areas of Interest:
1. Development of Novel Synthetic Methods in Organic Chemistry.
2. Carbohydrate Chemistry.
3. Medicinal Chemistry.
4. Synthesis of Bioactive Molecules.

Awards, Honors, Scholarships and Fellowships:
1. Rank of Honorary Colonel Commandant NCC, Govt. of India – 2010.
2. Excellent Teacher award of State Govt. of Maharashtra : September 2006.
3. Austrian Govt. fellowship (OAD) for Doctorate degree at University of Vienna:1988-1991.
4. Young Scientist award (ICC): 1994.
5. Tetrahedron Letters Award (USA) for most cited paper during 2003-06: Sept. 2006.
6. Lok Raja Shahu Maharaj Award – 2008.
7. Vivekanand Puraskar – 2008.
8. Sangola Ratna – 2008.
9. Adarsh Samajbhushan Puraskar ,Pune-2011
10. R.N.Chavan Puraskar, Vai (Satara)-2011
11. Avishkar Puraskar ,Kolhapur-2011
12. Fellow of Maharashtra Academy of Sciences: January 2003.
13. UGC visiting fellow Sardar Patel University, Vallabh Vidyanagar, Gujrat 2006 and 2007, Rashtrasant Tukdoji Maharaj Nagpur University, Nagpur:2006-2007.

Invited Lectures: Many National and International Seminars, Conferences, Symposia, and Refresher courses.

Editor for many international research journals

Referee for evaluation of Ph.D. thesis: 21 Different Universities in India and abroad.

Research and research related Funds: Total **Seven crore twenty Lakhs.**

Patents: 13

(i)One US Patent

(ii) One Canadian Patent.
(iii) One South-African Patent
(iv) Ten Indian Patents.

Dr. R. R. Deshmukh,
M.Sc. Ph.D. B.Ed.
Professor of Physics
Institute of Chemical Technology, Matunga, Mumbai 400 019 India.
Email: rr.deshmukh@ictmumbai.edu.in, rajedeshmukh@rediffmail.com

Dr. Deshmukh joined ICT (formerly known as UDCT) as an Assistant Professor in 1996. Currently he is working as a Professor of Physics and Controller of Examinations in the Institute of Chemical Technology (ICT), Matunga, Mumbai,

He has visited University of Maryland under TEQIP for three months in 2007. He was a **Post**-Doctoral Fellow at the University of Texas, Arlington (USA) from February 2009 to March 2010. Research Interest: Plasma Technology, Polymer Physics, Functionalization of nano-particles. Molecular tailoring of surfaces using plasma for biomedical applications, textile physics, PECVD, thin films, Electro-optical properties of Polymer Dispersed Liquid Crystals. Polymer nano composites materials. Conducting polymers, Gas sensors etc.

Students Guided: Ph.D. 5 (completed), 5 (ongoing)M.Sc. 2 (completed), M. Tech: 2 (completed)
Completed Govt. sponsored and Industry sponsored projects
Publications: International-85, National-04, Book Chapters-06
Patents: 01 (US patent applied)

Delivered invited talks in various national and international conferences.
Courses taught: Heat, Optics, Lasers and Fibre optics, Ultrasonics, Electricity and Magnetism, Modern physics, Chemical Physics, Solid State Physics. Instrumental methods for chemical analysis.

Editorial Board Member: International J of Materials Science and Applications, Science Publishing Group.International J of Chemical and Physical Sciences.
BOS member in Physics: Dr. Babasaheb Ambedkar Technological University, Lonere
K. J. Somaiya Institute, Mumbai
Member of Selection committee and CAS promotions in Physics, Nagpur University
Subject expert for MPSC

Name : Dr. Moses Kolet

Designation : Associate Professor, Department of Botany
Associate NCC Officer (Rank- Captain)

Qualification : M.Sc., M.Phil, Ph.D. FSAB, FBFI

e-mail address : mjkolet@vpmthane.org,
mjkolet@hotmail.com

Research Area : Botany, Mycology, Applied Mycology, Fungal Endophytes, Environmental Biotechnology, Rural Biotechnology

No. of Research papers Published : 25

No. of Research papers Presented : 48

Membership in University:

- Appointed as University Observer
- Appointed as Zonal Chairman of Vigilance Squad, University of Mumbai
- Appointed as In charge of Nodal Centre for University Examinations
- Appointed as Joint Chief Conductor for University Examinations
- Appointed as Member of University Committee for selection of Students Council, University of Mumbai
- Appointed as Member of University Accommodation Committee, All India Vice- Chancellor's Conference, Mumbai
- Appointed as Member of University Syllabus Committee in Botany
- Appointed as Paper setter and Examiner at PG Examinations in Botany (Swami Ramanand Teerth Marathwada University, Nanded)

About the National Conference

There is an urgent need to discuss the problems related to the environment and basic science resources and their applications so that they can be useful for human being. This conference will provide a forum for professors, young researchers and students from universities, colleges, academic institutions and industries to participate, discuss the recent advances in environment and basic sciences and to create awareness about research in basic science as well as its application through research involved in the field. Eminent personalities from academic and research institutes will enlighten the participants through different sessions.

Themes:

- Environmental chemistry
- Green chemistry
- Synthetic Organic Chemistry
- Nano-materials and their applications
- Cosmology and Astrophysics
- Electronics and communications
- Material Science
- Molecular biology and systematics
- Biodiversity and its conservation
- Biotechnology and Bioinformatics
- Animal and plant physiology
- Mathematics and its applications
- Zoology and Micro Biology

Key Note:

Prof. Dr. A.D. Sawant
M.Sc. Ph.D (Chem)
Prof. of Chemistry & Environmental Science
Former: Head Environment Science Dept., Sectional Head , Inorganic Chemistry Division

Resource Person:

- Dr. B. P. Bandgar, Former Vice-Chancellor, Solapur University, Solapur.
- Dr. R. R. Deshmukh, Indian Institute of Technology, Mumbai.
- Prin. Dr. Moses Kolet, G. M. Momin College, Bhiwandi.

One Day National Conference

On

“Recent Trends and Developments In Environmental and Basic Sciences”

Saturday, 10th March 2018

Inauguration Function

Welcome Address:	Prin. N. K. Phadke
About the National Conference:	Dr. R. S. Mane
Inauguration:	
Publication of Souvenir:	
Key-note Address:	Prof. Dr. A. D. Sawant
Vote of Thanks:	Dr. K. P. Joshi

Valedictory Function

Address by Organising Secretory:	Mr. A.S. Pansare
Principal’s Address:	Prin. N. K. Phadke
Presidential Address:	Prof. Dr. N. T. Joshi
Vote of Thanks:	
Vande Mataram:	

One Day National Conference

On

"Recent Trends and Developments in Environmental and Basic Sciences"

Programme

Saturday, 10th March 2018

9:15am-10.00 am	**Registration**
10:15am-10.30 am	**Inauguration**
10:30am-11.45 am	**Key Note Address**
11:45am-1.00 pm	**(Session I) Dr. B. P. Bandgar**
1.00pm -2.00pm	**Lunch and Poster Session**
2.00pm -3.30pm	**(Session II) Dr. R. R. Deshmukh**
3.30pm -4.15pm	**(Session III) Dr. Moses Kolet**
4.15pm -4.45pm	**Valedictory**
4.45pm -5.00pm	**Distribution of Certificate**

-Venue-

Conference Room 1st Floor
Dr. S. D. D. Arts College & Commerce
& Science College, Wada.

About the Institution:

Shikshak Sanchalit Shikshan Sanstha, Wada is an educational, social and cultural institute registered under society registration act started its operation in 1968 by late Shri. S. P. Kulkarni. “Shikshak Sanchalit Shikshan Sanstha is an institute which is run by a few dedicated and selfless teachers which is situated at Wada, Palghar, Maharashtra, India. We believe in bringing social and cultural change through value education and service to the society. We have undertaken the task of educating the most uncared human beings of our society, especially tribal students of remote forested area inhabited of known Wada, Vikramgarh and Dahanu tahsils of Palghar - a Tribal district. In the tribal belt of Palghar district, 80% tribal populace are below poverty level. We have been starving to educate in order to uplift these tribal and other backward human being through mainstream society despite of tremendous constrains. Main objectives of the institution are-

1. To provide value based quality education to the tribal students
2. To bring cultural transmission through education
3. To provide career oriented courses
4. To eradicate evils of the tribal society such as superstitions

At present our institute runs a senior college - Dr. S. D. D. Arts College & Commerce & Science College, Wada, affiliated to Mumbai University, a junior college, three secondary schools and a technical school. We have five hostels for tribal students (free lodging and boarding), a gymnasium and a computer center.

About the College:

After establishment of the Degree College (Arts and Commerce streams) in 1981, it was the only college existing in Wada tehsil at that time. The progress of the college since its establishment has been remarkable. It began with 50 students and now the number of students has reached about 5500. Out of them 85% are the tribal students. In 2013-14, we have started the first Degree College of Science stream in Wada tehsil. The college have well qualified and experience staff and Science faculty runs four UG courses in Chemistry, Physics, Botany and Mathematics.

Recently, on the occasion of 48th International Mother Earths Day, we have started “Environment Forum”, through which we are educating students there by society about many environment issues like Global warming, Deforestation, Pollution etc.

CONTENTS

National Conference on Recent Trends and Developments in Environmental and Basic Sciences (RTDEBS-2018)
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Biodiversity Conservation and Management

Dr. Bhika. Lala. Jadhav
Associate Prof., HOD Commerce Gokhale Education Society's Arts, Commerce and Science College, Jawhar, Jawhar, Palghar, Maharashtra, India

ABSTRACT

The climate of the Earth is changing from years to year due to the human activities and naturally occurring processes. Biodiversity is the biological diversity which includes the variety of the all species present on earth. It includes plants, animals, micro-organisms and their genes, terrestrial, water ecosystems, and marine ecosystems in which they all are present. Biodiversity is considered at three different levels including species diversity, genetic diversity and ecosystem diversity. Biodiversity provides food from livestock, fish, crops, and forestry. It is of use to modern agriculture as a source of new crops, as a source of material for breeding improved varieties and as a source of new biodegradable pesticides. Biodiversity is a rich source of substances with therapeutic properties. Some of the existing measures of biodiversity conservation include; zoological gardens, botanical gardens/arboretums, seed banks, national parks and game reserves. Biodiversity is very important for our existence as well as valuable in its own right. Many of the important pharmaceuticals have originated as plant-based substances, which are of incalculable value to human health. This is because it provides the fundamental building blocks for many goods and services which provide a healthy environment to lead our life. Conservation and sustainable uses of biodiversity have been an integral part of Indian ethos. The varied eco-climatic conditions coupled with unique geological and cultural features have contributed to an astounding diversity of habitats, which harbor and sustain immense biological diversity at all levels. The challenge is for nations, government agencies, organizations and individuals to protect and enhance biological diversity, to ensure intra and intergenerational equity, it is important to conserve biodiversity.

Keywords: Biodiversity, Human activities, Conservation, Values

I. INTRODUCTION

The climate of the Earth is changing from years to year due to the human activities and naturally occurring processes. By the human activities like industrialization, pollution due to Industrial revolution mean surface temperature of Earth increased at an average of 10 Celsius per century. Due to the accumulation of green house gases in atmosphere and also due to the water pollution the water quality is also changing & to adjust to the changed environmental conditions some adaptations occurs in the organisms to adjust the changed environmental conditions & Mutations are also occurring due to this mutations in genetic makeup of the organisms, the newer species are arising and many species which do not change according to the changes, becoming extinct.

Biological diversity or Biodiversity is threat part of nature which includes the differences in genes among the individuals of a species, the variety and richness of all the plant and animal species at different scale in space, locally, in a region, in the country and world, various types of ecosystems, both terrestrial and aquatic, within a defined area."

Thus, biodiversity includes genetic variation within species, the variety of species in an area, and the variety of habitat types within a landscape. Biodiversity is of much importance to functioning of all natural and manmade ecosystems. Living organisms play central roles in the cycles of major elements (Carbon, nitrogen, etc) and water in environment and diversity specifically is important, thus these cycles require numerous interacting species.

II. LITERATURE REVIEW

The term biodiversity was coined by Walter and Rosen (1985) and is the abbreviate word for Biological diversity (Samit Roy and Arun K. Roy 2010). Biodiversity or biological diversity refers to the range of life forms on Earth, including millions of plants, animals and microorganisms. During the last 200 million years, 100 to 1,000 species became extinct in each century (Wilson 1988)) forth new life forms replacing species that were lost. Today, we are losing about 1,500 species every two months (Kothari 1992). That's why the year 2010 & decade 2010-20 is declared as the international biodiversity year & decade respectively. The 1992 United Nations Earth Summit in Rio de Janeiro defined 'biodiversity' as "the variability among living organisms from all sources, including, 'inter alia', terrestrial, marine, and other aquatic ecosystems, and the ecological complexes of which they are part: this includes diversity within species, between species and of ecosystems" (UNEP 1992).

III. OBJECTIVES OF THE STUDY

The Study is based on following objectives:

1. To know the present scenario of Biodiversity.
2. To know importance of Biodiversity.
3. To know the different types of Biodiversity.
4. To know the values of Biodiversity.
5. To know the profile of Biodiversity in India

IV. RESEARCH METHODOLOGY

The study is based on secondary data. Data has been collected from National and International Journals, Government publication and websites related to Biodiversity. On the basis of data available from various sources research finding and conclusion are made.

V. RESEARCH FINDINGS

A) Types of Biodiversity

1. Genetic diversity

Genetic diversity is the raw material that permits species to adjust to a changing world. Whether these changes are natural or caused by human interfere. Each member of any animal or plant species differs widely from other individuals in its genetic makeup because of the large number of combinations possible in the genes that give every individual specific characteristic. The more variation there is the better chance that at least some of the individuals will have an allelic variant that is suited for the new environment & the genetic variability is also essential for a healthy breeding population of a species. If the number of breeding individual is reduced, the dissimilarity of genetic makeup is reduced and inbreeding occurs. Eventually this can lead to extinction of the species. The diversity in wild species forms the gene pool from which our crops and domestic animals have been developed over thousands of years, and newer varieties of crop plants & domestic animals are produced by using the wild type varieties. Modern biotechnology manipulates genes for developing better types of medicines and variety of industrial products. There is a delicate interdependence between biological and genetic diversity changes in biodiversity results in changes in the environment, requiring subsequent adaptation of the remaining species.

2. Species diversity:

Species diversity constitutes the number of species of plants and animals present in a region. Species diversity is a measure of the diversity within an ecological community that incorporates both species richness (number of species in a community) and evenness of species abundance. This diversity is seen in natural or man engineered ecosystems some areas are more rich in species than the others for example Natural undisturbed tropical forests have a greater species richness than plantations developed by the forest department for timber production, thus the value of natural forest for species richness is more than plantations. Species diversity is one component of the concept of biodiversity and is influenced by species richness communities with more species are considered to be more diverse. For example a community containing 10 species would be more diverse than a community with 5 species. Species diversity also influenced by the relative abundance of individuals in the species found in a community.

3. Ecosystem diversity :

It is also known as Ecological diversity Ecological diversity is the variety of biological communities, as forests, deserts grasslands and streams that interact with each other and with their Physical and Chemical environments. Ecosystem diversity can be described for a specific geographical region or political entity as country State, District, Taluka, small village or any small pond. Ecosystem includes natural ecosystems as forests, grasslands, deserts seas, rives or manmade ecosystems as crop field, dams, lakes etc.

B) Value of Biodiversity

At global, regional and local levels the environmental services from species and ecosystems are essential. The reduction of carbon dioxide & production of oxygen, to maintain the water cycle, to protect the soil are important services. It is now well known fact that loss of biodiversity is the cause of environmental climate change. Forests are being lost day by day which is coupled with increasing carbon dioxide level in environment and decrease in oxygen level because the forests convert CO2 to O2. Industrialization on increase the release of carbon dioxide and other gases & contributes to green house effect global warming is warming, the ice caps converting ice in to liquid form, which is resulting in rise in sea level which is submerging the law lying areas under sea water. The environmental temperature is also increasing. Some areas of world are facing with serious droughts & some areas are facing floods. The biodiversity is also important to preserve the ecological processes as fixing & recycling of nutrients, soil formation, circulation of water & air, watershed protection, erosion control etc.

1. Consumptive Value

Local forest communities directly utilize timber, food fuel wood, fodder etc. The biodiversity provides forest dwellers their daily needs as food, building material, fodder, medicines and other materials. Forest dwellers know different species of trees their qualities & their different uses. They collect daily the local fruits roots and plant material that they use as food, construction material or medicines. Fisher men depend on fishes and know where & how to catch fish and other edible aquatic animals and plants. Many fishes have the medicine values other aquatic animals & plants are also having good food, medicinal values and also having the economic values.

2. Productive values:-

The biodiversity has a greatest producing value in production of goods & services. The pharmacologist obtain drugs from plants and animals as atropine from belladonna, caffeine from Tea, Coffee cocaine from cocoa, menthol from mint, papaya proteinase from papaya, penicillin from penicillium fungi quinine from yellow cinochrona etc. Biotechnologists uses boorish areas to search for potential genetic properties in plants and animals that can be used to develop better verities of crops & animals, for industries the biodiversity is a store house from which new products develops. For the better good production the biodiversity plays an important role, as a raw material.

3. Social Values :

The consumptive & productive values biodiversity are closely linked to social concerns in traditional communities. Ecosystem people value biodiversity as a part of their livelihood as well as through cultural and religious sentiments. Cultivators cultivate number of plants varieties & if one variety of plant fails to grow other grows & acts as insurance. Traditional societies require less resource that preserved their biodiversity as a life supporting resources. Modern man has rapidly depleted it even to the extent of leading to the irrecoverable loss due to extinction of several species. Thus, apart from the local use or sale of products of biodiversity, there is a social aspect in which more and more resources are used by different societies.

4. Ethical values

Each species is unique and has a right to exist. Each species is worthily of respect regardless of its worth to human beings. Ethical values related to conserve biodiversity based on importance of protection all forms of life.

5. Aesthetic Values :-

Each species & ecosystem adds to the richness and beauty of life on the planet. Once a species becomes extinct it gone forever. A natural ecosystem once destroyed, it is impossible to recreate. The value people attribute to the aesthetic function of nature is partly reflected in the number of people who visit areas of natural beauty. This function near or within a dense human settlement is best seen at Sanjay Gandhi National Park on the outskirts of Bombay, which receives traffic of 15 lakhs visitors every year (Kothari et al 1989). Knowledge and appreciation of the presence of biodiversity for its own sake is another reason to preserve it. Killing wildlife for food is less important than to attract tourist. Biodiversity is a beautiful & wonder aspect of nature, sitting in a forest & listening to birds songs, observe the spider weave, its complex web observe, a fish feeding it is magnificent & fascinating.

6. Economic Values :

The every healthy ecosystem and each species are of potential value to human. Now the global collection of genes, species, habitats, and ecosystems are the resources that are providing human needs, and are also essential for human survival in the future. Humans depend on other species for all of their food and for many medicines and industrial products. In developing countries up to 80 percent of people depend on traditional medicines for primary health care, most of which derived from plants animals & mineral sources. 20,000 species of plants are medicinal nearly about 25 percent of all prescription drugs used in developed world are based on plants including 21 indispensable mainstream drugs, plants contain complex chemical structures which may be impossible to synthesis in laboratory.

Therefore, biodiversity represent a living library of options for adapting to local and global change.

C) BIODIVERSITY OF NATIONAL & LOCAL LEVELS.

India is very rich in all aspects of biodiversity it stands 8th position in biodiversity of plants. Varying Physiographic & climatic conditions at different parts of India are the reason for this high level of biodiversity. India has about 329 million hectare & has almost all kind of ecological zones found in the world it has two of the 34 recognized biodiversity. Hotspots, in the Himalaya & Westerns ghats.

1. The Himalaya

The Himalayan mountain range is important hot spot of India. Stretches over 3000 kilometers of northern Pakistan, Nepal, Bhutan, Northwestern and Northern states of India.

a. Diversity of Plants

In Himalaya about 10,000 species of plants have been reported of which 3160 species & 71 genera are endemic, five plant families Tetracentraceae, Henamelldaceae, Circaestraceae, Butomaceae and stachyuroceae are endemic to this region. Largest family of flowering plants is orchidaceae with 750 species.

b. Diversity of animals :

Nearly 980 species of birds (15-endermic). About 300 mammal species have been recorded in Himalaya (9 dozan endemic), 175 species of reptiles & 105 species of amphibian (50 & 40 endemic respectively), 270 species of fishes (30 endemic). Including cyprinidae 93 species (11 endemics). Baliotozidae 47 species (14-endemic) sisordae 34 species (4-endemic)

Table 1. The vertebrate animal species of Himalaya.

Class	species
Fishes	270
Amphibia	105
Reptiles	175
Birds	980
Mammals	300

2) The Western Ghats :

Western Ghats contain Malabar plains & the chains of mountains running parallel to India's westerns coast (30-50 Km. in land) & covering about 1,60,000 km2 area. The westerns Ghats contains about 5000 species of vascular plants belonging to 2200 genera about 700 species and about 58 genera endemic. In India, 48,000 species of plants are present which belongs about 11% of world flora & 80,000 species of animals belonging about 6.4% of the world's fauna. India's floral diversity includes 17,500 species of angiosperms over 64 species of Gymnosperms 1,022 species of Pteridophytes, 2,843 species of Bryophytes 1,600 species of Lichens 23,000 species of fungi & 2,500 species of Algae (Table-2).The faunal diversity of India includes 5,000 species of Molluscs 60,000 species of Insects, 1,693 species of fishes 205 species of amphibians, 400 species of reptiles 1,200 species of birds & 372 species of mammals (Table 3).

Table 2. Floristic diversity of India.

Group	Number of species
Angiosperms	17,500
Gymnosperms	64
Pteridophytes	1,022
Bryphytes	2,843
Lichens	1,600
Fungi	23,000
Algae	2,500

Table 3. Faunal diversity of India.

Group	Number of species
Mammals	372
Birds	1,200
Reptiles	420
Amphibians	205
Fish	1,693
Mollusks	5,000
Insects	60,000

(Biodiversity profile of India)

India as a centre of Origin:

India is one of the 12 primary centers of origin of crop plants and domesticated animals. India is homeland of 167 agriculturally important plant species and also India is home of 114 breeds of domesticated animals.

A species found in a particular region and not present anywhere in the world is said to be endemic to that region & the unique phenomenon is called endemism. India biodiversity is rich is endemism. Nearly about 4900 species of flowering plants are endemic to India. About 3% of Indian flora and 62 % of India fauna are endemic. (Supriya Chakraborthy – 2004).

A) Biodiversity Conservation Strategies:

1. In-situ (on-site) conservation includes the protection of plants and animals within their natural habitats or in protected areas. Protected areas are land or sea dedicated to protect and maintain biodiversity.

2. Ex-situ (off-site) conservation of plants and animals outside their natural habitats. These include botanical gardens, zoo, gene banks, seek bank, tissue culture and cryopreservation.

B) Biodiversity Consrvation Efforts In India

At international level due to the awareness about the importance of biodiversity several international organizations working for conserving biodiversity since 1970. India has developed awareness in ancient period and rich knowledge on nature. Ancient 5 Criptures are justifying the need survival. Indian emperor Ashok planted different trees on sides of road to provide shade & shelter & be done knowingly or unknowingly great lot in conservation of trees. The "Bishnoi" communities of Rajasthan have projected antelopes as their blood brothers in time immemorial and still today in some remote areas they continue with painting antelope sketches on walls of huts. This revels a good understanding and relationship of man & animals.

The Chipko movement done by the women of Mandal Village of UP was against deforestation. The Narmada Bachao movement was done under leadership of Medha Patkar and Baba Amte. The Bali pal movement took place to protest against the use of fertile soil of Bali pal Region for missile testing. All these movements were primarily for protecting environment are the examples of awareness of Indian peoples for environment & indirectly Biodiversity Conservation.

VI. CONCLUSION

Conservation of Biodiversity, Management of Biodiversity and Sustainable development are inter-related branches focusing on economic growth, social progress, and environmental protection at the same time ecosystem conservation is also essential. Conservation includes the efforts carried out in protected areas such as Community reserves, National parks and in other areas with rich and important biodiversity where conservation is not the main focus. It is in these latter productive landscapes where sustainability is needed most. Sustainable management, Sustainable agriculture and sustainable fisheries of natural resources are the main approaches for preserving these landscapes for long-term economic, social, and ecological benefits.

VII. REFERENCES

[1]. B. R. RAMESH, Biodiversity Conservation and Management, Tropical Ecology 44(1): 85-91, 2003 ISSN 0564-32.

[2]. Dr. P.J. Sudhakar, Addl. Director General, PIB, Bhopal, Conservation of Biodiversity.

[3]. Joseph Wanjui, Biodiversity Conservation Needs and Method to Conserve the Biological Diversity, Wanjui, J Biodivers Endanger Species 2013, 1:3.

[4]. Kothari (1992), Biodiversity the way ahead, the India magazine.

[5]. Kothari A., Pande P., Singh S.and Variava D.(1989) Management of National Parks and Sanctuaries in India. A status report, Indian Institute of Public Administration New Delhi, August PP21-29.

[6]. Ministry of Environment and Forests Government of India, India's Fifth National Report to the Convention on Biological Diversity, Ministry of Environment and Forests, Government of India, 2014

[7]. Samit Ray and Arun K Ray (2010) Biodiversity and Biotechnology, New central book Agency Ltd.

[8]. Thecla M. Mutia, Biodiversity Conservation, Presented at Short Course IV on Exploration for Geothermal Resources, organized by UNU-GTP, Ken Gen and GDC, at Lake Naivasha, Kenya, November 1-22, 2009I

[9]. Wilson E.O (1988) Biodiversity, National Academy Press, Washington D.C.

[10]. www.google .com

[11]. www.observatoire-comifac.net

[12]. www.ebrd.com

[13]. https://cmsdata.iucn.org

[14]. www.observatoire-comifac.net

[15]. https://mscbiodiversity.org

[16]. https://sustainabledevelopment.un.org

[17]. https://en.wikipedia.org/wiki/Biodiversity

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Study of Different Breeding Site Activities of Openbill Stork, Anastomus Oscitans ,in Palghar, Maharashtra

Anuja A. Desale, R. B. Singh
Department of Zoology, S.D.S.M. College, Palghar, Maharashtra, India

ABSTRACT

Different breeding site activities like preening, neck movement, flapping, fighting, movement, yawning, regurgitation and feeding of Asian openbill stork, Anastomus oscitans were studied in Palghar during three breeding seasons from 2015 to 2017.Palghar is the newly carved Adivashi district of Maharashtra which is nearly 90 km away from Mumbai on the western railway. It was found that preening and neck movement were exceptionally high which in turn were helpful in social grooming and prevention from predator. In this paper authors have attempted to enumerate the different breeding site activities of Openbill stork.

Keywords: Openbill stork, breeding, Palghar.

I. INTRODUCTION

The Asian Openbilled stork, Anastomus oscitans, is a large wading bird in the stork family Ciconiidae. They breed amidst or near water bodies (Ali and Ripley 1995). The Asian Open Bill Stork is found as a resident colonial breeder. It was documented that total of the nineteen species of storks found globally, nine species occurred in India (Ali and Ripley, 1987).The self-maintenance activity is those that serve to remove sources of irritation, extraneous materials, care for the body surface and plumage, and counteracts the effects of muscular activity (Potts1976).A recurring idea in ecological literature is that the life history strategies of animals are inextricably linked with allocation patterns of time and energy (King 1974). Activity budget analyses have been useful in determining ecological, behavioral and physiological adaptations of avian species (Quinlan and Baldassarre 1984)

There are many studies that have been already documented nesting behavior, breeding behavior, parental care and foraging behavior, but hardly attempted to study different breeding site activities of Asian Openbill stork. We could find scanty references of these different activities. The present study aims to know different breeding site activities like preening, neck movement, flapping, fighting, movement, yawning, regurgitation and feeding of Asian open bill stork at Palghar railway station.

II. MATERIALS AND METHODS

The study area of Asian Openbill storks was Palghar district, Maharashtra. Geographic coordinates of Palghar-Latitude: 19°41′48″ N Longitude: 72°45′55″ Elevation above sea level: 17 m = 55 ft. Palghar railway station was the study site where Asian Openbill storks used to breed regularly. Regular observations were made at different time intervals of the day on different behavioral aspects. Observations were made with the help of binocular ,Camera and naked eyes. (Fig. 1a & 1b) .We kept observing one bird continuously for 10 minutes and in another 10 minutes observations were shifted on different bird like this full day was covered from dawn to dusk. Then the average of all the observations of one day was used as the frequency of that particular day. Finally the average of whole month was taken as the frequency of that particular activity for calculation purpose.


Figure 1a


Figure 1b

III. RESULT AND DISCUSSION

Monthly different activities of Openbill storks were observed during three subsequent breeding seasons between 2015 to 2017. It was observed that breeding season lasted for 6 months in Palghar area from first week of May to Ist week of November. During the breeding seasons different monthly activities of Openbill Stork were recorded like preening, neck movement, flapping, fighting, movement, yawning, regurgitation and feeding. The frequencies of each activity recorded monthly are given in Table 1 A to 1 C and Figure 2 A to2 C.

Table 1A. Different breeding activities of Openbill Stork during 2015

	MAY	JUNE	JULY	AUGUST	SEPTEMBER	average
P	8.11	6.97	9.7	14.71	5.65	9.028
NM	5.05	3.69	5.44	8.33	2.95	5.092
FLP	0.97	1.17	1.03	1	0.75	0.984
PAC	0.9	0.33	0.56	0.63	0.25	0.534
FT	1.2	0.55	0.56	0.75	0.75	0.762
M	0.98	0.78	0.67	0.66	1	0.818
Y	0.66	0.89	1.52	1.41	0.5	0.996
R	0	0	0.76	1	1.15	0.582
FEE	0	0	1.18	1.08	0.83	0.618

Table 1B. Different breeding activities of Openbill Stork during 2016

	MAY	JUNE	JULY	AUGUST	SEPTEMBER	average
P	7.13	8.29	11.79	15.01	9.37	10.318
NM	2.74	3.71	5.57	8.34	4.75	5.022
FLP	1.28	1.49	1.54	1.22	0.73	1.252
PAC	0.76	0.53	0.58	0.78	1	0.73
FT	0.71	0.81	0.83	1.07	0.3	0.744
M	0.88	0.73	0.82	0.4	0.67	0.7
Y	1.4	1.23	1.28	1	1.07	1.196
R	0	0	0.75	1.3	1	0.61
FEE	0	0	1.03	1.29	1.67	0.798

Table 1C. Different breeding activities of Openbill Stork during 2017

	MAY	JUNE	JULY	AUGUST	SEPTEMBER	average
P	10.33	11.01	16.1	18.2	13.25	13.778
NM	5.35	3.44	6.28	7.13	3.5	5.14
FLP	1.83	2.01	2.04	1.89	1.5	1.854
PAC	1.18	0.93	0.71	1	1	0.964
FT	1.07	1.14	0.93	1.1	0	0.848
M	1.17	0.76	0.93	1.3	0.8	0.992
Y	1.74	1.29	1.91	1.89	1.4	1.646
R	0	0	0.71	1	1.15	0.572
FEE	0	0	1.64	1.67	1.15	0.892

(P-Preening, NM-Neck Movement, FLP-Flapping, P-Packing, FT-Fighting, M-Movement, Y-Yawning, R-Regurgitation and FEE- Feeding)

Preening and neck movement were more in August followed by July and in rest of the months i.e. May, June and September it was moderate in the subsequent years (2015, 2016, 2017).Other activities like flapping, packing, fighting, movement, yawning, Regurgitation and feeding were less than moderate in all the three years. (**Figure. 2 A to 2 C)**

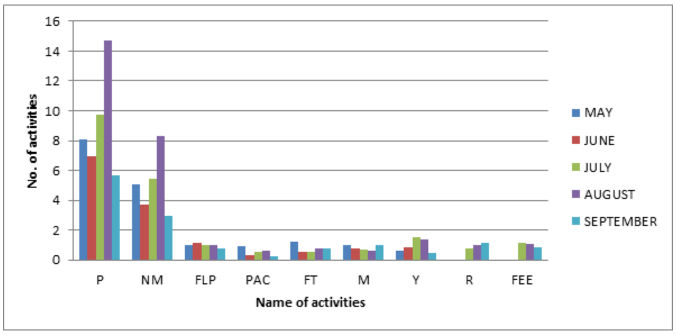

Figure 2A. Monthwise different breeding activities of Openbill Stork during 2015.

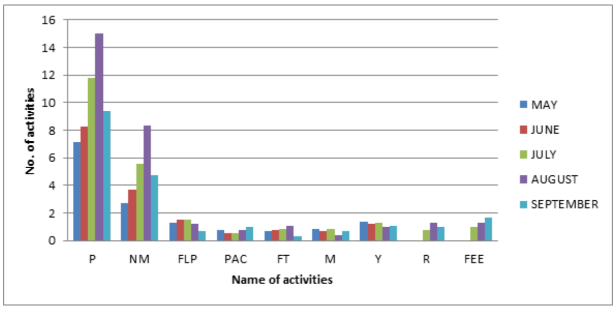

Figure 2B. Monthwise different breeding activities of Openbill Stork during 2016.

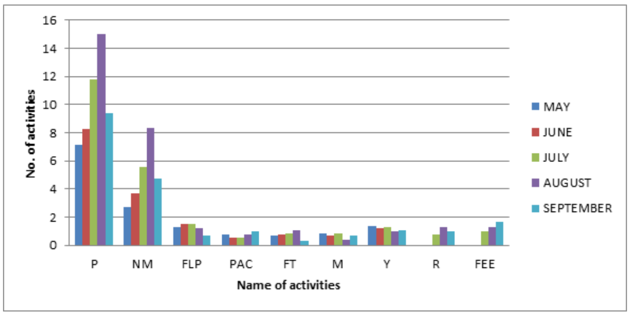

Figure 2C. Monthwise different breeding activities of Openbill Stork during 2017.

When we consider one breeding season as the one breeding year and plotted the graph from the observations, it was found that again preening was maximum followed by neck movement and other activities were found less than moderate.

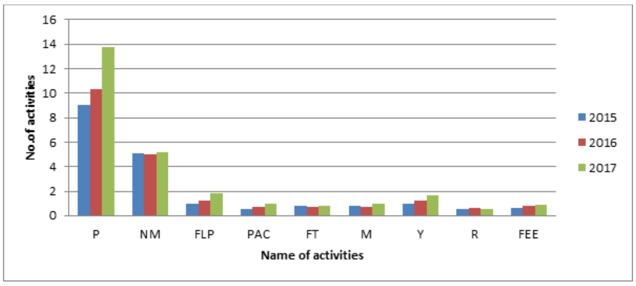

Figure 3. Yearwise different breeding activities of Openbill Stork during 2015 to 2017.

Aerial display, allopreeening, copulatory behaviors were observed in, Raiganj wildlife sanctuary, west Bengal (Pramanik et al., 2016). Innate behavioral activities of Openbill stork were recorded by Desale and Singh 2017, and opened that it will help to understand the energy budget for this bird and in turn their conservation. Singh et_al 2017, studied the nesting site activities of Asian Paradise Flycatcher, Terpsiphone paradise during breeding season like neck movement, eye movement, tail movement, beak movement and yawning. Preening is a type of behavior described and studied in many bird species, mainly in captivity, like budgerigars (Zampiga et al. 2004, Griggio and Hoi 2006, Griggio et al. 2010), domestic canaries Serinus canaria (Lenouvel et al. 2009), mallards Anas platyrhynchos (Delogu et al. 2010), feral pigeons Columba livia (Rózsa 1993, Waite et al. 2012), zebra finches Taeniopygia guttata (Kulkarni and Heeb 2007), with only few studies in the wild: swallows Hirundo rustica (Møller 1991) ,terns Sterna spp. (Van Iersel and Bol 1958). Varghese 2002 studied in Marottichal and Bhoothathankettu forests self-maintenance activities of Malabar Trogon.

It was found that preening and neck movement were highest in the month of July and August and moderate in May, June and September, which is very much correlated with the incubation and development of fledglings. Incubation started in June and the fledglings were seen in July. Since both the parents were engaged in nurturing the young ones they spent maximum time with their family during the month of July and August. This was also the time when young ones were more vulnerable to the predation. The parents were very much visilant from predators by showing more neck movement. Preening was also useful to maintain the body of each other and also to protect them from ectoparasites. It seems that preening and neck movement are helpful in nurturing the healthy family.

In our observations on Openbill stork we found that preening and neck movement activities were highest. The birds spent more time for preening and neck movement which helped them in nurturing the healthy family by protecting the young ones from parasites and predators.

IV. CONCLUSION

In this study of different activities of Openbill stork, it was found that preening and neck movement were exceptionally high which in turn were helpful in social grooming and prevention from predator.

V. REFERENCES

[1]. Ali, S. & Ripley, S.D. (1987). Handbook of the Birds of India and Pakistan; Oxford University Press, Delhi; 737pp.

[2]. Ali S. and Ripley S.D. 1995. Hand book of birds of India and Pakistan. Oxford University Press, Delhi, 110-112.

[3]. Desale A. A and Singh R. B., 2017. Preliminary studies on innate Behaviour of Openbill Stork, Anastomus Oscitans. International Journal of Creative research Thought Volume 5(4), 3098-3103 ISSN: (2320-2882), IF: 5.97.

[4]. Delogu M., De Marco M.A., Di Trani L., Raffini E., Cotti C., Puzelli S., Ostanello F., Webster R.G., Cassone A., Donatelli I. 2010. Can preening contribute to influenza A virus infection in wild waterbirds? -PLoS ONE, 5: e11315.

[5]. Griggio M., Hoi H. 2006. Is preening behaviour sexually selected? An experimental approach -Ethology, 112:1145-1151.

[6]. Griggio M., Hoi H., Pilastro A. 2010. Plumage maintenance affects ultraviolet colour and female preference in the budgerigar -Behav. Process. 84: 739-744.

[7]. King, J.R. 1974. Seasonal allocation of time and energy resources in birds. 4-70. In:

Avianenergetics. Paynter, Jr (EdPublication Number 15. Nuttall ornithological club,Cambridge, Massachusetts

[8]. Kulkarni S., Heeb P. 2007. Social and sexual behaviours aid transmission of bacteria in birds -Behav. Process. 74: 88-92.

[9]. Lenouvel P., Gomez D., Théry M., and Kreutzer M. 2009. Do grooming behaviours affect visual properties of feathers in male domestic canaries, Serinus canaria? -Anim. Behav. 77: 1253-1260

[10]. Moller A.P. 1991. The preening activity of swallows, Hirundo rustica, in relation to experimentally manipulated loads of haematophagous mites -Anim. Behav.42: 251-260.

[11]. Potts, K. J. 1976. Comfort movements of the Kea, Nestor notabilis (Psittacifonns, NecitoridaeNotornis 23:302-309.

[12]. Pramanik A. K., Santra K. B. and Manna C. K. 2016. Parental care and chick development of the asian open-billed stork (anastomus oscitansin the raiganj wildlife sanctuary, west bengal, India, International Journal of Plant, Animal and Environmental Sciences :Volume-6(461-71.

[13]. Quinlan, E.E. and Baldassarre, G.A. 1984. Activity budgets of non breeding green winged teal on Playa lakes in Texas. J. Wildl. Manage. 48(3): 838-845

[14]. Rozsa L. 1993. An experimental test of the site specificity of preening to control lice in feral pigeons -J. Parasitol. 79: 968-970.

[15]. Singh, R. B., Desale, A. A., Gupta,.R.V; Keni, S. J. , and Narvankar, S.S. & Kini, P.H.,2017. Nesting site activities in breeding time of Asian Paradise flycatcher, Terpsiphone paradisi, at Dandekar College, Palghar, Maharastra. Paripex -Indian Journal of Research Volume: 6(1270-272.

[16]. Van Iersel J.J.A., Bol A.A.C. 1958. Preening of two tern species. A study on displacement activity -Behaviour, 13: 1-88.

[17]. Varghese A. P. 2002. Ecology and behaviour of malabar trogon,Harpactes fasclatus malabarlcus , Thesis submitted to Mahatma Gandhi University Kottayam

[18]. Waite J.L., Henry A.R., Clayton D.H. 2012. How effective is preening against mobile ectoparasites? An experimental test with pigeons and hippoboscid flies -Int. J. Parasitol. 42: 463-467.

[19]. ampiga E., Hoi H., Pilastro A. 2004. Preening, plumage reflectance and female choice in budgerigars-Ethol. Ecol. Evol. 16: 339-349.

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Thermal Studies of Thiazole Schiff Base Metal Complexes of Co(II), Ni(II), Cu(II), Cr(III), Mn(III), Fe(III), VO(IV), Zr(IV) and UO2(IV)

S. R. Kelode
Department of Chemistry, Arts, Commerce and Science College, Maregaon, Maharashtra, India

ABSTRACT

A newly synthesize thiazole Schiff base has been prepared by the condensation of 2-hydroxy-5-chloro-3-nitro acetophenone and thiazole. The ligand was characterized by elemental analysis and spectral methods. The newly synthesize thiazole Schiff base and metal complexes with Co(II), Ni(II), Cu(II), Cr(III), Mn(III), Fe(III), VO(IV), Zr(IV) and UO_2(VI) have been prepared and characterized by elemental analysis, molecular weight determinations, conductance measurements, spectral and thermal studies. The isolated products are coloured solids, soluble in DMF, DMSO and THF.

Keywords: Schiff base, Magnetic susceptibility, Thermal,

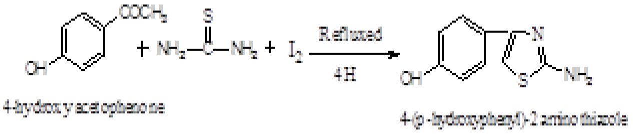
I. INTRODUCTION

Schiff's bases, widely used as analytical reactants and have been studied for chemistry.[1] Antimicrobial evaluation of 2-amino pyridine-derived Ligand Schiff base and its complexes with Cu (II), Hg (II), Ni (II), Mn (II) and Co (II)[2]. Schiff bases metal complexes have many applications in different fields. The Schiff bases derived from thiazole and substituted acetophenone have been widely used as ligand for the synthesis of transition metal complexes. Thiazole Schiff base ligands and their metal complexes are biologically active[3] and are known for their biological application[4] i.e. one of the drug in cytotoxicity of anticancer[5]. The aim of present investigation is to synthesize various transition metal complexes of Schiff base derived from 2-hydroxy-5-chloro acetophenone and 4-(p-hydroxyphenyl)-2 amino thiazole

II. EXPERIMENTAL

All the chemicals were of A.R. grade and used as received. 2-hydroxy-5-chloro-3-nitro acetophenone (HCNA) and 4-(p-hydroxyphenyl)-2 amino thiazole was prepared by known methods[6-9]. The solvents were purified by standard methods[10].

Synthesis of 4-(phydroxyphenyl)-2aminothiazole;



Synthesis of 2-hydroxy-5-chloro-3-nitro acetophenone 4-(p-hydroxyphenyl)-2 imino thiazole [HCNAT]: A solution of 4-(p-hydroxyphenyl)-2 imino thiazole (0.02M) in 25ml of ethanol was added to an ethanolic solution(25ml) of 2-hydroxy-5-chloro-3-nitro acetophenone (0.02M) and the reaction mixture was refluxed on a water bath for 4h. After cooling a pale yellow coloured crystalline solid was separated out. It was filtered and washed with ethanol, crystallized from DMF and dried under reduced pressure at ambient temperature. The purity of ligand was checked by elemental analysis and m.p. It was also characterized by IR and ^{1}H NMR spectral studies. Yield:70%; m.p. 310^{0}C

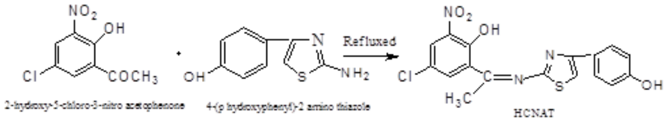


Table1. Analytical data of the Ligand.

Ligand	Molecular Formula	Formula Weight	Color and nature	Elemental Analysis			
				C% found (Cal.)	H% Found (Cal.)	Cl% Found (Cal.)	S% Found (Cal.)
HCNAT	$C_{17}H_{13}N_3O_4SCl$	390.6	Yellow Crystalline	52.34 (52.22)	03.26 (03.32)	9.02 (9.08)	08.12 (08.21)

Preparation of complexes: All the metal complexes were prepared in a similar way by following method. To a hot solution of ligand HCNAT (0.02M) in 25ml of ethanol a suspension of respective metal salts was added drop wise with constant stirring.

Table 2. Analytical data and molar conductance of the compounds.

Ligand	Formula weight g mole^{-1}	Colour	Elemental Analysis Found (Calcd.)				μ_{eff} B.M	Λ_M (Ω^{-1} cm^2 mol^{-1})
			M%	C%	H%	Cl%		
$[CoL_2(H_2O)_2]\ H_2O$	892.1	Brown	6.25 (6.60)	44.86 (45.73)	3.25 (3.36)	7.70 (7.95)	4.6	6.8
$[NiL_2(H_2O)_2]\ H_2O$	891.9	Green	6.30 (6.58)	45.58 (45.74)	3.16 (3.36)	7.72 (7.96)	3.1	7.6
$[CuL_2(H_2O)_2]\ H_2O$	896.7	Brown	6.90 (7.08)	45.26 (45.50)	3.12 (3.34)	7.72 (7.91)	1.6	8.2
$[CrL_2(H_2O)Cl]\ H_2O$	902.7	Green	5.32 (5.76)	44.90 (45.19)	2.36 (2.88)	11.08 (11.79)	3.8	18.6
$[MnL_2(OAc)]\ H_2O$	929.1	Brown	5.40 (5.90)	46.15 (46.49)	3.16 (3.33)	7.32 (7.64)	4.6	18.4
$[FeL_2(H_2O)Cl]\ H_2O$	906.6	Black	6.02 (6.16)	44.81 (45.00)	3.02 (3.08)	11.41 (11.74)	5.2	22.2
$[VOL_2]$	846.2	Green	5.63 (6.02)	48.01 (48.21)	2.15 (2.83)	8.32 (8.39)	1.4	12.4
$[ZrL_2\ (OH)_2]\ 2H_2O$	940.4	Yellow	9.48 (9.69)	43.13 (43.38)	3.06 (3.19)	7.26 (7.54)	Dia	16.2
$[UO_2L_2]$	1049.3	Orange	22.43 (22.69)	38.51 (38.88)	2.11 (2.28)	6.32 (6.76)	Dia	14.2

The reaction mixture was refluxed on a water bath for 4-5 h. The precipitated complexes were filtered, washed with ethanol followed by ether and dried over fused calcium chloride. Yield : 50-55%. The complexes are soluble in DMSO and DMF but insoluble in water and common organic solvents. The metal chloride content of complexes were analyzed by standard methods[11-12] The ^{1}H NMR spectra of ligand was recorded and obtained from RSIC Chandigarh. IR spectra of the compounds were recorded on Perkin Elmer 842 spectrophotometer in the region 400-4000cm^{-1}, Carbon, Hydrogen and Nitrogen analysis were carried out at RSIC, Punjab University, Chandigarh. The molar conductance of the complexes at 10^{-3} M dilution in DMF were determined using equiptronic digital conductivity meter EQ-660 with a cell constant 1.00 cm^{-1} at room temperature. The magnetic moment measurement were made on a Gouy balance at room temperature using $[HgCo(SCN)_4]$ as the calibrant. The thermogravimetric analysis were performed on laboratory set up apparatus in air atmosphere at 10^0 C min^{-1} heating rate. The molecular weights of the complexes were determined by Rast method.

III. RESULT AND DISCUSSION

The Schiff base HCNAT and its complexes have been characterized on the basis of ^{1}H NMR, IR spectral data, elemental analysis, molar conductance, magnetic susceptibility measurements and thermo gravimetric analysis data. All these values and analytical data is consistent with proposed molecular formula of legend. All the compounds are coloured solid and stable in air. They are insoluble in water but soluble in coordinating solvents like DMF and DMSO. The molar conductance values in DMF (10^{-3} M) solution at room temperature (Table2) shows all the complexes are non electrolytes. The ^{1}H NMR spectra of ligand HCNAT shows signals at δ 12.11, (1H, s phenolic OH), δ 9.52 (1H, s, phenolic OH), δ 7.56, 7.54, 7.53 and 7.52 (4H, m, phenyl) δ 6.81, 6.80, and 6.78(3H, s Phenyl), 6.68 (1H s thiophene), and 2.56(3H, s, methyl) [11,13-15]. IR spectra of ligand and metal complexes shows ν(C=N) peaks at 1620 cm^{-1} and absence of C=O peak at around 1700 – 1750 cm^{-1} indicates the Schiff base formation[16-19].

Table 3. IR spectra of ligand and metal complexes

Compound	ν(O–H) hydrogen bonded	ν(C=N) imine	ν(C–O) phenolic	ν(M–O)	ν(M–N)	ν(C–S)
HCNAT (LH)	3119	1620	1514	--	--	1122
$[CoL_2(H_2O)_2]\ H_2O$	--	1608	1506	472	432	1098
$[NiL_2(H_2O)_2]\ H_2O$	--	1585	1464	469	423	1090
$[CuL_2(H_2O)_2]\ H_2O$	--	1610	1503	508	412	1110
$[CrL_2(H_2O)Cl]\ H_2O$	--	1590	1505	475	410	1115
$[MnL_2(OAc)]\ 2H_2O$	--	1562	1461	496	422	1090
$[FeL_2(H_2O)Cl]\ H_2O$	--	1602	1502	510	441	1080
$[VOL_2]$	--	1598	1505	512	446	1098
$[ZrL_2(OH)_2]\ 2H_2O$	--	1600	1496	446	414	1108
$[UO_2L_2]$	--	1585	1440	548	480	1082

Thermogravimetric studies:

Thermogravimetric study indicates all the complexes are stable up to 60-70°C. All the complexes shows half decomposition temperature(Table 4). The Thermal activation energy was calculated by Freeman-Carroll[20], Horowitz-metzger[21] and Broido[22] method.

Table 4. Thermal decomposition data of HCNAT and its complexes.

Compounds	Half Decompo-sition Tempera-ture (°C)	Activation Energy (kJ $mole^{-1}$)			Frequency Factor Z (sec^{-1})	Entropy Change -ΔS (J mol^{-1} K^{-1})	Free Energy Change ΔF (kJ mol^{-1})
		B*	H-M**	F-C***			
HCNAT (LH)	260.50	3.27	5.45	4.36	87.25	212.55	117.75
$[CoL_2(H_2O)_2]\ H_2O$	433.40	5.73	9.55	9.55	191.11	208.24	156.67
$[NiL_2(H_2O)_2]\ H_2O$	384.12	4.13	8.26	3.30	66.03	216.60	145.64
$[CuL_2(H_2O)_2]\ H_2O$	494.84	11.28	11.28	10.16	203.31	208.54	170.28
$[CrL_2(H_2O)Cl]\ H_2O$	550.42	9.08	12.98	12.98	259.74	207.11	183.52
$[MnL_2(OAc)]\ 2H_2O$	710.42	11.11	18.51	11.11	222.32	209.86	217.58
$[FeL_2(H_2O)Cl]\ H_2O$	429.22	3.77	9.44	8.49	169.89	209.30	155.47
$[VOL_2]$	400.20	5.20	8.67	6.94	138.87	210.62	148.73
$[ZrL_2(OH)_2]\ 2H_2O$	711.19	7.41	18.54	11.12	222.52	209.77	217.65
$UO_2L_2]$	800.00	19.85	22.06	17.65	353.20	206.79	239.62

IV. CONCLUSIONS

In conclusion, we have synthesized new ligand 2-hydroxy-5-chloro-3-nitro acetophenone 4-(p-hydroxyphenyl)-2 imino thiazole and their metal complexes. Ligand was found to bind the metal ion monobasic (ON) bidentate manner. Thermogravimetric analysis concluded water loss in metal complexes from the nature of thermograms and half decomposition temperature.

V. REFERENCES

[1]. Aghera V.K. and Parsania P. H., J. Sci. and Ind. Res.,2008, 67, 1083.

[2]. Rehab K A.S., Wurood A J., and Ali N N., J. Pharma, Bio and Chem Sci., 2017, 8(3), 174.

[3]. Raziya S., Mohan S. and Rao S.,Indian J. Chem., 2007, 46B, 884.

[4]. Kumar S.,Dhar D.and Saxena P.,J. Sci.and Indu.Research, 2009, 68, 181.

[5]. Reji T., Devi S,Thomas K., Sreejalekshmi K., Manju S., Francis M.,.Philip S , Bharathan A., and Rajasekharan K.,Indian j. Chem., 2008, 47B, 1145.

[6]. Aswar A., Bahad P.,.Pardhi A. and Bhave N.,J. Poym. Mater. 5, 232 (1988).

[7]. Pattan S.,.Ali M,Pattan J., Purohit S., Reddy V. and Nataraj B., Indian J. Chem., 45B, 2006, 1929.

[8]. Khrustalev D., Suleimenova A. and Fazylov S., Russian J. App. chem., 81(5), 2008, 900

[9]. Maradiya H.,and Patel V.,J. Fibers and poly., 3(1), 2002, 43.

[10]. Furniss B.,Hannaford A., Smith P. and Tatchell A., Vogel's practical organic chemistry 5 thEd. (Logman Scientific Technical, John Wiley and Sons), (1989).
[11]. Sadigova S., Magerramov A.and Allakhverdiev M., Russian J. Org. chem., 81(5), 2008, 900.
[12]. Vogel AI, "A Text book of quantitative inorganic chemistry"3thEd., (ELBS,London,1961).
[13]. Campbell E. and Nguyen S.,J. Tetrahedron, 42, 2001, 1221.
[14]. Pietikainen P. and Haikarainen A. J. Mole. Catalysis., 180, 2002, 59.
[15]. Kidwai M., Poddar P. and Singhal K., Indian J. Chem., 48B, 2009, 59.
[16]. Sonwane S., Srivastava S. and Srivastava S.,Indian J. Chem., 47B, 2008 633.
[17]. Patel K. and Mehata A.,E. J. Chem., 3(13), 2006, 267.
[18]. Maurya R.,Antony D., Gopinathan S., Puranic V., Tavale S.and Gopinathan C., Bull. Chem. Soc. Jpn., 68, 1995, 2847.
[19]. Boghaei D.and Mohebi S.J. Tetrahedron, 58, 2002, 5357.
[20]. Mallikarjun K., E. J. Chem., 1(2), 2004, 105.
[21]. Horowitz H. and Metzger G.,Anal. Chem., 35, 1963, 1464.
[22]. Broido A., J. Polym. Sci. Part, A2, 1964, 1761.

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Automated Guided Vehicle as an office boy

N. D. Chinchkhede[1], A. T. Shende[2]

[1]Scholar, Dept of Electronics, S.B. Jain Institute of Technology, Management & Research Nagpur, Maharashtra, India

[2]Department of Physics, Dr. S.D.D. Arts College and Commerce and Science College, Wada, Palghar, Maharashtra, India

ABSTRACT

Office and its environment finds very effective and important place in many organizations and one required an efficient and cost effective technique for fast, reliable and efficient work. Many times some unskilled tasks are repeated like transferring files from one table to another and for such task need an office boy. Such simple and repeated task invests skilled human mind and efforts. These skilled efforts instead may be used in complex and important tasks. In this regard the paper has made to give theoretical model of Robot who works as an office boy. The robot also called as Automated Guided Vehicle (AGV) as that Semi- Autonomously Navigates in the office environment.

Keywords: AGV, Office boy, Office environment, Robot, Sensors

I. INTRODUCTION

AGV is a Computer-Controlled, Non-manned, Electric Powered Vehicle Capable of Handling Material The first AGV was brought to market in the 1950s, by Barrett Electronics of Northbrook, Illinois, and at the time it was simply a tow truck that followed a wire in the floor instead of a rail. Out of this technology came a new type of AGV, which follows invisible UV markers on the floor instead of being towed by a chain. The first such system was deployed at the Willis Tower (formerly Sears Tower) in Chicago, Illinois to deliver mail throughout its offices.[1] Over the years the technology has become more sophisticated and today automated vehicles are mainly Laser navigated e.g. LGV (Laser Guided Vehicle). Today, the AGV plays an important role in the design of new factories and warehouses, safely moving goods to their rightful destination.

An Automated Guided Vehicle is a Robot that follows black line on the floor or uses vision or lasers. AGV uses several sensors suits to characterize its behaviors. They are mostly used in industrial application to move material around a manufacturing facility or a warehouse. Automated Guided Vehicle increases efficiency and reduce costs by helping to automate a manufacturing facility or a warehouse. AGVs are available in a variety of models and can be used to move products on assembly line, transport goods throughout a plant or warehouse and deliver loads to and from stretch wrappers and roller conveyors. The block diagram of AGV Robot is showing in figure 1.

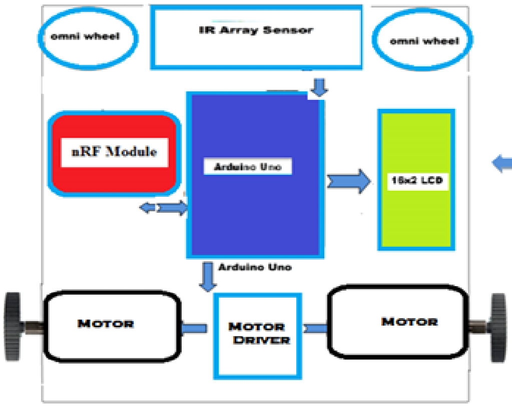

Figure 1. Block diagram of AGV Robot

An automatic guided vehicle is a programmable mobile vehicle. The automatic guided vehicle (AGV) is a mobile robot used in industrial applications to move materials around a manufacturing facility or a warehouse. Many research and development have been made for upgrading, controlling and monitoring the AGV.[2-5] . With due all respect the same mobile robot may be use as an office boy to transfer files from one table to other and also for many other unskilled work. Now a day's human mind is used an office boy for such unskilled work but if instead an AGV is used then human mind may be utilizes for other skilled work required in an office. By taking this concept the present paper gives an idea about theoretical model of Robot who works as an office boy. The block diagram for office set up and complete system of AGV+ office setup are shown in figure 2 and figure 3 respectively.

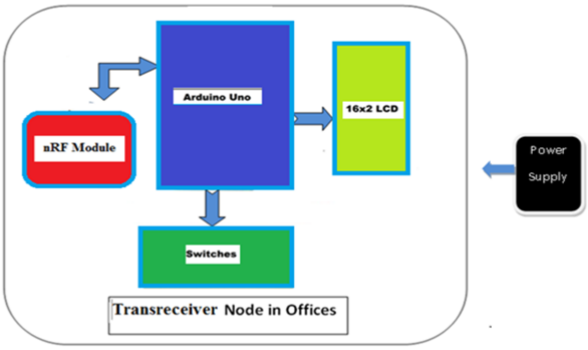

Figure 2. Block diagram of Office Setup

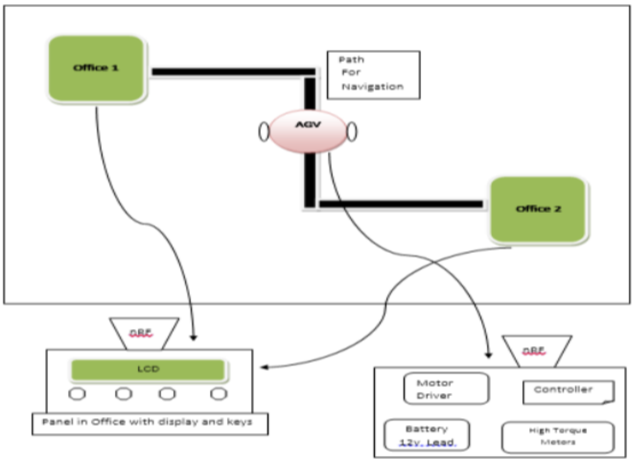

Figure 3. Block diagram of complete system of AGV+ Office setup

II. MATERIALS AND METHODS

2.1 Materials

The components used for manufacturing AGV Robots are:

i) 1x Aluminum Chassis
ii) 2x Geared Motor
iii) 1x Motor Driver 10A
iv) 2x Wheels
v) 2x Omni Wheel
vi) 1x Battery 12V 7.4 Ah
vii) 2xArduino Uno
viii) 1xArduino Mega
ix) 3x nRF Module
x) 3x LCD 16x2
xi) 3x Keypad
xii) 1xLine Array Sensor
xiii) 2x 9V Adapter(for office setup)
xiv) 1x Buzzer
xv) 1x Pick and Place Mechanism on robot
xvi) 1x Docking Mechanism on robot
xvii) 1x Proximity Sensor
xviii) 2x Limit switch

2.2 Methods and Working

i) For Autonomous Navigation predefined markers will be put on the floor in the form of black line so that AGV can navigate accurately throughout the office space.

ii) Every desk will have a panel with a display and key panel having following switches to provides different commands to the Robot:

a) Request Robot.

b) Send to office

iii) On placing the request, it will plans its direction to the office and move using the concept of line following.

iv) If request is placed while AGV is busy doing the some other task then it will give priority according to the predefined priority table or first come first serve after completing the first task.

v) AGV will compromise of high torque Geared Motor to accommodate the large payloads.

vi) AGV will have an on- board pick and place mechanism to automatically pick the files and objects. So user has to just place the file in predefined space and push the request button. Everything will be done by AGV.

vii) AGV will be independent system consisting of the on-board battery, controllers and all required accessories.

The flow chart for working of complete system of AGV + office is

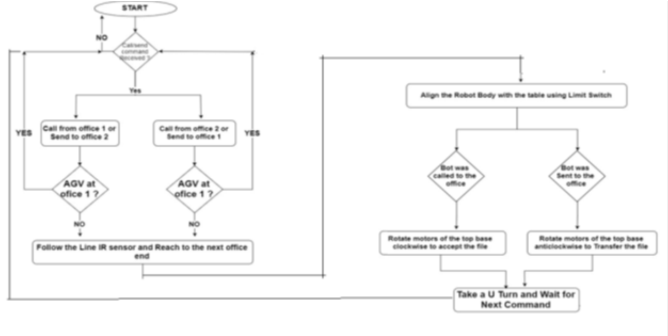

Figure 4. Flow chart for working of complete system of AGV + office

III. OBJECTIVES

The working of AGV is very efficient and cost effective. The complete system of AGV is reliable too. There are following objectives which are the outcomes after developing AGV:

i) It will help to reduce the efforts required in the office.

ii) Autonomously navigate from one desk to another depending on the Input provided.

iii) Securely transmit the files from one desk to another.

iv) Provide an easy interface to control the actions of the AGV.

v) Priority based transfer of documents.

vi) Large payload.

vii) Completely mobile and wireless system.

viii) On board pick and place system on Robot.

IV. RESULT AND DISCUSSION

The automation of transportation is a key point in the optimization of logistics. Automated Guided Vehicle Systems (AGVS) provide several benefits to fulfill this task.[6] Material handling [7-8] involves the movement of materials from one place to another for the purpose of processing or storing. According to American Material Handling society,' Material Handling is an art and science of involving the movement, packing and storing of subsystems in any form. Along with material handling Path planning is one of the key aspects of designing and implementing intelligent robots.[9]An Automated guided vehicles normally mean mobile robots (or unmanned vehicles) used in transporting objects. They were traditionally employed in manufacturing systems, but have recently extended their popularity to many other industrial applications. In this paper, An Automated Guided Vehicle (AGV) is presented as an Office boy. The flow chart gives the systematic procedure for robot as an office boy. The basic function of AGV is divided into two systems namely navigation and load transfer. In this work, the tasks of the robot office boy are assigned in a purely random manner. We predict a room for performance improvement. Although we have seen only a moderate tardiness for a typical number of operational AGVs with our current strategy, improvement will be done in future if a sophisticated task dispatching strategy could be incorporated. Such a dispatching strategy is desired to work collaboratively with the routing algorithm. It can still run safely and smoothly with unexpected disturbances, such as abrupt changes of container delivery schedule and the appearance of obstacles in the workspace, or even with some failures.

V. CONCLUSION

From the above discussion it was found that the AGV is very efficient and cost effective and reliable as well. We conclude that the vehicle can reach from the initial position moved along with generated path with accurate location.

VI. REFERENCES

[1]. Wikipedia, https://en.wikipedia.org/wiki/Automated_guided_vehicle

[2]. Butdee S.,Vignat F.,Suebsomran A.,Yarlagadda P., Estimation and control of an Automated Guided Vehical, In: 9thGlobal Congress on Manufacturing and Management, 12-14, November, 2008, Gold Coast, Australia.

[3]. R. J. Mentel and H. R.A. Landeweerd, Design and operation control of an AGV system, International Journal of Production Economics, 41 (1995), 257-256

[4]. Naiqi Wu and M-C. ZFou, AGV Routing for Conflict Planning and Scheduling in a Flexible Manufacturing System Using at Resolution in AGV Systems, Proceeding of the 2003 IEEE International Conference on Robotics & Automation, Taipei, Taiwan,September 14-19, 2003, 1428-1433

[5]. M. Gourgand, X-C. Sun and N. Tchernev, Choice of the Guide Path Layout for an AGV Based Material Handling, IEEE, 1995,475-483

[6]. Schulze L., Behling S., Buhrs S., Automated Guided Vehicle Systems: a Driver for Increased Business Performance", Proceedings of the International Multi Conference of Engineers and Computer Scientists 2008 Vol II IMECS 2008, 19-21 March, 2008, Hong Kong

[7]. Gaur A.V. , Pawar M. S. "AGV Based Material Handling System: A Literature Review", Volume III, Issue IA, January 2016 IJRSI ISSN 2321 -2705

[8]. Agrawal, G.K. and Heragu, S.S. (2006) A survey of automated material handling systems in 300-mm semiconductor fabs.IEEETransactions on Semiconductor Manufacturing, 19, 112-120.

[9]. Guo L., Yang Q., Yan W. "Intelligent path planning for automated guided vehicles system based on topological map", 2012 IEEE Conference on Control, Systems & Industrial Informatics 23-26 Sept. 2012 10.1109/CCSII.2012.6470476

[10]. Das S.K., Pasan M.K. ,Design and Methodology of Automated Guided Vehicle-A Review", IOSR Journal of Mechanical and Civil Engineering (IOSR-JMCE) e-ISSN: 2278-1684, p-ISSN: 2320-334X

[11]. Yahyaei M., Jam J. E. , Hosnav R., Controlling the navigation of automatic guided vehicle (AGV) using integrated fuzzy logic controller with programmable logic controller (IFLPLC)-stage 1", IntJ AdvManufTechnol(2010) 47:795-807 DOI 10.1007/s00170-009-2017-8

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Diversity of Arbuscular Mycorrhizal (AM) fungi in Some Medicinal Plants of Malshej Ghat Region in Western Ghats

Jaydeep Jambilkar[1], **Rahul Wani**[2]
[1]Department of Botany, Arts, Commerce & Science College, Kinhavali, Thane, Maharashtra, India
[2]Department of Botany, Savitribai Phule Pune University, Pune, Maharashtra, India

ABSTRACT

Arbuscular mycorrhizal (AM) fungal symbiosis is considered as one of the primary determinants of plant health and soil fertility in terrestrial ecosystems. The fine hyphae extending out into soil exploit minerals more efficiently than plant roots alone, and presence of fungi consistently reduces soil-borne fungal and nematode attacks on roots. These different attributes of AM fungi contribute to their role in protecting endangered plants. Medicinal plants from Malshej Ghat are endangered due to over exploitation and are facing the threat of habitat destruction. In present study, medicinal plants viz. Tectona grandis, Butea monosperma, Terminalia cuneata and Hemidesmus indicus showed presence of arbuscular mycorrhizal fungi. AM fungi viz. Acaulospora and Sclerocystis have wide occurrence in rhizosphere soil of all four medicinal plants, while Scutellispora was restricted to Terminalia cuneata and Hemidesmus indicus only.

Keywords: Arbuscular mycorrhizal (AM) fungi, medicinal plants, endangered plants, Malshej ghat.

I. INTRODUCTION

Forests of the Western Ghats region are source of nearly 5000 medicinal plants; of which some are used in traditional and folk medicinal practices [7]. Medicinal plants are important for pharmacological research and drug development, not only as plant constituents used directly as therapeutic agents, but also as starting materials for the synthesis of drugs or as models for pharmacologically active compounds [9]. Western Maharashtra is composed of tall steep hills which constitute the northern part of the Western Ghats. Malshej Ghat region (19^{0}00'N and 73^{0}17'E) is a part of Western Ghats located in Western Maharashtra and is on the way from Kalyan to Ahmednagar (National Highway 61). A major portion of the Malshej Ghat is included under Thane district whereas the small portion is under Pune district. It is situated at an altitude of about 900m. Due to high rainfall and humidity it is one of the richest spot of angiosperm vegetation diversity [1]. Malshej Ghat is facing threat of habitat destruction due to developmental activities and tourism. Due to an increasing demand for medicinal plants and loss and fragmentation of natural habitats around 1,000 species are estimated to be facing various degrees of threat across different bio geographic regions in the country [13].

Mycorrhizae are non – pathogenic symbiotic soil fungi which invade the root system of plants. Arbuscular mycorrhizal (AM) fungi are associated with about 80% of the plant families in the world [5]. The arbuscular mycorrhizal (AM) fungal symbiosis is considered to be the primary determinant of plant health and soil fertility in terrestrial ecosystems [6]. The fine hyphae extending out into the soil exploit minerals more efficiently than plant roots alone, and the presence of the fungi consistently reduces soil-borne fungal and nematode attacks on roots [16]. These different attributes of AM fungi will contribute to their role in protecting endangered plants.

Diversity characterization of AMF association with the medicinal plants from Malshej Ghats is not available till date. The present study was aimed to explore the arbuscular mycorrhizal fungal diversity in some commonly occurring medicinal plants of Malshej Ghats.

II. METHODS AND MATERIALS

Description of study site:

The association of AM fungi with four selected medicinal plants was carried by collecting plant roots and rhizosphere soil from locality Naneghat present in Malshej Ghats near National highway 61, Maharashtra, India.

Sample Collection:

Roots and rhizosphere soil from four medicinal plants viz. Tectona grandis, Butea monosperma, Terminalia cuneata and Hemidesmus indicus was collected from study site in month of January. Roots and soil sample from each plant at the depth of 20-30 cm were collected in polythene bags. Roots were preserved in formalin for study of AM colonization. Medicinal plants are identified by using Flora of Maharashtra [14, 15].

Estimation of root colonization:

Preserved roots in formalin were washed and cut into 1 cm length for percentage of root colonization. Roots were washed and boiled in 10 % KOH until roots became transparent, acidified with 2 N HCl and stained with 0.05 % Trypan blue. The percentage root colonization was estimated by slide technique [10]. Thirty segments were mounted on a slide (five segments each slide) and examined under binocular microscope at 10×10 magnification. A root segment was considered as positively infected if it showed mycelium, vesicle and arbuscules or any other combination of these structural characteristics of AM colonization. The presence or absence of colonization in the root pieces was recorded and the percentage of colonization was calculated by the following formula:

$$\boxed{\begin{array}{l}\text{\% root}\\ \text{colonization}\end{array} = \frac{\text{Number of AM positive segments}}{\text{Total number of segments studied}} \times 100}$$

Isolation and estimation of Arbuscular mycorrhizal fungal spores:

Arbuscular mycorrhizal fungal spores were identified by wet sieving and decanting method [4]. From each sample, 100 gm soil was taken in a 1000 ml capacity glass beaker and 500 ml of water was mixed with the soil to make slurry. After soil settled down, the suspension was passed through the 250μm and 75μm sieves gradually to extract the spores. The residues of the sieves were collected in beaker along with water and filtered through Whatman filter paper No-1. Squares of intersecting gridlines were drawn earlier on the filter paper for easy counting of spores. Spore number from each sample was counted and the result was expressed as number of spores per 100 gm of dry soil.

Identification of AMF spores:

Different AMF spores were separated based on morphological characters and mounted in polyvinyl lactoglycerol (PVLG) mounting media and identified on the basis of spore shape, size, colour, and hyphal attachment by using manual [12].

III. RESULTS AND DISCUSSION

In present study, medicinal plants viz. Tectona grandis, Butea monosperma, Terminalia cuneata and

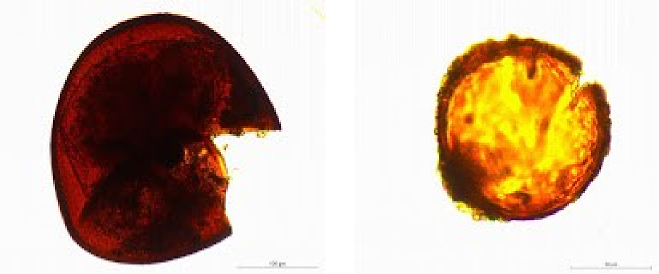
Hemidesmus indicus shows presence of arbuscular mycorrhizal fungi. Arbuscular mycorrhizal fungi belonging to five genera were identified in four medicinal plants figure 1.

Occurrence of AMF spores in every host and their detailed morphological description is described in table 1.

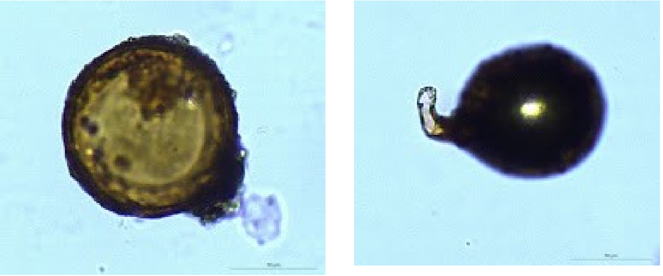
Results of root colonization, spore population and AM fungi associated with medicinal plants are shown in table 2.

Percentage AM colonization ranged from 30.00% to 93.33%. Maximum AM colonization was recorded in Butea monosperma (93.33%) followed by Tectona grandis (80.00%). Less AM colonization was observed in Terminalia cuneata (30.00%) and Hemidesmus indicus (33.33%).

Spore number per 100gm of rhizosphere soil of four medicinal plants varied from 207 to 453. Rhizosphere soil of Terminalia cuneata exhibited more spore number (453) followed by Tectona grandis (311). Comparatively less spore number was observed in Butea monosperma (210) followed by Hemidesmus indicus (207).



Acaulospora spp. Gigaspora decipiens



Glomus tenebrosum Scutellispora nigra

Figure 1. Photomicrograph of AM fungal spores isolated

Table 1. Morphological identification of spores

Sr.No.	Name of the species	Colour	Size (µm)	Shape	Hyphal Attach-ment
Tectona grandis L.					
1	Acaulospora spp.	Y-Br	165	Globose	Absent
2	Gigaspora decipiens Hall & Abbott.	Y-Gold	215	Globose	Absent
3	Sclerocystis spp.	Br-Bl	433	Globose	Present
Butea monosperma (Lam.) Taub.					
1	Acaulospora spp.	Y-Br	165	Globose	Absent
2	Glomus tenebrosum (Thaxter) Berch.	Br-Bl	132	Globose	Present
3	Sclerocystis spp.	Br-Bl	433	Globose	Present
Terminalia cuneata Roth.					
1	Acaulospora spp.	Y-Br	165	Globose	Absent
2	Gigaspora decipiens Hall & Abbott.	Y-Gold	215	Globose	Absent
3	Glomus tenebrosum (Thaxter) Berch.	Br-Bl	132	Globose	Present

4	Sclerocystis spp.	Br-Bl	433	Globose	Present
5	Scutellispora nigra (Readhead) Walker & Sanders	Bl	489	Globose	Present
Hemidesmus indicus (L.) Schult.					
1	Acaulospora spp.	Y-Br	165	Globose	Absent
2	Gigaspora decipiens Hall & Abbott.	Y-Gold	215	Globose	Absent
3	Glomus tenebrosum (Thaxter) Berch.	Br-Bl	132	Globose	Present
4	Sclerocystis spp.	Br-Bl	433	Globose	Present
5	Scutellispora nigra (Readhead) Walker & Sanders	Bl	489	Globose	Present
H-W: hyaline to white, Y-Br: Yellow to Brown, Br-Bl: Brown to Black, YBr-Br: Yellow brown to Brown, H-Y: Hyaline to white, Bl: Black.					

Table 2. Root colonization and spore count

Sr. No.	Plant Species	Percentage AM colonization (%)	Spore count/ 100 gm of soil
1	*Tectona grandis* L.	80.00	311
2	*Butea monosperma* (Lam.) Taub.	93.33	210
3	*Terminalia cuneata* Roth.	30.00	453
4	*Hemidesmus indicus* (L.) Schult.	33.33	207

IV. CONCLUSION

The present work was undertaken to reveal AM fungi diversity in important medicinal plants from Malshej Ghat. The mycorrhizal colonization differed among medicinal plant species and there was a considerable variation in percentage of root colonization and number of different Arbuscular mycorrhizal fungal spores associated with rhizosphere soil but no definite correlation could be established between them, which are in agreement with the previous findings [8, 11]. This could be due to the fact that Arbuscular mycorrhizal fungal sporulation is dependent on a wide range of host fungal and environmental factors, and their germination potential varies at different times of the year [3, 17]. AM fungi viz. Acaulospora and Sclerocystis have wide occurrence in rhizosphere soil of all four medicinal plants under study, while Scutellispora is restricted to Terminalia cuneata and Hemidesmus indicus.

The study will provide basis for use of AM fungi in enhancing the important medicinal compounds from the AM inoculated medicinal plants, which are endangered in study areas.

The study will be beneficial for enhancing the growth of plant and amount of medicinally important compounds in AM inoculated medicinal plants. Further if in future the studied medicinal plants face threat of extinction, colonization of those endangered medicinal plants with arbuscular mycorrhizal fungi will increase their sustainability in the field.

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V. REFERENCES

[1]. Chaudhary B. L., and Bhagora F. S., "Epiphytic Mosses of Malshej Ghats (North Konkan) Maharashtra, India", Environmental Issues and Solutions: 36, (2008).

[2]. Dudhane M.P., Borde M.Y. and Jite P.K., "Diversity of arbuscular mycorrhizal (AM) fungal species in plants surrounding the Bauxite mines from Kolhapur District, Maharashtra, India", Proceedings: International Conference on Biodiversity and its Conservation (2011).

[3]. Gemma J.N. and Koske, R.E. "Seasonal variation in spore abundance and dormancy of Gigaspora gigantea and in mycorrhizal inoculum potential of a dune soil", Mycologia, v: 211-216, (1988).

[4]. Gerdemann, J. W, Nicolson, T. H. "Spores of mycorrhizal endogene species extracted from soil by wet sieving and decanting", Transactions of the British mycological Society, 46: 235-244, (1963).

[5]. Giovannetti M., Sbrana, C., "Meeting a non-host: the behavior of AM fungi", Mycorrhiza 8:123–130, (1998).

[6]. Jeffries P, Gianinazzi S, Perotto S, Turnau K. and Barea J.M., "The contribution arbuscular mycorrhizal fungi in sustainable maintenance of plant health and soil fertility", Biol Fertil Soils 37:1–16, (2003).

[7]. Joy P. P., Thomas J., Mathew S. and Skaria B. P., National seminar cum workshop on "Scope of medicinal, aromatic and dye yielding crops in dry land agriculture", Central Research Institute for Dryland Agriculture, Hyderabad, India, (2001).

[8]. Kalita R.K., Bora D.P. and Dutta D. "Vesicular arbuscular mycorrhizal associations with some native plants", Indian Journal of Forestry, 25: 143–146, (2002).

[9]. Mukherjee P.K. Indian Systems of Medicine. In: Mukherjee, P.K. and R.Verpoorte (eds), GMP for Botanicals: Regulatory and Quality Issues on Phytomedicines. Business Horizons, New Delhi. 99–112, (2003).

[10]. Phillips, J. M., Hayman, D. S. "Improved procedures for clearing roots and staining parasitic and vesicular arbuscular mycorrhizal fungi for rapid assessment of colonization", Trans Br Mycol Soc.; 55:158-160, (1970).

[11]. Radhika K.P. and Rodrigues B. F., "Arbuscular mycorrhizal fungal diversity in some commonly occurring medicinal plants of Western Ghats, Goa region", Journal of Forestry Research 21(1): 45–52, (2010).

[12]. Schenck, N.C. and Perez, Y., Manual for the identification of VA Mycorrhizal fungi. Third edition. Florida USA. (1990).

[13]. Seth S.D. and Sharma B., Medicinal plants in India. The Indian Journal of Medical Research, 120: 9–12, (2004).

[14]. Singh N. P., Karthikeyan S., Lakshminarasimhan P., and Prasanna P. V. Flora of Maharashtra state- Dicotyledones. Botanical Survey of India 1:610, (2001).

[15]. Singh N. P., Karthikeyan S., Lakshminarasimhan P., and Prasanna P. V. Flora of Maharashtra state- Dicotyledones. Botanical Survey of India 2:5, 386-387, 696 (2001).

[16]. Smith S.E. and Read D.J., Mycorrhizal symbiosis, 3rd edn. Academic, San Diego, (2007).

[17]. Tommerup I.C. "Spore dormancy in vesicular arbuscular mycorrhizal fungi", Transactions of British Mycological Society, 81: 37–38, (1983).

[18]. Yadav S.R., Chandore A. N., Nimbalkar M. S. and Gurav R. V.,"Reintroduction of Hubbardia heptaneuron Bor, a critically endangered endemic grass in Western Ghat", Current Science, 96 (7), (2009).

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"Efficient Potentiostatically Electrodeposited MnO_2 Electrode for Electrochemical Pseudocapacitor Applications"

S. M. Ingole[2], Y. H. Navale[1], V. B. Patil*[1]
[1]Functional Materials Research Laboratory, School of Physical Sciences, Solapur University, Solapur, Maharashtra, India
[2]Arts , Comerce & Science College Onde, Palghar, Maharashtra, India

ABSTRACT

A manganese oxide (MnO_2) electrode has been developed by using potentiostatic electrodeposition method and characterized for its compositional, morphological and afterward envisaged in pseudocapacitor applications. The elemental analysis of MnO_2 electrode was studied using X-ray photoelectron spectroscopy (XPS). The supercapacitive properties of MnO_2 electrode studied using cyclic voltammetry and galvanostatic charge-discharge measurements in 1M Na_2SO_4 electrolyte. A high specific capacitance of 626 Fg^{-1} was obtained within the potential range of –0.3 to 0.8 V in 1M Na_2SO_4 electrolyte. Additionally, MnO_2 electrode exhibited high charge/discharge efficiency of 98.32%. The present study signifies successful application of potentiostatic electrodeposited MnO_2 thin films as a supercapacitor electrode.

Keywords: Manganese Oxide; X-ray Photoelectron Spectroscopy; SEM, Cyclic Voltammetry; Galvanostatic Charge-Discharge.

I. INTRODUCTION

Supercapacitors as one of the most significant energy devices want to be designed with high energy density and high levels of important mechanical properties, especially flexibility to meet the power needs of modern gadgets and various designs [1]. From the materials points of view, three families of materials have been used in supercapacitors until now, that is, conducting polymer, metal oxide, and carbon [2]. Each type of material they have its own advantages and disadvantages. Carbon materials have good mechanical and long cycle life, but low specific capacitance [3]. Conducting polymers are eminent for their high flexibility, but low specific capacitance with poor cyclability [4]. In metal oxides, MnO_2 is considered as the most capable material for the next generation of supercapacitors because of its environmentally friendly nature, high specific capacitance, high energy and power densities, excellent rate capability, excellent long-term cycle stability [5].

A number of techniques including coprecipitation [6], simple reduction [7], thermal decomposition [8], sol–gels [9] and electrochemical methods (potentiostatic [10], galvanostatic [11] and potentiodynamic [12]) are available to prepare this metal oxide. In the present study, electrochemical potentiostatic electrodeposition was chosen because it allows for the material to be homogeneous, rapidly and reproducibly deposited on a stainless steel substrate as electrode in ECs.

In the present work, MnO_2 thin film electrode was synthesized by potntiostatic electrodeposition method and characterized using various techniques such as XPS (X-ray Photoelectron Spectroscopy), and SEM (Scanning Electron Microscope) respectively. The electrochemical performance was carried out using cyclic voltammetry (CV), and Galvanostatic charge–discharge for its application as pseudocapacitors. The electrochemical performance is studied in 1M Na_2SO_4 aqueous electrolytes. The obtained MnO_2 electrode shows outstanding capacitive performance in terms of specific capacitance and high coloumbic efficiency which is promising for supercapacitor application.

II. EXPERIMENTAL DETAIL

The potentiostatic electrodeposition method were used for the deposition of the MnO_2 thin film electrode on stainless steel substrate. For the depostion, 0.1 M manganese sulphate ($MnSO_4$) of high purity 99.9% was used as precursor in 100ml distilled water. Stainless steel (SS) substrate of 304 grades is used as conducting substrate for deposition of active material. The optimized potential and time for deposition of manganese on stainless steel is 1.2V and 10 minutes respectively. By potentiostatic method the formation of manganese on stainless steel is uniform, homogeneous and well adherent. The electrodeposited material film was annealed at 400°C for 1 hrs. After annealing well deposited black colored manganese oxide films were obtained which were used for compositional, morphological and supercapacitive characterization.

Chemical state of the prepared electrode was investigated by X-ray photoelectron spectroscopy (XPS) using a Kratos AXIS Ultra X-ray photoelectron spectrometer.Scanning Electron Microscopy (SEM) was used to explore the surface morphology of prepared MnO_2 electrode. The mass of deposited material was measured using high precision analytic balance (CONTECH, with 0.01 mg sensitivity).

Electrochemical study on MnO_2 electrodes were carried out on a CH Instruments Electrochemical Workstation (CH608E). All electrochemical study were investigated in a conventional three-electrode system equipped with, platinum electrode as a counter electrode, prepared MnO_2 as a working electrode and a saturated calomel electrode (SCE) as a reference electrodes. Cyclic voltammetry (CV) and galvanostatic charge–discharge (CP) methods were used to examine capacitive properties of MnO_2 electrode.

III. RESULT AND DISCUSSION

X-ray photo-electron spectroscopy (XPS) is a most extensively used technique for analyzing the chemical states of the surface elements.

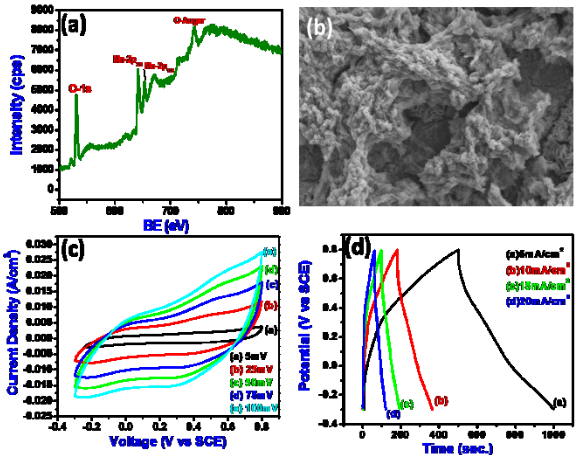

Figure 1. (a) XPS, (b)SEM, (c)CV &(d)GCD of MnO2

Figure 1(a) shows the XPS survey spectra of MnO_2 electrodede. The two peaks at binding energies of 641.44 and 653.17 eV corresponding to the spin-orbit doublet attributed to the Mn 2p3/2 and Mn 2p1/2 and the peak at 529.7 eV gives the Mn–O–Mn bond, the peak at 531.8 eV is due to the adsorbed oxygen species. Hence from XPS spectra we confirm the formation of MnO_2. Figure 1(b) shows SEM image of the as-prepared MnO_2 electrode. The potentiostatic deposited MnO_2 is uniformly coated on stainless substrate and builds up an interconnected network with highly porous structure. Importantly, the porous structure is beneficial for improved electrochemical performance of the active materials, since it would lead to fast ion/electron transfer and sufficient contact between electrolytes and active materials[13].

The MnO_2 thin films deposited by potentiostatic electrodeposition were used in the development of electrochemical supercapacitors and their performance was examined by studying cyclic voltametry test. Figure 1(c) shows the CV curves of MnO_2 electrode with different scan rates in 1M Na_2SO_4 electrolyte within voltage range of –0.3 to 0.8 V. The MnO_2 electrode exhibited the maximum specific capacitance of 626 Fg^{-1} at 5mV scan rate. Fig. 1(d) shows galvanostatic charge/discharge plot of MnO_2 electrode in 1M Na_2SO_4. The charge/discharge cycles of MnO_2 electrode was studied by galvanostatic charge/discharge technique under a constant current of 5 to 20 mA cm^{-2} between -0.3 to 0.8V. The MnO_2 electrode shows high coloumbic efficiency of 98.32% in 1M Na_2SO_4 electrolytes, indicating the material has potential application for energy-storage device.

IV. CONCLUSION

In summary, MnO_2 thin film electrode has been developed by simple and inexpensive potentiostatic elecrodeposition method. The MnO_2 electrode exhibited the high specific capacitance of 626 Fg^{-1} with high coloumbic efficiency. These results demonstrate that MnO_2 thin film deposited by potentiostatic electrodeposition method is a good candidate as electrode material for electrochemical capacitor.

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VI. REFERENCES

[1]. R.F. Service, Science 313 (2006) 902.
[2]. B.E. Conway, J. Electrochem. Soc. 138 (1991) 1539.
[3]. E. Frackowiak, F. Beguin, Carbon 39 (2001) 937.
[4]. S. Ghosh, O. Inganas, Adv. Mater. 11 (1999) 1214.
[5]. Qi Li, Zi-Long Wang, Gao-Ren Li, and Ye-Xiang Tong, , Nano Lett. 12 (2012) 3803–3807.
[6]. Toupin, M.; Brousse, T.; Belanger, D. Chem. Mater.14 (2002) 3946–3952.
[7]. C.C. Hu, T.W. Tsou, Electrochem. Commun. 4 (2002) 105.
[8]. Reddy, R. N.; Reddy, R. G. J. Power Sources 124 (2003) 330–337.
[9]. Kim, S. H.; Kim, S. J.; Oh, S. MChem. Mater. 11 (1999) 557–563.
[10]. Nagarajan, N.; Humadi, H.; Zhitomirsky, I. Electrochim. Acta 51 (2006) 3039–3045.
[11]. Chen, Y.-S.; Hu, C.-C.; Wu, Y.-T.. J. Solid State Electrochem. 8 (2004) 467–473.
[12]. Devaraj, S.; Munichandraiah, N.. Electrochem.Solid-State Lett. 8 (2005) A373–A377.
[13]. S. M. Ingole S. T. Navale Y. H. Navale I. A. Dhole R. S. Mane F. J. Stadler and V. B. Patil J. Solid State Electrochem., 21 (2017) 1817–1826.

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Nanoparticulate Oral Vaccines – An Update

Remya Madan Gopal[1], Prashant C. K.[2]
[1]Asst. Professor. Pillai HOC College of Arts, Science & Commerce, Rasayani, Navi Mumbai, Maharashtra, India
[2]Asst. Professor. Pillai College of Arts, Commerce & Science, New Panvel, Navi Mumbai, Maharashtra, India

ABSTRACT

Being non-invasive in nature, painless and safe, oral delivery of antigens for vaccination is an attractive route of immunization. Oral delivery of vaccines is also a cost-effective strategy. But to escape the acidic environment of the stomach, antigens need to be suitably encapsulated to protect them from rapid degradation. By changing soluble antigens to nanoparticulate forms, it is now realised that better effective oral vaccines may be in the pipeline.

Keywords: Oral Vaccines, Nanoparticles, Particulate Antigens.

I. INTRODUCTION

Oral delivery of antigens for vaccination is an attractive proposition because of being non-invasive in nature, painless and safe for use in infants. Oral delivery of vaccines is also a cost-effective strategy.[1-4] To escape the degradative acidic environment of the stomach, antigens need to be suitably encapsulated to protect them from rapid degradation and also, a higher dose may be required for oral vaccination.

We have shown in an earlier work[5] that the FDA approved poly-ε-caprolactone (PCL) polymer, because of its slow degradation kinetics, gives a prolonged and slow antigen release, making the availability of the antigen for generation of very effective subsequent immune responses, both through the humoral and cell mediated arms. This in itself has an advantage over the conventional alum based vaccine wherein only humoral immune responses are generated with little or no cell mediated immunity.

Particulate antigens and immunological aspects:

The development of an effective adaptive immune response depends on effective presentation of antigenic peptides on MHC class I and MHC class II molecules. The mechanism of antigen internalization significantly influences the efficiency of cross-presentation. Soluble antigens are poorly presented, while particulate antigens, which enter cells via phagocytosis, are presented more efficiently by MHC class I molecules. Hence, more potent CTL responses are generated by particulate antigen delivery systems.

Oral HBsAg Vaccine

Hepatitis B virus infection is a major global health problem with about 30% of the global population infected with HBV and 350 million are HBV carriers. Persistent HBV infection causes chronic hepatitis, liver cirrhosis and hepatocellular carcinoma[6]. The current hepatitis B vaccination includes three intramuscular injections of HBV surface antigen (HBsAg) with adjuvant (aluminum hydroxide) at 0, 1 and 6 months. In rural India and other developing countries dropout rate is high among individuals who do not turn up for booster dose. The prolonged period of immunity with less number of booster dose and development of effective systemic as well as mucosal immunity are important grand challenges for HBV vaccination and needs specific innovations. Dialysis patients, HIV-positive individuals, inflammatory bowel disease (IBD) patients, those with celiac disease, the morbidly obese, and the elderly are all at risk of low antibody titer (<10 mIU/mL) after receiving the standard three injected doses. Thus a more efficient vaccine for HBV is very much needed.

Building up on our group's earlier study we explored the PCL polymer nanocarrier for oral immunization in Swiss albino mice[7] comparing it to the conventional parenteral route of administration. We found a superior antibody response with a higher titer of anti-HBsAg antibody till 2 months following single oral administration compared to other routes of immunization and conventional alum-based HBsAg vaccine. The nanoparticles (NPs) with the antigen were found in the macrophages in small intestinal villi, peripheral lymph nodes and other reticulo-endothelial organs 2 months after oral administration. This study suggests the efficacy of the current nanocarrier system for efficient antigen presentation disseminated in peripheral lymphoid tissues following oral administration with a prolonged antibody response, which can minimize the requirement of booster dose. The oral delivery vehicle with the PCL system may prove to be very effective with requirement for no or reduced booster doses and painless delivery of the vaccine resulting in increased compliance of the population for mass immunization schedule.

Recent trends in development of oral nanoparticulate antigens:

Albrecht RM et al.[8] used correlative instrumental neutron activation analysis and electron microscopy to quantitatively and qualitatively study the gastrointestinal uptake and subsequent tissue/organ distribution of 4, 10, 28, and 58 nm diameter metallic colloidal gold particles following oral administration to mice. In their quantitative studies they found that colloidal gold uptake is dependent on particle size: smaller particles cross the gastrointestinal tract easily. Electron microscopy revealed that particle uptake occurred in the small intestine by persorption through holes created by extruding enterocytes.

D'Souza MJ et al.[9] used particulate delivery to generate immune response against prostate cancer antigens. The aim of this study was to evaluate the efficacy of prostate cancer vaccine derived from a murine prostate cancer cell line, TRAMP C2 in murine model via oral route using aleuria aurantia lectin as a targeting ligand for M-cells in the intestinal Peyer's patches. The whole cell lysate was obtained from TRAMP C2 murine prostate cancer cell line and was formulated into particles using spray drying process. For in vivo studies, 4-6 week old C57BL/6 male mice were vaccinated orally biweekly for 10 weeks. Serum samples were analyzed at regular intervals to determine serum IgG levels. The mice were then challenged with live TRAMP C2 cells to determine efficacy of the vaccine. The serum IgG levels of vaccinated animals were higher compared to that of the controls. Moreover, the tumor growth was retarded significantly in the vaccinated mice compared to that of controls ($p < 0.001$).

The same group[10] studied a microparticulate vaccine prepared with the use of a spray dryer using whole cell lysate of a murine ovarian cancer cell line, ID8. These particles were designed for oral delivery using enteric polymers such as methacrylic copolymer, Eudragit(®) FS30D and hydroxyl propyl methyl cellulose acetate succinate. These particles were targeted for uptake via microfold cell (M-cell) in Peyer's patches of small intestine using the earlier M-cell targeting ligand, Aleuria aurantia lectin. The particles obtained were of 1.58±0.62 μm size with a charge of 12.48±2.32 mV. The vaccine efficacy was evaluated by administering the particles via oral route to C57BL/6 female mice. At the end of vaccination, mice were challenged with live tumor cells. Vaccinated mice showed around six-fold retardation of tumor volume in comparison to non-vaccinated animals for 3 weeks after the tumor challenge ($p<0.001$). CD8+ T-cell, CD4+ T-cell and B-cell populations in different lymphatic organs were elevated in case of vaccinated mice. They concluded that such a vaccine could potentially be an effective treatment for patients with residual tumor or high tumor-relapse probability.

Cho CS et al.[11] have discussed the potential use of thiolated chitosan microspheres as next-generation mucosal vaccine carriers. Chitosan is a natural biodegradable polymer and of great interest in biomedical research due to its excellent properties including bioavailability, nontoxicity, high charge density, and mucoadhesivity. Chitosan microspheres are promising carrier systems for mucosal vaccination, especially via the oral and nasal route to induce enhanced immune responses. Moreover, the thiolated form of chitosan is of considerable interest due to its improved mucoadhesivity, permeability, stability, and controlled/extended release profile.

Bilosomes represent a key advance in oral vaccine delivery because they are more resistant to disruption by gastric acid as well as enzymes. Kesharwani P et al.[12] have in their review focused on different aspects of bilosomes including composition, developmental techniques, stability, transitional modifications and scale-up - emphasizing their biomedical potential in oral immunization against various diseases.

Avadi M et al.[13] fabricated trimethyl chitosan (TMC) nanoparticles using ionic gelation studied the utility of the particles in the oral delivery of hepatitis B surface antigen (HBsAg) employing solutions that simulated gastric and intestinal conditions. The particle size, morphology, zeta potential, loading capacity, loading efficiency, in vitro release behavior, structure, and morphology of nanoparticles were evaluated, and the activity of the loaded antigen was assessed. Size of the optimized nanoparticles and that of the antigen-loaded nanoparticles were 85 nm and 158 nm, respectively. SEM images revealed a spherical shape as well as a smooth and near-homogenous surface of nanoparticles. Results of the in vitro release studies showed that formulation improved the acid stability of the TMC nanoparticles as well as their capability to preserve the loaded HBsAg from gastric destruction. The results suggest that TMC/HPMCP nanoparticles could be used in the oral delivery of HBsAg vaccine.

Kang SM et al.[14] explored the oral route of vaccination with a microparticulate formulation. Microparticles containing inactivated influenza A/PR/34/8 H1N1 virus with Eudragit S and trehalose as a matrix were prepared using the Buchi spray dryer. Particle size distribution of microparticles was measured and the bioactivity of vaccine in a microparticle form was analyzed using a hemagglutination activity test. Furthermore, the efficacy of microparticle vaccines was evaluated in vivo in Balb/c mice. Analysis of serum samples showed that microparticles resulted in enhanced antigen-specific immunoglobulin G (IgG), IgG1, and IgG2a antibodies. Upon challenge with homologous and heterologous influenza viruses, microparticle vaccines showed significantly increased levels of protection.

II. CONCLUSION

Particulate antigens have an advantage over soluble antigens in eliciting strong humoral, cellular and mucosal immune responses. Antigen cross presentation also is enhanced. Antigens suitably entrapped in nanoparticles can thus also be used effectively for oral immunization as they protect the antigens from the acidic environment of the stomach while also acting as effective vaccines. The multitude of studies being reported in the area of nanoparticulate oral vaccines promises a new generation of better vaccines effective against infectious agents and neoplastic growths.

III. REFERENCES

[1]. Strategies for Developing Oral Vaccines for Human Papillomavirus (HPV) Induced Cancer using Nanoparticle mediated Delivery System. Uddin MN, Kouzi SA, Hussain MD. J Pharm Pharm Sci. 2015 Apr-Jun;18(2):220-34.

[2]. Homogeneous PLGA-lipid nanoparticle as a promising oral vaccine delivery system for ovalbumin. Tongtong Ma, Lianyan Wang, Tingyuan Yang, Guanghui Ma, Siling Wang Asian Journal of Pharmaceutical Sciences2014 9(3):129–136

[3]. In vivo evidence of oral vaccination with PLGA nanoparticles containing the immunostimulant monophosphoryl lipid. A F. Sarti, G. Perera, F. Hintzen, et al. Biomaterials. 2011 32(16):4052–4057

[4]. Vaccination: oral vaccine induces genitorectal immunity E. Hutchinson Nat Rev Drug Discov. 2012 11(9):673–673

[5]. Fabrication of nanoadjuvant with poly-e-caprolactone (PCL) for developing a single-shot vaccine providing prolonged immunity.Prashant CK, Bhat M, Srivastava SK, Saxena A, Kumar M, Singh A, Samim M, Ahmad FJ, Dinda AK. Int J Nanomedicine. 2014 9:937-50.

[6]. Berzofsky, J. A.; Ahlers, J. D.; Janik, J.; Morris, J.; Oh, S.; Terabe, M.; Belyakov, I. M.Progress on new vaccine strategies against chronic viral infections. JCI 2004, 114, (4), 450- 462

[7]. Novel nanocarrier for oral Hepatitis B vaccine. Dinda AK, Bhat M, Srivastava S, Kottarath SK, Prashant CK.Vaccine. 2016 Jun 8;34(27):3076-3081.

[8]. Gastrointestinal persorption and tissue distribution of differently sized colloidal gold nanoparticles.Hillyer JF1, Albrecht RM.J Pharm Sci. 2001 Dec;90(12):1927-36.

[9]. Oral delivery of particulate prostate cancer vaccine: in vitro and in vivo evaluation.Akalkotkar A, Tawde SA, Chablani L, D'Souza MJ. J Drug Target. 2012 20(4):338-46

[10]. Formulation and evaluation of oral microparticulate ovarian cancer vaccines.Tawde SA, Chablani L, Akalkotkar A, D'Souza C, Chiriva-Internati M, Selvaraj P, D'Souza MJ. Vaccine. 2012 30(38):5675-81.

[11]. Design and application of chitosan microspheres as oral and nasal vaccine carriers: an updated review.Islam MA, Firdous J, Choi YJ, Yun CH, Cho CS.Int J Nanomedicine. 2012;7:6077-93.

[12]. Bilosomes in the context of oral immunization: development, challenges and opportunities.Shukla A, Mishra V, Kesharwani P. Drug Discov Today. 2016 21(6):888-99.

[13]. Enteric trimethyl chitosan nanoparticles containing hepatitis B surface antigen for oral delivery.Farhadian A, Dounighi NM, Avadi M.Hum Vaccin Immunother. 2015;11(12):2811-8.

[14]. Immunogenicity and protection of oral influenza vaccines formulated into microparticles.Shastri PN, Kim MC, Quan FS, D'Souza MJ, Kang SM. J Pharm Sci. 2012 101(10):3623-35.

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Transport Properties of Polypyrrole/Graphene Nanocomposites

Prerna R. Modak[1], Subhash B. Kondawar[2], Deoram V. Nandanwar[2]
[1]Department of Physics, RMG Art, Science and Commerce College, Saoli, Chandrapur, Maharashtra, India
[2]Department of Physics, Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur, Maharashtra, India
[3]Department of Physics, Shri Mathuradas Mohata College of Science, Nagpur, Maharashtra, India

ABSTRACT

Graphene, as a new member of carbon allotropes and with its exceptional carrier mobility and ballistic electron transport properties, is prime nanofiller to be employed in nanocomposites for many applications. Polypyrrole is one of the conducting polymers which has attracted a great deal of interest because of its good electrical conductivity, environmental stability, porous nature and easy synthesis. To improve and extend their functions, the fabrication of conducting polymer nanocomposites has attracted a great deal of attention. In this paper we report the study of nanocomposites synthesized by an in-situ chemical oxidative polymerization of aniline monomer with concentration of 1 and 3 wt% functionalized Graphene (GNS) with that of pure polypyrrole (PPy).As prepared nanocomposites were charecterized by SEM and XRD. Nanocomposite shows high electrical conductivity as compared to pure PPy. The transport parameters such as charge localization length, most probable hopping distance and charge hopping energy of PPy/GNS were also studied at 303-353 K.

Keywords: Nanocomposites, Polypyrrole, Graphene, Transport properties

I. INTRODUCTION

Conducting polymers can conduct electricity due to partial oxidation or reduction (i.e., doping), are potential classes of advanced materials. They possess an extended π-conjugation along the polymer backbone and reveal semiconducting behavior [1]. polypyrrole (PPy), is one of the conducting polymers which has attracted a great deal of interest because of its good electrical conductivity, environmental stability, porous nature and easy synthesis. PPy has been used in a various applications, such as batteries, supercapacitors, sensors, and microwave shielding and corrosion protection. These composites offer potentials in EMI shields, electronic packaging, display devices and electrodes [2,3]. The carbon based materials such as graphite, expanded graphite, carbon black, carbon nanotubes and graphene have been explored for various applications. Graphene is originated from graphite [4]. It is a two-dimensional hexagonal lattice [5]; one-atom-thick planar sheet of sp^2 [6]. bonded carbon atoms has emerged as a conductive nanomaterial [7]. The carbon based material graphene and graphene based conducting polymer nanocomposites are found to be more attractive due their exceptional properties like low density, good electrical and mechanical properties, ease to processes and many more. So far, Electrical Conductivity and transport properties of PANI/PVC blends were studied [8]. The transport properties of PANI/CNT and PTH/CNT were also studied [9].

In the present work, PPy/GNS nanocomposites were synthesized by an in-situ chemical oxidative polymerization method with concentration of 3% functionalized Graphene (GNS) as well as pure polypyrrole (PPy).The prepared nanocomposites were characterized by SEM and XRD. The electrical conductivity of the nanocomposites measured using four probe methods. The transport pa-rameters such as charge localization length, most probable hopping distance and charge hopping energy of PPy/GNS were also studied at room temperature 303K **Experimental**

II. MATERIALS AND METHODS

Polypyrrole ammonium persulfate, hydrochloric acid, sulphuric acid and nitric acid, hydrazine monohydrate, potassium permangnate were procured from Merck Ltd., India. Graphene flakes were made available from National Physical Laboratory, New Delhi (India). All chemicals were of AR grade. Pyrrole was distilled under reduced pressure and kept below 4°C before used for synthesis. De-ionized water was used in all synthesis.

Preparation of PPy/GNS composites: GNS and the functionalization of GNS were conducted in our previously reported work [10] . Graphite oxide (GO) was synthesized from natural purified graphite flakes by the Hammers method, and graphene nanosheets (GNS) were prepared by exfoliation of GO [11,12].The PPy/GNS composites were synthesized by an in-situ polymerization of pyrrole in the presence of GNS. The complete synthesis process is reported in the earlier work [13].

III. RESULTS AND DISCUSSIONS

Morphology: To study the morphology of the composites SEM images were obtained using scanning electron microscope. SEM image of functionalized GNS shows a shiny black nature which confirms the exfoliation of graphene sheets (Fig. 1a). The SEM image of PPy shows granular morphology. The individual granule observed were nearly spherical and has a close packing and high porosity (Fig. 1b) [4]. The PPy/GNS composite shows highly porous morphology (Fig. 1c). The uniform spherical builds up of PPy on top up each other with some pores throughout the GNS. Pyrrole diffused into graphene nanosheets during polymerization and polymerized on the surface of graphene nanosheets layer by layer. In this composite, graphene sheets act as electron acceptors while PPy serves as an electron donor [15,16].

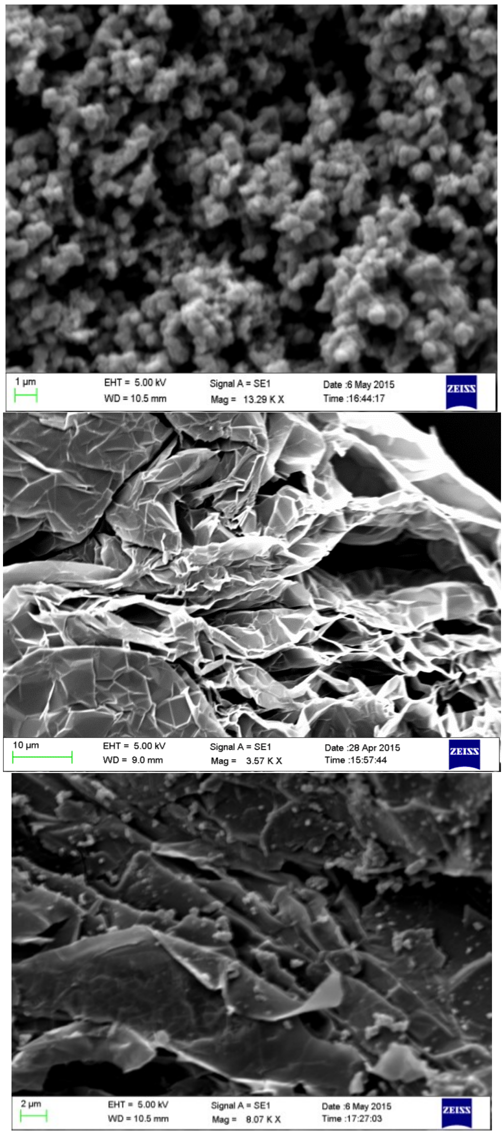

Figure 1. (a) SEM image of pure polypyrrole,(b) functionalized graphene and (c)PPy/GNS nanocomposite

X-ray diffraction: The diffraction pattern of PPy shows a peak at about $2\theta = 12^{\circ}$ and a hump around at

2θ = 24º which is typical for conducting amorphous polymer polypyrrole which is already reported. XRD pattern of PPy/1%GNS and PPy/3%GNS nanocomposites are shown in Fig. 2(a) and (b) respectively. The composites show the peaks for both PPy and GNS with some additional Peaks indicating covalent interactions between the phases. Due to this covalent interaction degree of electron delocalization of the conjugated π-system between PPy and GNS suppress. The XRD pattern of PPy/GNS exhibited diffraction peaks at 24.5°, 26° and 42.8º. The diffraction peaks at 24.5° and 42.8º correspond to (002) and (100) planes of graphite like structure while that the peak at 26º corresponds to amorphous PPy. In the PPy/GNS composite, as GNS percentage increased, the broad peak shifted from 2θ ≈ 26º to 24.8º, implying that interaction occurs between GNS and PPy. This feature supports the presence of PPy on graphene sheets.

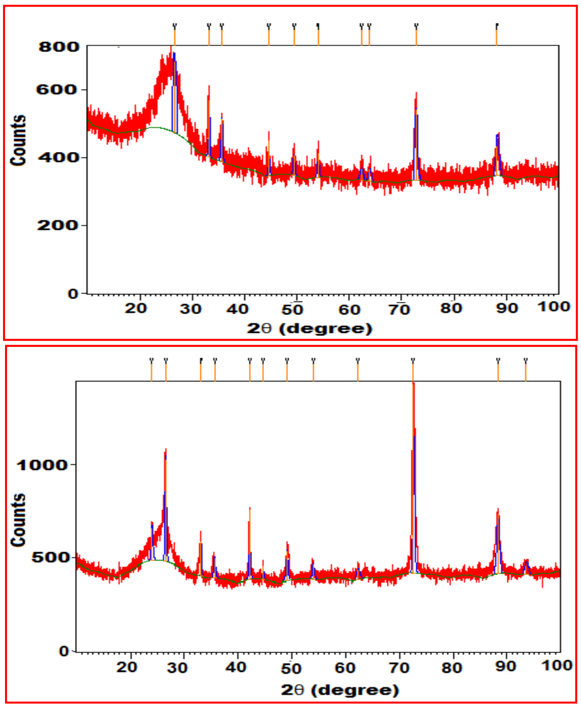

Figure 2: (a) XRD of PPy/1%GNS (b) XRD of PPy/3%GNS.

Electrical conductivity: The intrinsic conductive polypyrrole filled with conductive graphene nanofillers to develop lightweight electrically conductive composite materials. These materials show a non-linear increase of the electrical conductivity as a function of the filler concentration. At certain loading fraction, known as percolation threshold, the fillers forms a network leading to a sudden rise of the electrical conductivity of the composite. The intrinsically high conductivity and aspect ratio of graphene nanofillers make them ideal candidates to achieve this percolated network at low loading fractions [17, 18]. The numerous factors influence the electrical conductivity and the percolation threshold of the composites are concentration of the graphene nanofiller, the presence of functional groups and aspect ratio of graphene sheets, inter-sheet junction, distribution in the matrix, wrinkles and folds in the graphene sheets. The graphene fillers are in direct contact with the polymer matrix for flow of current, the conduction take place via tunnelling between thin polymer layers surrounding the filler particles [19].

We observed that, PPy behaves in the usual activated manner when the temperature increases indicating semiconducting property. It indicates that the conductivity increase with temperature is due to the increase of efficiency of charge transfer. Also the increase in temperature affects the chain alignment of the polymer; this increases the conjugation length and which in turn brings about the increase in conductivity. The increase in temperature will bring the change in molecular arrangement, which make the molecules favourable for electron delocalization [20].

The electrical conductivity of the nanocomposite PPy/GNS were also measured using four probe method, it showed that the electrical conductivity of the nanocomposite increases almost linearly with increase in temperature. The Electrical conductivity is also increases as the weight percent of GNS increases in PPy. The deposition of PPy over the GNS facilitates the electron transfer process between the PPy channels [21]. As shown in Fig. 3, the electrical conductivity for nanocomposite PPy/GNS increases linearly from pure PPy to PPy / 3%GNS, and remains constant for 5% GNS loading at 30ºC, whereas at higher temperature it increases almost linearly the values of electrical conductivity for pure PPy and PPy/GNS composites. It is clear that the highly temperature dependent nature of the nanocomposites at a low graphene content can be related to the dominance of the tunnelling mechanism when the number of graphene sheets are insufficient to allow physical contacts among them. The extent of temperature-dependence became less noticeable when the GNS content increased above the percolation threshold and finally the conductivity remained almost constant when the GNS content was above 3 wt%. At this point, the physical contacts among the fillers are well developed and the "contact" conductivity dominates over the tunnelling mechanism. The slight decrease in conductivity with increasing temperature is an evidence for the prominent role of contact conductivity in these composites.

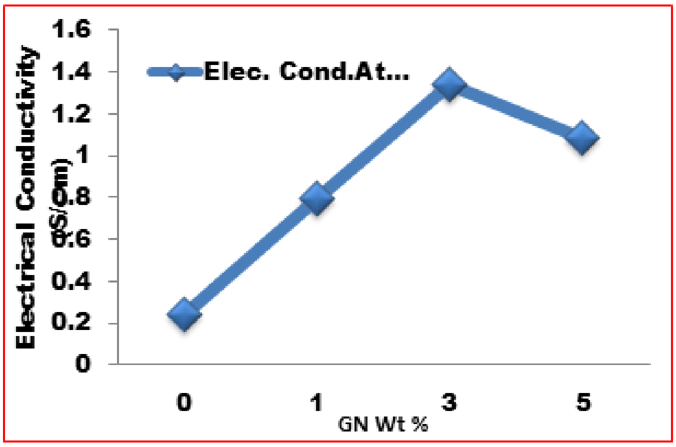

Figure 3: Electrical Conductivity with different weight percent of Graphene in Polypyrrole at 30ºC and 85ºC

Charge Transport:

PPy/GNS interaction could facilitate the charge transfer process between them and influence the charge transport properties of composite [10]. The room temperature conductivity of the nanocomposites along with transport parameters are reported in Table 1. To find transport parameters of the polymer nanocomposites from the data of electrical conductivity, Ziller equation (1) [22], has been used, which describes the inter-chain conductivity where only the neighbour variable range hoping (VRH) of charge is considered.

$$\sigma(T) = \sigma(o)e^{\left(\frac{T_o}{T}\right)^{1/2}} \quad (1)$$

The plot of *log* σ(*T*) versus $T^{1/2}$ was found to be linear for pure PPy and PPy/GNS nanocomposite, hence *To* was determined from the slope of the line. '*To*' is the characteristic temperature, can be used to calculate the transport parameters such as charge localization length (α^{-1}), most probable hopping distance (*R*) and charge hopping energy (*w*) using equations (2), (3) and (4) respectively,

$$\alpha^{-1} = \frac{8N(Ef)Zk}{T0} \quad (2)$$

$$R = (T_o/T)^{1/2}\,(\alpha^{-1}/4) \quad (3)$$

$$w = ZkT_o/16 \quad (4)$$

In these equations, *Z* is the number of nearest neighbouring chains (~4), *k* is Boltzmann constant and *N(Ef)* is the density of states per electron volt and is approximately 5×10^{18} eV^{-1}[23]. GNS serve as a "conducting bridge" which connects the PPy conducting domain. Thus functionalized GNS in PPy matrix have better conductivity with enhanced solubility and processability as compared to that of pure PPy.

IV. CONCLUSION

The nanocomposite of PPy/GNS was successfully synthesized by an in-situ chemical oxidative polymerization of aniline. SEM and XRD show the favorable interaction between PPY and GNS also confirm the coating of PPY layer on the GNS surface. The electrical conductivity of nanocomposites was found to be drastically increased as compared to that of pure PPy at room temperature. Incorporation of functionalized GNS into PPY matrix improved the transport properties of the nanocomposite. Transport parameters of PPy/GNS nanocomposite shows that the composite is better electronic material than pure Polypyrrole.

Table 1. Transport Properties of PPy and PPy/GNS composite

Polymers	σ(S/cm) at 303K	T_o(K)	α^{-1} (nm)	R(nm)	w(eV)
PPy	0.242	14.073	0.15	0.255	0.4855
PPy/1%GNS	0.7932	16.874	0.13	0.242	0.5821
PPy/3%GNS	1.34	11.244	0.19	0.289	0.3879
PPy/5%GNS	1.0877	21.812	0.10	0.212	0.7525

V. REFERENCES

[1]. Kondawar, S. B., Deshpande, M. D., Agrawal, S. P. Transport Properties of Conductive Polyaniline Nanocomposites Based on Carbon Nanotubes. International Journal of Composite Materials, (2012), 2(3): 32-36.

[2]. D.D Ateh, H.A Navsaria, P. Vadgama, Polypyrrole-based conducting polymers and interactions with biological tissues, (2006).

[3]. Hasoon Salah Abdulla and Abdullah Ibrahim Abbo , Optical and electrical properties of thin films of polyaniline and polypyrrole, Int.J. Electrochem.Sci., (2012), 7, 10666 – 10678.

[4]. Patole, A. S., Patole, S/P., Jung, S.Y., Yoo,J.B., An, J.H., Kim, T.H. Self assembled graphene/carbon nanotube/polystyrene hybride nanocomposite by in situ microemulssion polymerization, European polymer journal, (2012), 48: 252-259

[5]. Liu, Z.Y., Liu, L.J., Li, H.,Dong, Q.F., Yao, S., KiddI, A.B., Zhang , X.Y., Li, Z.Y., Tian, Y. J. , A "Green" polymer solar cell based on water-soluble poly [3-(potassium-6-hexanoate)thiophene-2,5-diyl] and aqueous-dispersible non covalent functionalized graphene sheets, Solar Energy Materials & Solar Cells, (2012), 97: 28–33

[6]. Brownson, D.A.C., Kampouris, D.K., Banks, C. E. , An overview of graphene in energy production and storage applications, Journal of Power Sources, (2011). 196: 4873–4885.

[7]. Yen, M.Y., Hsiao , M.C., Liao , S.H., Liu ,P.I., Tsai, H.M., Ma , C.C.M., Pu, N.W.,Ger, M.D. Preparation of graphene/multi-walled carbon nanotube hybrid and its use as photoanodes of dye-sensitized solar cells. Carbon , (2011), 49:3597–3606.

[8]. Subramaniam, C. K., Kaiser, A. B., Gilberd, P. W., Wesslinc, B. Electronic Transport Properties of Polyaniline/ PVC Blends. Journal of Polymer Science: Part B: Polymer Physics, (1993), 31:1425-1430.

[9]. Deshpande, M. D., Kondawar , S.B. Transport properties of multi-walled carbon nanotubes based conducting polythiophene / polyaniline nanocomposites, Advance Material Letters, (2016),7(10): 844-850.

[10]. Modak, P., Kondawar, S.B., Nandanwar, D.V. Synthesis and characterization of conducting polyaniline/graphene nanocomposites for electromagnetic interference shielding, Procedia Materials Science, (2015). 10: 588 – 594,

[11]. T. Chen, J. Qui, K. Zhu, Y. Che, Y. Zhang. J. Zhang, H. Li, F. Wang and Z. Wang: J Mater Sci. Mater Electron, (2014), 25, p. 3661

[12]. Mohamad Fahrul Rajdi Hanifah, Juhana Jaarfar, Madzlan Aziz, A. F. Ismail, M H D Othman and Mukhlis A Rahman, Effect of reduction time on the structural, electrical and thermal properties of synthesized reduced graphene oxide nanosheets ,Bull. Mater Sci. (2015), 38, 6, 1569-1576.

[13]. Prerna Ramnath Modak, Deoram Vithoba Nandanwar2 and Subhash Baburao Kondawar, Conducting Polypyrrole/Graphene Nanocomposites as Potential Electromagnetic Interference Shielding Materials in the Ku-band, Journal of Physical Science, (2016),Vol. 27(3), 137–157,

[14]. Hemant K. Chitte, Narendra V. Bhat, Ajit V. Gore, Ganesh N. Shind, Synthesis of Polypyrrole Using Ammonium Peroxy Disulfate (APS) as Oxidant Together with Some Dopants for Use in Gas Sensors , Materials Sciences and Applications, (2011), 2, 1491-1498

[15]. Burcu Saner Okan, Selmiye Alkan Gursel, Yuda Yürüm, Utilization of functionalized graphene and its nanocomposites as a catalyst support in fuel cells, Am. Chem. Soc., Div. Energy Fuels, (2013), 58 (1),1-2

[16]. Burcu Saner, Selmiye Alkan Gürsel and Yuda Yürüm, Facile synthesis of polypyrrole/graphene nanosheet-based nanocomposites as catalyst support forfuel cells, MRS Fall Meeting, (2011),1312, 391-396, ISSN 02729172

[17]. Raquel Verdejo, M. Mar Bernal, Laura J. Romasanta and Miguel A. Lopez-Manchado, Graphene filled polymer nanocomposites, J. Mater. Chem,(2011), 21,21,3301-3310

[18]. Avanish Pratap Singh, Praveen Gerg, Firoz Alam, Kuldeep Singh, R.B.Mathur, R.P.Tandon, Amita Chandra, S.K.Dhavan, Phenolic resin based composite sheets filled with mixtures reduced graphene oxide, γ-Fe2O3 and carbon fibres for excellent electromagnetic interference shielding in the X-band, Carbon, (2012), 50, 3868-3875

[19]. Dilini Galpaya, Mingchao Wang, Meinan Liu, Nunzio Motta, Eric Waclawik, Cheng Yan, Recent Advances in Fabrication and Characterization of Graphene-Polymer Nanocomposites, Graphene, (2012), 1, 30-49

[20]. Hasoon Salah Abdulla and Abdullah Ibrahim Abbo, Optical and Electrical Properties of Thin Films of Polyaniline and Polypyrrole, Int. J. Electrochem. Sci., (2012), 7, 10666 - 10678

[21]. Saswata Bose, Nam Hoon Kim, Tapas Kuila, Kin-tak Lau and Joong Hee Lee, Electrochemical performance of a graphene-polypyrrole nanocomposite as a supercapacitor electrode, Nanotechnology, (2011), 22, 295202-295211

[22]. Deshpande, M. D., Kondawar , S.B. Transport properties of multi-walled carbon nanotubes based conducting polythiophene / polyaniline nanocomposites, Advance Material Letters, (2016), 7(10): 844-850.

[23]. Nandapure, B. I., Kondawar, S. B., Salunkhe, M.Y., Nandapure, A. I, Magnetic and transport properties of conducting polyaniline/nickel oxide nanocomposites. Advance Matterial. Letters, .(2013), 4(2), 134-1139.

Table 2. Transport Properties of PPy and PPy/GNS composite

Polymers	**σ(S/cm) at 303K**	**T_0(K)**	**α^{-1} (nm)**	**R(nm)**	**w(eV)**
PPy		14073	0.015	0.0255	
PPy/1%GNS		16874	0.013	0.0242	
PPy/3%GNS		11244	0.019	0.0289	
PPy/5%GNS		21812	0.010	0.0212	

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Synthesis of Semiconducting Copper Sulphide Crystal ,Grown in Gas-Geland its Characterisation

K. P. JOSHI
Dr. S. D. Devsey Department of Physics, Arts Commerce And Science College Wada, Palghar, Maharashtra, India

ABSTRACT

A crystal of copper sulphide have been grown by simple single diffusion gel technique A cubical bigger sized crystal were obtained for this alternative supernatants ,incorporating solutions its concentrations affects on growth of these crystals. Structural analysis optimum condition, infra radiations, gap,energy dispersive analysis were performed , spectrophotometer and diffract meter are used to obtain spectra for content determination and hkl calculation .

Keywords: X-ray diffraction, FT-IR, UV-VIS spectrophotometer, Energy gap, gel technique, unit cell, EDAX.

I. INTRODUCTION

In 1913 Liesgang was studying the growth of crystal in gel and he recorded he studied the formations of rings. Afterwards, mechanism of growth had been discussed extensively by many his coworkers, this work were accelerated by researchers still today. The growth of crystal in silica gel at an ambient temperature for the material, which is sparingly soluble in water, is an attractive alternative to the techniques involving high temperature. A variety of crystals required for the purpose of application can be grown in silica gel. During the last few years, a successful application of gel growth technique has been demonstrated by the preparation of crystals of alkaline earth metal sulphides. The gel growth technique appeared quite attractive for growing crystals of such compounds on account of its unique advantage in terms of crystals produced and the simplicity of the process. The crystals of sulphide exhibit non linear properties .A non linear optical phenomenon's are found to be a wide variety of applications in many areas of modern science engineering and technology.

A variety of crystals for research and technology can be grown in silica gel. In this method almost complete suppression of large scale movement like convection is achieved which otherwise affects to the crystals perfection. The growing crystal are held in the gel in a strain free manner thus limiting effects due to impact of the bottom or the sides of the container which are used.

In gel method, the rate of diffusion of reactant can be controlled science, the gel are network of cavities of several tens to several thousand of angstroms in diameter, communicating through slightly smaller orifices .Gel technique is inexpensive and simple but quite attractive, The beauty and sparkle of many faced crystal found all over the earth's, the earth's crust have attracted mans interest in the history. Crystal has been treasured primarily because of their ornamental value. A new application for crystals has been discovered in solid state devices. The word of minerals provides many examples of crystals bounded by well developed plane faces which exhibit the point group symmetry of the crystal structure. According to Researchers similar faced on different crystal of the same mineral form identical angles. These angles are characteristics of each different kind of crystal. This law is the foundation of the science of crystallography.

It is also reported that sulphide are semiconductor in nature the synthesis of sulphide are complicated because of relative low vapour pressure of the sulphur ,neverth less successively more attention is being turns toward investigating sulphide of various materials .There is no need to explain the role of semiconductor in the development of present electronic industries and semiconductor device for e.g. Zink sulphide (ZnS) used for lenses and other optical devices lead sulphide used in infra, red sensors ; cadmium sulphide [cds] which is used in photocell. Iodate, iodides and sulphide are taken it basic material copper, it is known that copper and its compounds has a wide spread use in a different range of application. It is used to make electrical products and electronics in electric generators and motors, electrical power and lighting fixture. Electrical wiring, chemical and pharmaceutical manufacturing, radio and television sets, computers air conditioning system and other electrical appliances in building construction .

In the present work, an attempt has been made to characterize gel grown crystals of copper Sulphide by X-ray diffractometry, infrared spectroscopy, Thermal analysis i.e.TGA and DSC, EDAX, Chemical Analysis, UV-VIS spectrophotometer

The results the observations have been described in this chapter

1.2 Experimental procedure:

A copper sulphide crystal are grown using chemical reaction method. This method involves growing of copper sulphide crystals by allowing the reaction of two solutions of soluble salts by diffusion through a gel containing copper chloride and distilled water containing H_2S gas with subsequent nucleation and the crystal growth which continues due to the gradual precipitation of insoluble product.

Preparation of gel:

Initially different concentration solution of sodium Meta silicate taken for e.g. 10gm,12gm ,14 gm, 16 gm, 18 gm, 21gm, 22gm in distilled water to get 250cc solution. The solution is constantly stirred and then filtered by Dr Watts filter paper. It is then kept in to an airtight bottle free from dust and contamination. Density of the solution was measured using specific gravity bottle. A solution of different molarities prepared by adding proper amount of chemicals to the double distilled water for copper nitrate, copper chloride, Hydrogen sulphide gas, acetic acid and sodium meta silicate.

A gel formation of mineral or organic acid takes place with a mixing of sodium meta silicate solution. It forms process of polymerization in the mixture of solution or resultant solution. In the present work, various concentration of acetic acid and those of sodium meta silicate were tried for optimum condition with different concentrations of Hydrogen Sulphide gas solution.

Single diffusion methods:

In the present research work, single diffusion method was used to obtain crystals of copper sulphide in gel medium. In actual procedure, 5cc of 2N acetic acid was taken in a small beaker, to which sodium Meta silicate solution of density 1.04 gm/cc was added drop wise from burette with constant stirring performed with the help of magnetic stirrer, till pH of the mixture reaches a value 4.4. A pH meter HANNA instrument of digital pocket sized is used for this purpose. A 5cc of copper chloride solution of concentration 0.4M was added with constant stirring in mixture of acetic acid and sodium meta silicate solution .A continuous stirring process required to avoids excessive ion concentration which otherwise causes premature local gelling and makes the final medium inhomogeneous and turbid .The pH of the mixture was maintained at 4.4 Number of attempts were tried for optimum condition for appropriate range of pH values and allowed gel to obtain crystals of copper sulphide.

The gel setting time required for the silica gel solution of pH greater than 4.5was short, it is observed that the mixture of solution with pH value less than 4.2 required quite greater number of days, however in the pH range 4.2 to 4.4 there is appropriate waiting in gelation time. Room temperature and atmospheric effect also plays an important role on gelation, aging that is evaporation of water molecules form on surface of gel. To perform these experiment borosil glass test tubes of diameter 2.5cm and height 25cm was used as crystallizing vessels. This mixture was then transferred to the test tube, a mouth of test tube closed using cotton plug. which is used to avoid contamination and dust affecting from atmosphere. The gel setting time was 12 to13days .This completely set gel was left for aging for 4days.i.e.96 hour's to120 hours .It is also observed that the aging of gel reduces the diameter of the capillaries in gel so that reaction can be controlled. H_2S gas dissolved in distilled water was used as supernatant.

The chemical reaction inside the gel can be expressed as

$XCl_2 + Y_2S \rightarrow XS + Y_2Cl_2$

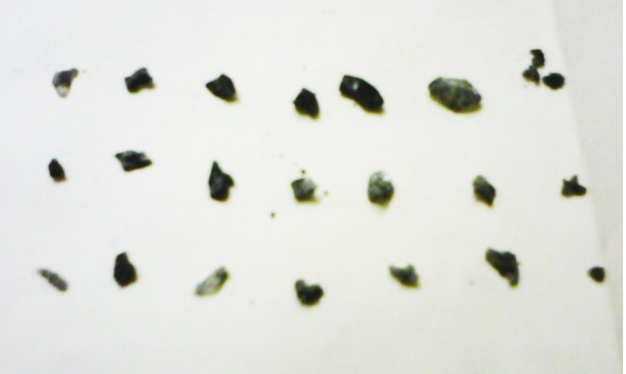

Figure 1. Number of grown crystals of copper sulphide

1.3 Nucleation:-

A formation of nuclei depends on number of parameters such as pH of solution maintained, concentrations of reactants, aging of gel, density of gel .It was observed that initial nucleation of this gel takes place on the surface of the gel and rarely inside the gel.. Nucleation of copper nitrate or copper chloride gel takes place after 9 to 12 days. Generally this time varies few hours too few days depending upon the ambient temperature.

1.4 Result and Discussions:

The optimum growth conditions for the growth of copper sulphide crystals are represented in table 1.0.The different parameters such as gel density, gel setting time; concentrations of reactants pH of gel etc have the considerable effect on the growth rate. In the steady state of concentrations gradient, growth rate also becomes steady which favors well developed crystals. However, very slow rate in one particular direction results in the different size of the crystals. Fast growth rate in one particular direction leads to the formation of elongated crystals like whiskers or dendrites.

In the present investigation, the growth of copper sulphide occurs in three different forms like whisker, dendritic and cubical. The whisker and dendrites growth occurs near the gel interface. It does mean that opaque whiskers and dendrites' are found to grow in the region of high concentration gradient respectively when the growth rate is very high. Just below the interface the concentration gradient is very high and hence the growth rate is also very high causing the whiskers of copper sulphide to grow in this region. As we go below away from the gel interface, the concentration gradient goes on decreasing. Hence below the whisker growth there is dendrtic growth of copper sulphide. Near the bottom of the test tube far away from the gel interface, the rate of diffusion of the feed solution of hydrogen gas reduces and becomes steady causing well developed cubical crystals are obtained.

The rate of arrival of the solute at the crystal surface influences perfection of the crystal, Hence, growth of more perfect crystal also occurs due to slow and steady diffusion of feed solution. No gel inclusion is observed in these crystals

Table1. Optimum lattice parameters:

Lattice parameter	**Copper sulphide concentrations**
Density of sodium Meta silicate	1.04kg/m^3
pH of mixture	4.4
Amount of 2N acetic acid	5ml
Temperature	Room temperature
Gel setting time	18 days
Gel aging time	6 days
Concentration of $CuCl_2$	1M
Concentration of $Cu(NO_3)_2$	1M
Period of growth	4 weeks

1.5.Observations:

The numbers of trials are performed to obtain optimum condition for growing copper sulphide crystals. Appreciable sizes of crystals are grown in gel medium. In some test tubes numbers of crystals are small and some are slightly big in size which are grown inside the gel .it is due to the effect of pH and diffusion of hydrogen sulphide gas in distilled water used as supernatant repeatedly . In Table1.0 the parameters such as concentrations of reactants, pH of gel impurities in solvent, gel setting time, gel aging time etc have the considerable effect on growth rate of copper sulphide crystals.

Increase in aging of gel reduces number of nucleation centers. Insufficient gel aging often leads to the fracturing of gel. At the time of addition of supernatant. Higher pH value gel sets early but crystals obtained are less transparent due to the inclusion of silica gel in them. Gel with pH less than 4.4, takes longer time to set and there is possibility of breaking of gel. Higher concentrations of reactants of hydrogen sulphide gas results on size of crystals near the gel interface.

It is necessary to study the effect of various parameters on crystal growth which is mainly depends on gel cell size, and cell size is influenced by gel density etc. Hence, these parameters have profound influence on nucleation density, growth rate habit and quality of crystals. Concentration of reactants is also important.

1.6 Effect of gel density:

The gels of different densities were obtained by mixing sodium Meta silicate solutions of specific gravity 1.02 to 1.08 with 2N acetic acid, keeping pH value constant. It was observed that transparency of the gel decreased with increase of gel density gels with higher densities required less setting time of gel compared to the gels with lower densities. It may be noted that well defined and transparent crystals were obtained with sodium Meta silicate solution of density 1.04gm/cc. On the other hand, gels with densities below 1.04 gm/cc required longer time to set and still gels were not stable .Density of 1.02 gm/cc was the lower practical limit .The effect of gel densities on the quality of crystals and the variation of gelation time with gel density shown in figure1.1 .It is observed that the gelation time decreases with increase in gel density .figures shows the effect of density on number of nuclei formed. A greater gel density implies smaller pore size and poor communication among the pores and thus decreasing the nucleation density. Bechhold et al showed that diffusion coefficient becomes distinctly smaller as gel densities increased. There is no evidence that the diffusion constant of small atoms was greatly influenced by the silica gel density as long as the density is low. Thus, the diffusion constant is not greatly influenced by the presence of dilute gel.

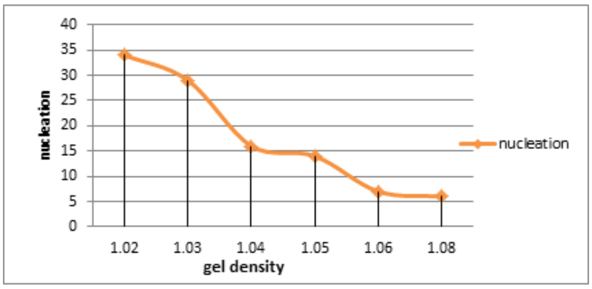

Figure 2. Plot of gel density against nucleation density

1.7 Effect of PH of gel.

A value of pH directly affects on transparency of growing crystal and gelation of solution containing in test tube, by changing the pH of gel without changing gel composition and concentration of reactants, the effect of pH on growth was studied. The pH value of gel was varied from 2 to 7 .The crystal grown at higher values of pH were not transparent and well defined. This may be due to contamination of the crystals with silica gel. Gel takes longer time to set with smaller pH values, such gel can be easily fractured at the time of addition of supernatant. The pH observed is the composition of acetic acid and sodium Meta silicate solution, for the optimum condition different pH values were tried and gel setting time. The value of gel pH to get ideal gel is found to be 4.4 .At pH values less than 4.4 ,the time for gelation increased ,and the resultant gel was unstable ,and for pH values greater than 4.4, the gelation occurred very soon and the resultant gel was not transparent. Figure 3 shows the graph of pH against setting time in days.

In the present work, pH value of 4.4 is the optimum condition to grow good quality crystal.

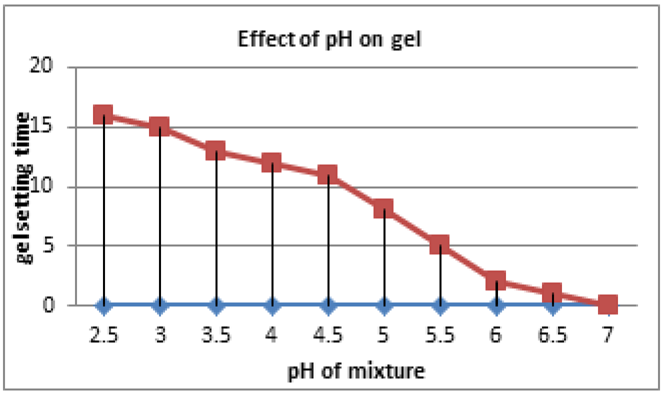

Figure 3. Plot of pH against gel setting time in days

1.8 Effect of gel aging:

Gel aging plays an effective role on the growth of copper sulphide crystals .To investigate the effect of aging on gels, gel of same pH and density were allowed to age for various periods before adding the feed solution over a set gel containing copper chloride. Supernatant of constant molarity was then added as a feed solution over the set gel. It was found that number of copper sulphide crystal decreases with increase in aging of gel. Aging of gel decreases the pore size as well as diffusion and nucleation density.

More aging causes more amount of water evaporation out of the gel. The effect of water evaporation should be considered before and after the formation of gel framework. Before the gel is set the evaporation of water causes an increase in gel density which in turn decreases the diffusivity of reactive sulphide ions in the gel, thereby decreasing the number of nucleation sites. After the gel containing copper chloride is set, the evaporation of water causes not only the lack of ionic carriers in the channel of gel framework, but also discontinuities in the channel due to the shrinkage of gel .Both these effects would adversely affect the diffusion of Hydrogen sulphide gas used as supernatant. Hence, observed the decrease in the number of nucleation sites.

Figure 4 shows the effect of aging time on number and the quality of crystal .fig–shows graph of aging in hours against the number of crystals.

In present work, aging of 120 hours was found suitable because it makes gel neither dry or brittle nor fragile. The aim of reduction in nucleation centers can also be achieved. Hence aging period of 120 hours is the optimum condition for the growth of good quality crystals.

Figure 1.3 Effect of gel aging time pH=4.4 , feed solution H_2S gas dissolved in distilled water

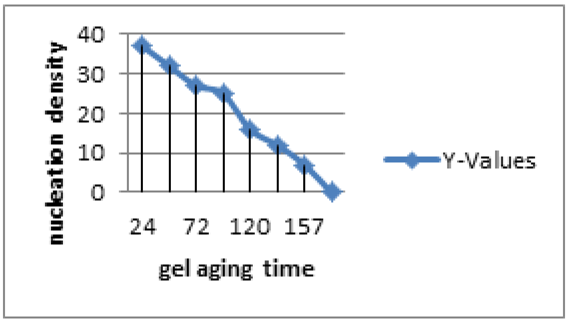

Figure 4. Plot of gel aging time against nucleation density for H_2S gas

Effect of copper chloride gel aging time pH=4.4 , feed solution H_2S containing distilled water

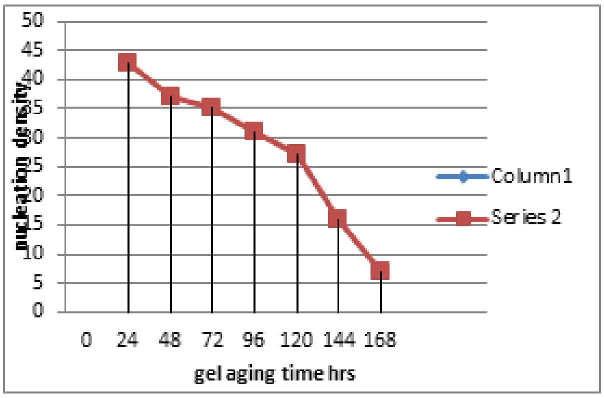

Figure 5. Plot of gel aging time against nucleation density

1.9 Effect of concentration of reactants:

In the present work different test tubes of copper chloride and copper nitrate solutions are used as reactant in silica gel medium. The grown crystals were found as shown in Figure after the diffusion of hydrogen sulphide gas solution in gel containing copper nitrate. The concentration of copper nitrate solution varied from 0.1M to 1.5M .A feed solution replaced with equal volume of 5ml in test tube repeatedly. The numbers of test tube were arranged having copper chloride solution incorporated in gel, a concentration of solution changed from 0.1M, 0.5M and 1.5M,. Due to this reactant in gel, large numbers of crowded crystals were attached to themselves of tiny size. As concentration of reactant increased, transparent crystals of copper sulphide were grown. Increase in concentration of copper chloride used to obtained bigger size crystals.

2.0 Effect of Concentration Programming:

Concentration programming is useful to improve the quality of crystal at the time of growing process, as shown in Table 5.7 many attempts were performed to grow good quality crystal of copper sulphide. A feed solution increases nuclei were formed. Further increase in concentration created very few nucleation centers and helps the previous nuclei to grow optimum size of copper sulphide crystal .Finally quality and transparency of copper sulphide crystal were increased due to the increase in concentration of feed solution or supernatant of hydrogen sulphide gas. In present work, solutions of hydrogen sulphide gas of same concentration were used as supernatant over a set gel containing of copper chloride. A feed solution was replaced by another dual volume in next 24 hour of the strength 0.4 M. This process was continued until the concentration of hydrogen gas reached for diffusion. It is observed that for lower concentration of feed solution, there will be no nucleation as observed .

2.1 Characterizations of gel grown crystals of copper sulphide

The growth of newer Engineering Semiconducting material in the form of crystal is widely useful in different technologies. Some grown crystals having optical, piezoelectric and NLO behavior. Copper sulphide crystals are insoluble in water which is decomposing before melting point. In the work reported have the determination of the optical band gap of the sulphide crystal, its structural behavior explained and calculated. Copper sulphide is a metallic conductor due to the incomplete occupancy of the sulfur, the determination of properties of copper sulfides is generally monovalent copper compounds.

Today crystals of Sulphide is quiet interest due to wide variety of applications in many areas of engineering, modern science and technology, the nonlinear devices find large application in optical communication , image processing and wave guide coupling ,Research on thin film solar cells with copper sulphide doped in iron, indium, cadmium, bismuth is great interest today.

The present work describes the characterization of copper sulphide crystals by Following Techniques.

X-ray diffraction (XRD) :

X-ray diffractogram is useful in the analysis of crystal structure, d-values, cell parameters, unit cell volume and lattice system etc. can be evaluated using X-ray diffractogram. When the high frequency electromagnetic waves are selected to have wavelength comparable to the interplaner spacing of the crystals, they are diffracted according to the physical laws. The inter planer spacing (d) can be calculated to four digits and even more significant figures by measuring the diffraction angles. This, in turn, can be used to determine cell parameters and the system to which the sample under study belongs, etc. the reflecting planes in crystal h, k, l values can be calculated (5).

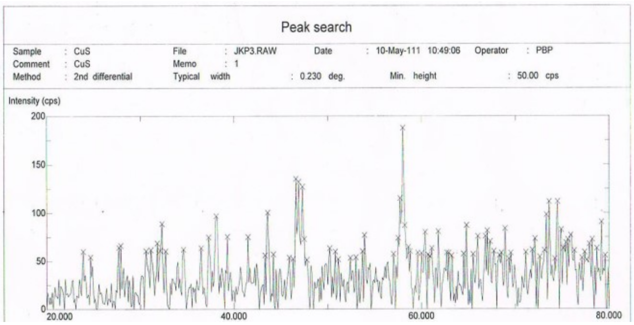

Figure 6. X-ray Diffractogram of copper sulphide

X-ray diffractogram of gel grown crystal of copper sulphide was recorded using Minislex model ,Japan with Cukα radiation of wave length 1.5408°.A and scanning speed of 10 ^{0}/minute.A copper target and nickel filter were used From the powder diffractogram on data of copper sulphide which shows twenty different peaks and corresponding d values and (h k l) values were computed by using computer program POWD [An interactive powder diffraction data interpretation and indexing program] The recorded X-ray diffractogram is as shown in fig. 1.5The study was carried out at Department of Physical sciences, North Maharashtra University Jalgaon, Maharashtra.

These values are computed using computer programmed, POWD is as shown in the table 1.1. From POWD it found the lattice parameter of unit cell satisfy condition a#b#c and α=β=90 and γ#90.so unit cell structure is monoclinic. Calculated unit cell lattice parameter of the copper sulphide crystal are given in table 1.1 as follows

Table 1. Lattice Parameters

Parameter	Copper sulphide
system	Monoclinic
a	8.617 A^0
b	4.3443 A^0
c	5.6428 A^0
α	90^0
γ	123.31 A^0
β	90^0
V	175.56 $(A^0)^3$
λ	1.5405 A^0

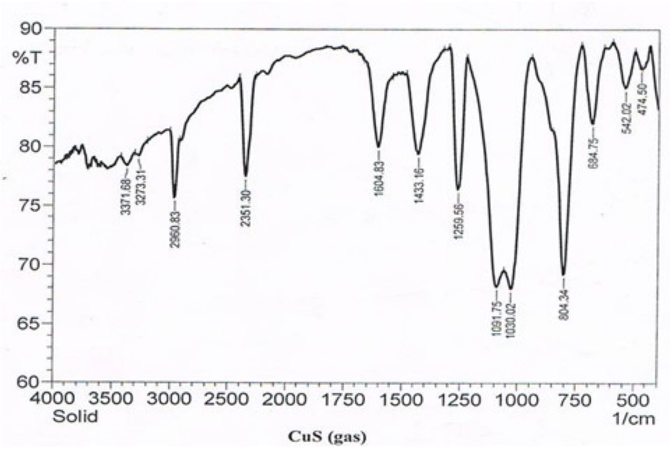

Figure 7. FT-IR spectrum of copper sulphide.

FT-IR is used for structural analysis In the present work IR spectrum of copper sulphide sample was recorded using SHIMADZU Spectrophotometer at North Maharashtra University Department of Chemical Technology Jalgaon . The IR spectra of these gel grown copper sulphide was recorded in the wave number range 500/cm to 4000/cm for KBr Line as shown in Figure 1.6

The bands at 3371.68cm^{-1} to 3273.31cm^{-1} are due to O-H stretching shows effect of C-H and N-H stretching in lower frequencies the fundamental frequencies of sulphoxide sulphides and sulphones are observed in all sulphide group compounds , which are also found in presents FT-IR analysis, which confirmed sulphide group of grown crystals. The bands at 1433.16cm^{-1}are due to SO2 sulphate and 1259.56cm^{-1} due to sulphones are due to –N-H stretching bands.

A stretching frequency observed at 1091.75cm^{-1}and 1031.02cm^{-1} are due to S-O-C or Si -O – Si stretching exhibits sulphoxides by –C-O and S=O stretching vibration .A pair of strong nitrites band observed at 804.34 cm^{-1} due N-O stretching nitrites .The organo halogen compound are detected due to carbon – halogen stretching of vibration bands at 684.75 cm^{-1}to 542.02 cm^{-1}.The C-H stretching are due to 2351.30cm^{-1} band A band of 1604.83cm^{-1} nitro group of CO O^{-} stretching and final libration of compound occurs at 474.50cm^{-1}. The assignment of copper sulphide peaks as shown in Table.

II. CONCLUSION

1) The crystal of copper sulphide can be grown by using gel technique Single diffusion gel growth technique is suitable copper sulphide crystals.
2) Different habits of copper sulphide crystals can be obtained by changing parameter like gel density, gel aging, pH of gel concentration of reactants etc.
3) Chemical composition of the grown crystal by chemical analysis and EDAX match with the theoretical calculation from molecular formula.
4) Unit cell parameter value and d values match very with the reported ones
5) The structure of copper sulphide is monoclinic confirmed by X-ray diffraction.

III. REFERENCES

[1]. Amjad(1991), Influence of Calcium Fluoride Crystal Growth by Polyelectrolytes.., Langmuir, Vol7,pp2405

[2]. Zhang, Birdwhistell, O'Connor (1990), Magnetic and electrical properties e phase: CrTe2 Solid State Commun. Vol, 74:pp443

[3]. O.Connor, In Research Frontiers in Magneto chemistry; C.J.O. O.Connor, Ed.; World Scientific Publishing, Inc.; London, (1993) pp 109

[4]. Vijayan,Bhagavannarayana,Maurya, Pal, Datta, Gopalakrishnan, and. Ramasamy (2007),Studies on the structural, thermal and optical behaviour of solution grown organic NLO material: 8-hydroxyquinoline cryst. Res. Technol. Vol-42-pp195

[5]. Gille and Glikin (2009), Kinetic anomalies of mixed crystal growth and their effect on the crystal isomorphic composition Cryst. Res. Technol. 44, No. 1,pp 13-18

[6]. Y. Kohzuki (2010), Interaction between a dislocation and monovalent anion in various alkali halide crystals Cryst. Res. Technol. Vol 45, pp957

[7]. Marinova,georgiev and Stoilova(2010),Infrared spectroscopic study of NH4+ and SO42- ions included in nickel sulfates and selenates Cryst. Res. Technol. Vol 45, pp111

[8]. Van der Leeden and van Rosmalen (1990), Effect of The Molecular Weight of Polyphosphinoacrylates on their Performance in BaSO4 Growth Retardation, J. Crystal Growth Vol 21 pp100: 109

[9]. Parekh and Joshi (2007), Growth and characterization of gel grown calcium pyrophosphate tetrahydrate crystal, cryst. Res. Technol. Vol-42- pp 127

[10]. Mansour Al-HajOnyszko Bogdanowicz, Kubiak, and Sieniawski j(2010),X-ray topography and crystal orientation study of a nickel-based CMSX-4 superalloy single crystal, Cryst. Res. Technol. 45, pp1326

[11]. Marinova, Georgiev, and Stoilova(2010),Infrared spectroscopic study of NH4+ and SO42- ions included in nickel sulfates and selenates ,Cryst. Res. Technol. Vol 45, pp111

[12]. YongfengWang Danli and Zhang Lingcu(2010), Temperature gradient controlled growth and optical properties of Er:BaY2F8 crystals,Cryst. Res. Technol. Vol 45, pp365

[13]. Marie Mark - Maurice and prode (2011), Metal sulphide for copper detection, chalcogenide letters, Vol - 8, pp301-308.

[14]. Kumar, Varghese and Louis(2010), Electrical conductivity of sulfamic acid single crystals, cryst. Res. Technol. 45, pp634

[15]. Oueslati, Selmi and Ben Nasr (2008), Crystal structure and spectroscopic studies of a new organic monohydrate mono phosphate dehydrate, Cryst. Res. Technol. 43, pp 108

[16]. Chen Weijun(1992),Thermal Behaviors of KAP,RAP and TAP of X- ray Analyzing, Crystals journal of synthetic crystalVo 04-pp12

[17]. Gostauto (2004), Copper sulphide formation by interaction of sulphur with copper ions, chemija Vol-15, pp5-10.

[18]. Chan and Juchen (1998), photoluminescence and electroluminescence from copper doped zinc sulphide Nan crystals and polymer composite, Elsevier Vol. 13, pp44-51.

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GC-MS Screening of Some Bioactive Compounds from Methanolic Extract of Medicinally Relevant Wild Edible Plant Parts

Mahadkar Shivprasad*[1], Jadhav Varsha[2]

[1]Assistant Professor, Department of Botany Dr. Shantilal Dhanji Devse Arts College, Commerce and Science College, Wada Palghar, Maharashtra, India

[2]Associate Professor, Department of Botany Shivaji University Kolhapur, Maharashtra, India

ABSTRACT

In present study the bioactive compounds from methanolic extract of Oroxylum indicum (L.) Vent, Zanthoxylum rhetsa (Roxb.) DC, Ensete Superbum (Roxb.) Cheesuran, Woodfordia fruticosa (L.) Kurz and Smilax zeylanica L. were evaluated by using GC-MS method. The GC-MS analysis of the methanolic extract revealed that presence of many similar major compound like Hexadecanoic acid- methyl ester, 9-Octadecynoic acid- methyl ester, n-Hexadecanoic acid, 9,12-Octadecadienoic acid- methyl ester and Pentadecanoic acid. Majority of the compounds were belonging to acid group. Common compound in all these plants was hexadecanoic acid.

Keywords : Bioactive Compounds, GCMS analysis, Wild Edible Plants.

I. INTRODUCTION

Wild edible plants having duel significance. They have edible as well as medicinal value. Wild edible plants considered as one of the main sources of biologically active compounds. Wild edible plants are capable for synthesizing low molecular weight organic compounds called secondary metabolites having unique and complex structures. GC-MS method used for the analysis these active principles in plants which is used in cosmetic, drugs, pharmaceutical or food industries.

Bioactive compounds consist of low-molecular weight compounds that are regarded as not essential for sustaining life, but as crucial for the survival of the producing organism. More than 50,000 structures have been identified in plants through various screening methods. The actual numbers of bioactive compounds in the plant kingdom would exceed 100,000 structures (Mathekaga and Meyer1998, Koperuncholan et. al. 2010, Koperuncholan and Ahmed 2011).

II. MATERIALS AND METHODS

Plant material

The five different plants viz. Ensete superbum (Roxb.) Cheesman, Oroxylum indicum (L.) Vent., Smilax zeylanica L., Woodfordia fruticosa (L.) Kurz. and Zanthoxylum rhetsa (Roxb.) DC. were collected from the Kolhapur district of Maharashtra, India.

Preparation of extract

The Sample of five different plant parts like fruits of Oroxylum indicum and Zanthoxylum rhetsa, flowers of Ensete superbum and Woodfordia fruticosa while leaves of Smilax zeylanica were used for preparation of extract. These plant parts were dried and Pulverized to powder in a mechanical grinder. Required quantity of the plant sample was weighted, transferred to flask, treated with the Methanol until the powder was fully immersed, incubated over night and filtered through a Whatmann No.41 filter paper. Filtrate is then concentrated till dry residue was remained. After weighing the residue, respective amount of methanol was added to make the final solution. Centrifugation was also done if needed in case of non clearance solution. These solutions were further used for GC-MS for analysis.

GC-MS/MS analysis of bioactive compounds from wild plants

The methanolic extract obtained from five wild edible plants were subjected to Gas Chromatography and Mass Spectroscopy for the determination of bioactive volatile compounds. Some of the important features are summarized below.

GC-MS analysis of the samples were carried out using Shimadzu Make QP-2010 with non polar 60 M RTX 5MS Column. Helium was used as the carrier gas and the temperature programming was set with initial oven temperature at 400C and held for 3 min and the final temperature of the oven was 4800C with rate at 100C [min.sup.-1]. A2 µL sample was injected with split less mode. Mass spectra was recorded over 35-650 amu range with electron impact ionization energy 70eV. The total running time for a sample is 45 min. The chemical components from the methanolic extracts of plants were identified by comparing the retention times of chromatographic peaks using Quadra pole detector with NIST Library to relative retention indices. Quantitative determinations were made by relating respective peak areas to TIC areas from the GC-MS.

III. RESULTS AND DISCUSSION

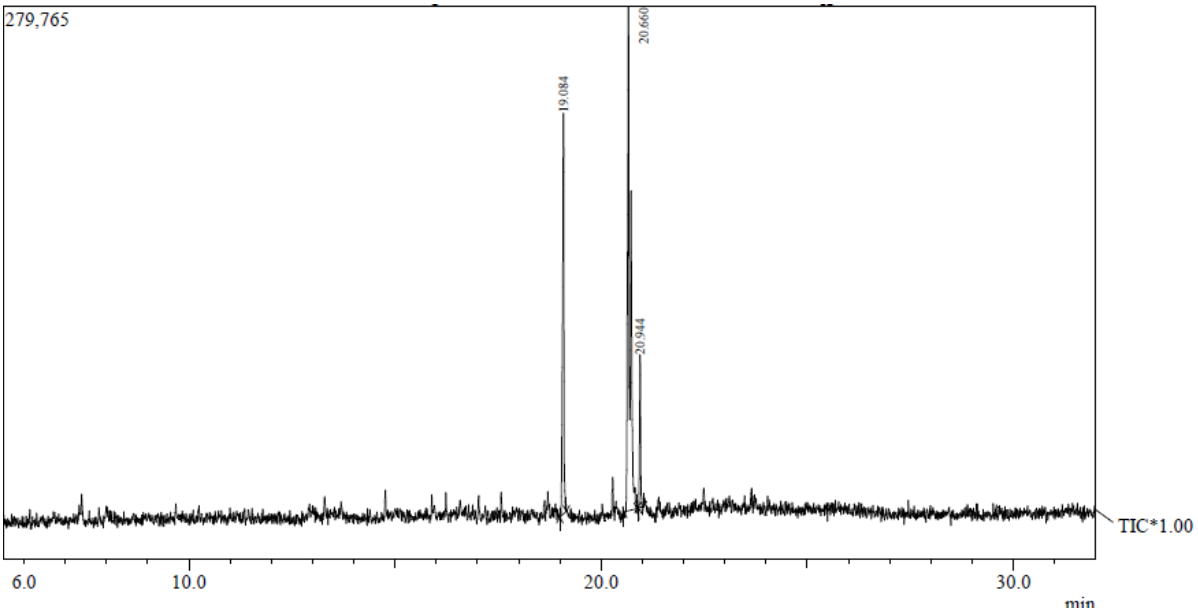

Figure 1. GC-MS chromatogram of methanolic extract of Fruits of Zanthoxylum rhetsa (Roxb.) DC

Lalitharani et al. (2010) carried out GC-MS analysis of ethanolic extract of Zanthoxylum rhetsa (Roxb.) DC. spines. They carried out investigation of ethanolic extract of spines of Z. rhetsa. Through GCMS analysis and detected total 15 compounds (Butane, 1,1 diethoxy-; Pentane, 1,1-diethoxy-; Hexanoic acid, ethyl ester; Propane, 1,1,3-triethoxy-; Hexadecanoic acid, ethyl ester; 3-Buten-2-one, 4-(2,6,6- trimethyl-1-cyclohexen-1-yl); Dodecanoic acid; Azulene, 1,4-dimethyl-7-(1-methylethyl)-; Tetradecanoic acid; 1,2- Benzenedicarboxylic acid,butyl octyl ester; n-Hexadecanoic acid; 9,12-Octadecadienoic acid(Z,Z)-; Oleic Acid; Octadecanoic acid, 2-hydroxy-1,3-propanediyl ester; 1, 2- Benzenedicarboxylic acid, diisooctyl ester). In present GCMS analysis methanolic extract offruits of Z. rhetsa showed 3 chemical compounds namely- n-Hexadecanoic acid; 9,12-Octadecadienoic acid, methyl ester, (E,E)- and Octadecanoic acid, 2-(2-hydroxyethoxy)ethyl ester. Some of the compounds found in both work were same.

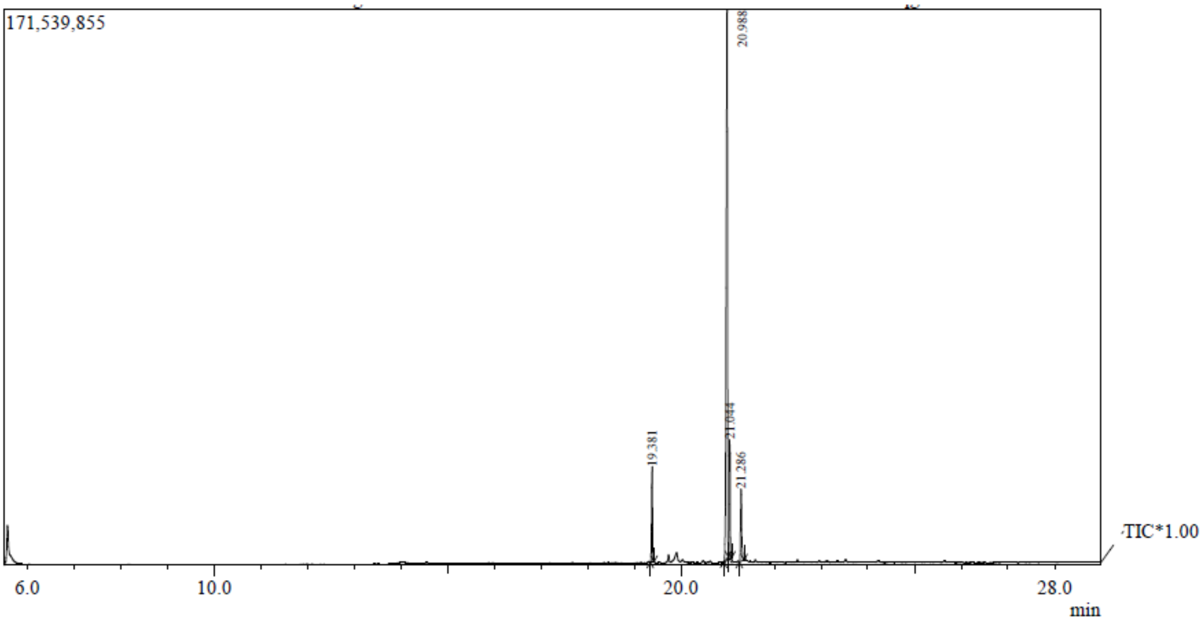

Figure 2. GC-MS chromatogram of methanolic extract of Fruits of Oroxylum indicum (L.) Vent.

D'Mello et al. (2012) have done investigation and quantification of phytoconstituents from O. indicum bark by GC-Mass and HPLC techniques. They determined composition of phytoconstituents terpenoids by GC and GC-Mass technique. GC-Mass result of petroleum ether extract showed presence of eucalyptol, terpineol, anethole, myrcene, terpinene, Rphellandrene, p-cymene, γ-terpenine, ocimene, δ-2-carene, p-copaene, p-cymene-8-ol, caryophyllene, limonene, decenol, α Pinene, valencene and dichloromethane extract showed presence of α copaene, β elemene, α, β caryophyllene, germacrene-D, α-cadinene, nhexacosane. In present study GCMS analysis of methanolic extract of fruits of O. indicum showed presence of Hexadecanoic acid; methyl ester; 9-Octadecynoic acid, methyl ester; 9- Octadecenoic acid, methyl ester, (E)-; Octadecanoic acid, methyl ester, respectively. Earlier authors analysed different compound in O. indicum bark and candidate identified same compound from fruit.

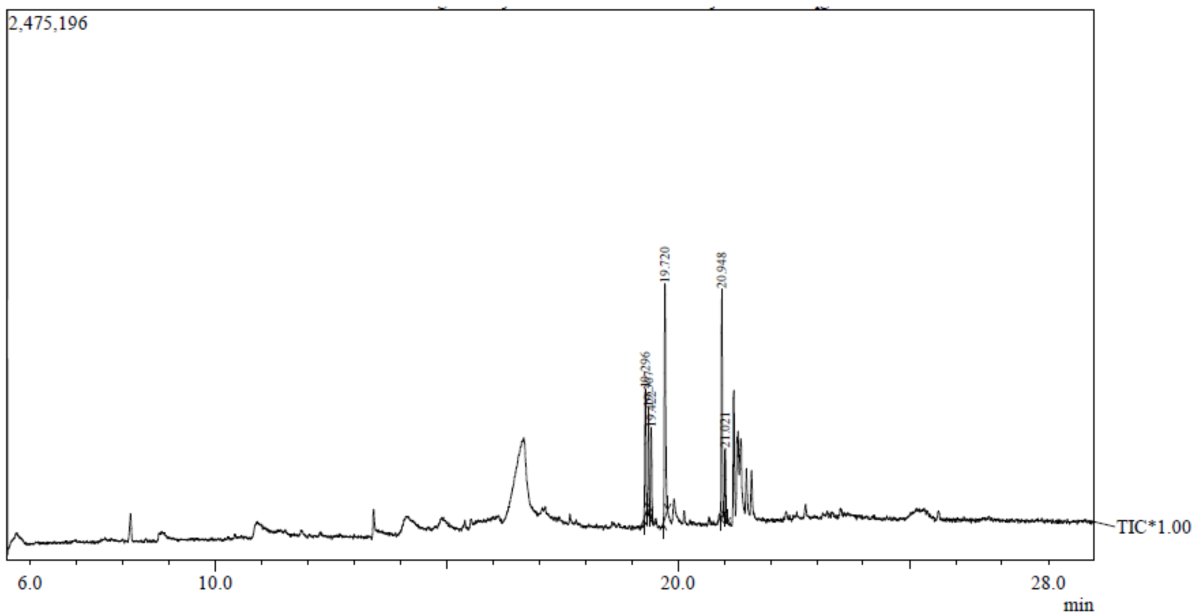

Figure 3. GC-MS chromatogram of methanolic extract of leaves of Smilax zeylanica L.

Zubair et al. (2013) carried out GC/MS profiling, in vitro antioxidant, antimicrobial and haemolytic activities of Smilax macrophylla leaves. They determined antimicrobial activity, antioxidant activity (total phenolic content, total flavonoids content, DPPH free radical scavenging activity) and n-hexane factors through GCMS. Through GCMS analysis they identified total 38 chemical compounds namely- 3-Methyl-1-pentene; 3-Methyl pentane; 2-Nitrobutane; 3,4-Dimethylpentane; 2,2-Dimethylpentane; 2,4-Dimethylpentane; 2,3- Trimethylbutane; 2,3-Dimethylpentane; 2,4-Dimethylhexane; 2,3,3-Trimethylbutane; 3,4- Dimethylhexane; 1,2,4-Trimethylcyclopentane; 2,3,4-Tetramethylpentane; 2,4,6- Trimethylheptane; 3-Ethyl-2,5-dimethylhexane; 2,6-Dimethyloctane; n-Decane; 5-Ethyl-4- methyl-3-heptanone; 5-Ethyl-4-methyl-3-heptanone; 3-Methyltridecane; 11, 14, 17- Eicosatrienoic acid, methyl ester; Heneicosane; Trans-Phytol; 9,12-Octadecadienoic acid (Z,Z); (6Z)-6-Octadecadienoic acid; Alpha-Tocopherol-beta-D-mannoside; Gamma-Sitosterol; n-Hexatriacontane; 1-(+)-Ascorbic acid 2,6-dihexadecanoate. In present work GCMS analysis of methanolic extract of leaves of S. zeylanica showed presence of chemical compounds namely- Hexadecanoic acid, methyl ester; n-Hexadecanoic acid; 9,12- Octadecadienoic acid, methyl ester; 11-Octadecenoic acid, methyl ester, (Z)-.

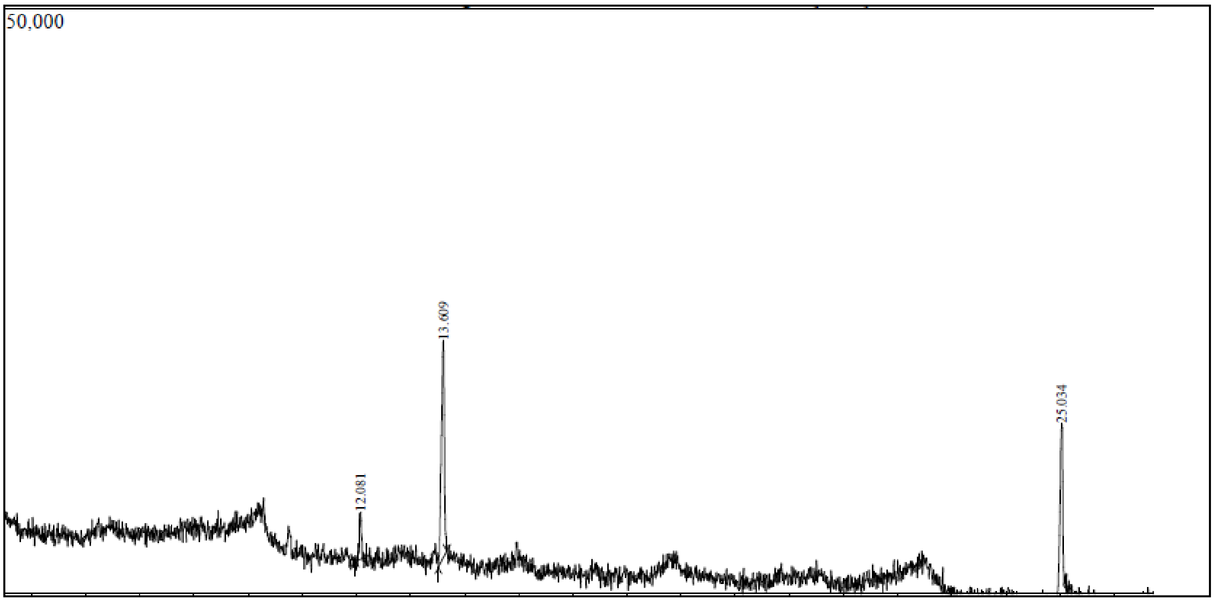

Figure 4. GC-MS chromatogram of methanolic extract of Flowers of Ensete superbum (Roxb.) Cheesman,

Graven et al. (1996) determined structure and molecular composition of the seed coat of the Musaceae. They selected mature seeds of Musa acuminata, M. balbisiana, M.mannii, M. paradisiaca, M. rosacea, M. textilis, M. velutina, Ensete ventricosum, E. glaucum, Musella lasiocarpa and determined macromolecular composition using various microscopic and chromatographic techniques. GCMS analysis of Musa velutina seed coat showed presence of propanedialdehyde; 2,3-butanedione; 2-butanone; 2-methylfuran; 3-methylfuran; acetic acid; 2-butanol cis/trans; hydroxypropane; 2,5-dimethylfuran; but-3-enal-2-one; 3- hydroxypropanal; pyruvic acid; (2H)-furan-3-one; 3-furaldehyde; 4,2-pentadienal; 2- furaldehyde; 1-(acetyloxy) propane-2-one; (5H)-furan-2-one; 2,3-dihydro-5-methylfuran-2- one; 5-methyl-2-furaldehyde; phenol; 2-hydroxy-3-methyl-2-cyclopentene-1-one; 4-methylphenol; 2-methyl-phenol (o-cresol); guaiacol; 2-ethylphenol; 4-methylguaiacol; 1,2 dihydroxybenzene; 4-vinylphenol; guaiacylethane (=4-ethylguaiacol); methyl-1,2- dihydroxybenzene; 4-vinylguaiacol; syringol; guaiacolaldehyde; 4-methylsyringol; 4-(trans- 2-propenyl)guaiacol; 4-butene guaiacol; 4-acetyl guaiacol; methyl 2-isopropylbenzoate; levoglucosan; methyl a-methyl cinnamate; 4-vinylsyringol; methyl b-methyl cinnamate; 2- butanone, 4-(4 hydroxy-3 methoxy phenyl, zingirone; syringylaldehyde; 4-(prop-cis-2-enylsyringol; 4-(prop-trans-2-enyl-) syringol; 4-acetyl syringol; 4-(prop-2-enol) guaiacol; 3-methoxy-4,4-hydroxy stilbene. In present work GCMS analysis of methanolic extract of flowers of Ensete Superbum showed presence of 4H-Pyran-4-one, 2,3-dihydro-3,5- dihydroxy-6-methyl-; 2-Furancarboxaldehyde, 5-(hydroxymethyl)-; Pentadecanoic acid.

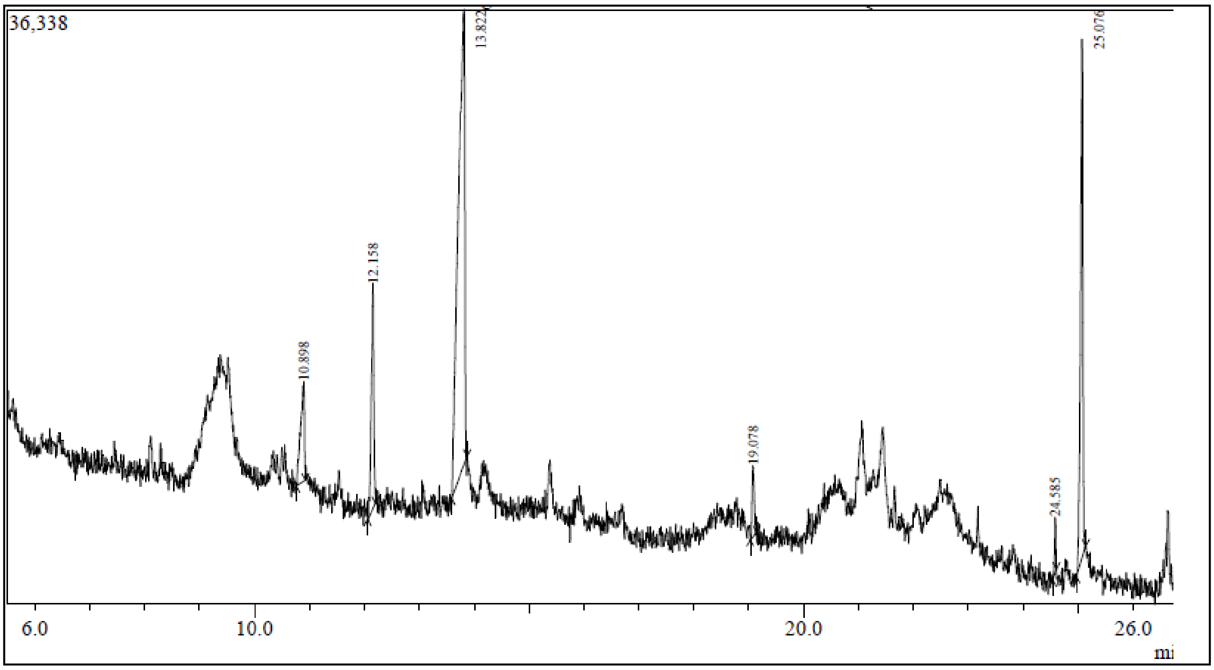

Figure 5. GC-MS chromatogram of methanolic extract of Flowers of Woodfordia fruticosa (L.) Kurz

Grover and Patni (2013) carried out phytochemical characterization using various solvent extracts and GC-MS analysis of methanolic extract of Woodfordia fruticosa (L.) Kurz. leaves. They selected leaves and flowers of W. fruticosa and extracted by using different solvents like ethyl acetate, methanol, benzene, ethanol, chloroform. GCMS analysis of methanolic extract of leaves of W. fruticosa showed Dihydroactinidiolide; Caryophyllene Oxide/Caryophyllene Epoxide; 8,11,14-Eicosatrienoic acid / Homo-gamma-linolenic acid; 10,12-Pentacosadiynoic acid; 6,9,12,15-Docosatetraenoic acid, methyl ester; 1-Cyclohexene- 1-methanol, .alpha.,2,6,6-tetramethyl-; Diisobutyl phthalate; Hexadecanoic acid,15-methyl-, methyl ester; 7,9-Di-tert-butyl-1-oxaspiro(4,5)deca-6,9-diene-2,8-dione; Benzenepropanoic acid / Hydrocinnamic acid/ 3,5-bis(1,1-dimethylethyl)-4-hydroxy-; Dibutyl phthalate/ Butyl phthalate/ Benzene-1,2-dicarboxylic acid di-n-butylester; Eicosanoic acid, ethyl ester/Arachidicacid; Cyclopropaneoctanoic acid, 2-hexyl-, methyl ester; Phytol; 2-Propanol, 1-(2-butoxyethoxy)-; Ethyl Oleate; 9-Octadecenoic acid (Z)-; 2H-1-Benzopyran-2-one; Di-noctyl phthalate; 1,2-Benzenedicarboxylic acid; Benzene,1-[[4-(4- butylcyclohexyl)phenyl]ethynyl]-2,4-dimethyl-; 1-([4-(4-Butylcyclohexyl)phenyl]ethynyl)- 2,4-dimethylbenzene; gamma.-Elemene; (E,E)-7,11,15-Trimethyl-3-methylene-hexadeca- 1,6,10,14-tetraene/β-Springene. In present study GCMS analysis of methanolic extract of flowers of W. fruticosa showed presence of chemical compounds namely- 1,3,5-Triazine-2,4,6-triamine; 4H-Pyran-4-one, 2,3-dihydro-3,5-dihydroxy-6-methyl-; 2- Furancarboxaldehyde, 5-(hydroxymethyl)-; Malonic acid, bis(2-trimethylsilylethyl ester; Pentadecanoic acid, 14-methyl-, methyl ester; Pentadecanoic acid. This study indicates the importance of wild plants and the utility of their bioactive compounds.

Table 1. Analysed bioactive compound from wild edible plants shown in

Sr.No.	Name of the plant	Retention Time	% Area of peak	Compound Analyzed	Molecular formula	Mol. Wt. (In grams)	Functional Group
1.	Zanthoxylum rhetsa (Roxb.) DC. **Family-** Rutaceae **Vernacular name-** Tirphal, Chirphal. **Edible part-** Fruit.	19.084	28.64	n-Hexadecanoic acid	$C16H32O_2$	256	Acid
		20.660	63.83	9,12-Octadecadienoic acid, methyl ester, (E,E)-	$C_{19}H_{34}O_2$	294	Acid
		20.944	7.53	Octadecanoic acid, 2-(2-hydroxyethoxy)ethyl ester	$C_{22}H_{44}O_4$	372	Acid
2.	Oroxylum indicum (L.) Vent. **Family-** Bignoniaceae. **Vernacular name-** Tetu. **Edible part-** Fruit.	19.381	8.59	Hexadecanoic acid, methyl ester	$C_{17}H_{34}O_2$	270	Acid
		20.988	72.51	9-Octadecynoic acid, methyl ester	$C_{19}H_{34}O_2$	294	Acid
		21.044	10.50	9-Octadecenoic acid, methyl ester, (E)-	$C_{19}H_{36}O_2$	296	Acid
		21.286	8.40	Octadecanoic acid, methyl ester	$C_{19}H_{38}O_2$	298	Acid
3.	Smilax zeylanica L. **Family-** Smilacaceae. **Vernacular name-** Chopchini, Ghotvel. **Edible part-** Leaves.	19.367	10.57	Hexadecanoic acid, methyl ester	$C_{17}H_{34}O_2$	270	Acid
		19.422	10.30	n-Hexadecanoic acid	$C_{16}H_{32}O_2$	256	Acid
		20.948	24.01	9,12-Octadecadienoic acid, methyl ester	$C_{19}H_{34}O_2$	294	Acid
		21.021	7.09	11-Octadecenoic acid, methyl ester, (Z)-	$C_{19}H_{36}O_2$	296	Acid
4.	Ensete Superbum (Roxb.) Cheesuran. **Family-** Musaceae. **Vernacular name-** Ran-keli, Chaveli-keli. **Edible part-** Flower.	12.081	7.86	4H-Pyran-4-one, 2,3-dihydro-3,5-dihydroxy-6-methyl-	$C_6H_8O_4$	144	Hydroxy or Corbonyl
		13.609	49.92	2-Furancarboxaldehyde, 5-(hydroxymethyl)-	$C_6H_6O_3$	126	Hydroxy or Corbonyl
		25.034	42.22	Pentadecanoic acid	$C_{15}H_{30}O_2$	242	Acid
5.	Woodfordia fruticosa (L.) Kurz. **Family-** Lytharaceae. **Vernacular name-** Dhayati. **Edible part-** Flower.	10.898	6.88	1,3,5-Triazine-2,4,6-triamine	$C_3H_6N_6$	126	Amine
		12.158	11.18	4H-Pyran-4-one, 2,3-dihydro-3,5-dihydroxy-6-methyl-	$C_6H_8O_4$	144	Hydroxy or Corbonyl
		13.822	56.15	2-Furancarboxaldehyde, 5-(hydroxymethyl)-	$C_6H_6O_3$	126	Hydroxy or Corbonyl
		19.078	3.05	Malonic acid, bis(2-trimethylsilylethyl ester	$C_{13}H_{28}O_4Si_2$	304	Acid
		24.585	1.18	Pentadecanoic acid, 14-methyl-, methyl ester	$C_{17}H_{34}O_2$	270	Acid
		25.076	21.57	Pentadecanoic acid	$C_{15}H_{30}O_2$	242	Acid

IV. CONCLUSION

All the studied wild edible plant parts, many compounds were detected, which were rich in bioactive volatile compounds. Among these volatile compounds some are represents functional group of hydroxy, acetyl, carbonyl, acid, hydrocarbon, siloxane, acetate and amine. The major compounds noticed were Hexadecanoic acid, methyl ester; n-Hexadecanoic acid; 9,12-Octadecadienoic acid, methyl ester; Octadecanoic acid; Octadecanoic acid, 2-(2-hydroxyethoxy)ethyl ester; 2-Furancarboxaldehyde, 5-(hydroxymethyl)-; 4H-Pyran-4-one, 2,3-dihydro-3,5-dihydroxy-6-methyl-; Pentadecanoic acid.

Hence, the presence of some of the important bioactive volatile compounds will certainly prove the use of extract of selected wild edible plant parts for the preparation of soaps, shampoos, shaving cream cosmetics, oil paints, varnishes, detergent, grease, household products (dispersing and thickening agent), rubber molding lubricant (anti-tack agent). Because of the presence of such volatile compounds in selected parts of wild edible plant, these may be highly demanded in the pharmaceutical and food industries.

V. REFERENCES

[1]. D'mello Priscilla, Shetgiri Preetam.and Darji, Kamil.(2012).Investigation and quantitation of phytoconstituents from Oroxylum indicum bark by GC-Mass and HPLC techniques.Int.J.Pharma and Bio Sci.3(1): 237-242.

[2]. Graven P., Koster DE C.G., Boon J.J.and Bouman F.(1996).Structure and macromolecular composition of the seed coat of the Musaceae.Annals of Botany.77(2): 105-122.

[3]. Grover N.and Patni.V.(2013).Phytochemical characterization using various solvent extracts and gc-ms analysis of methanolic extract of Woodfordia fruticosa (L.) KURZ.leaves.Int.J.Pharma.and Pharmaceutical Sci.5(4): 291-295.

[4]. Koperuncholan M and Ahmed John S.(2011): Antimicrobial and Phytochemical Screening in Myristica dactyloides Gaertn.Journal of Pharmacy Research.4: 398-400.

[5]. Koperuncholan M., Sathish Kumar P., Sathiyanarayanan G.and Vivek G.(2010): Phytochemical Screening and Antimicrobial Studies of Some Ethno medicinal Plants in South-Eastern Slope of Western Ghats.International Journal of Medicobiologial Research.1: 48-59.

[6]. Lalitharani S., Mohan V.R.and Regini G.S.(2010).GC-MS analysis of ethanolic extract of Zanthoxylum rhetsa (ROXB.) Dc spines.J.Herbal Medicine and Toxicology.4 (1): 191 192.

[7]. Mathekaga A.D.and Meyer J.M.(1998): Antibacterial activity of South African Helichrysum species.South Afr.J.Bot.64: 293–5.

[8]. Zubair M., Rizwan K., Rashid U., Saeed R., Saeed A.A., Rasool N., and Riaz M.(2013).

[9]. GC/MS profiling, in vitro antioxidant, antimicrobial and haemolytic activities of Smilax macrophylla leaves.Arabian J.Chemistry.Article is in press.

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Structural Relaxation of L-Alanine Molecule with Water Molecules and its Electrons Density of States by Dft

N. T. Tayade[1], A.T. Shende*[2], M.P.Tirpude[3]
[1]Department of Physics, Govt Institute of Science, Nagpur, Maharashtra, India
[2]Department of Physics, Dr. S. D. Devsey, Arts College and Commerce and Science College, Wada, Palghar, Maharashtra, India
[3]Department of Physics, Annasaheb Vartak College of Arts, K.M College of Arts & E.S. Andrades College of Science, Vasai, Dist Palghar, Maharashtra, India

ABSTRACT

Computer simulation methods currently have important predictive power and play a key role in understanding biological process including the model of protein, DNA and liquid water. The paper deals with the DOS and band gap of the L-Alanine calculated by DFT using plane wave method. The study conducted the ionic optimization for the relaxation in structure of L-Alanine in water to see its electron's density of state. As a relaxation progressed, how the variation in Eg, Ef and DOS occurred has been reported with supported explanation.

Keywords: DFT ground state calculation, Density of states, Energy band gap, L-Alanine, Protein

I. INTRODUCTION

L-alanine (CH_3CHNH_2COOH) is an amino acid. L-Isomer of alanine is the only natural form of alanine found in proteins. Its properties favors for possessing high electro-optic parameters and good thermal and mechanical stability of the crystals [1]. Its non-linear optical (NLO) property was reported [2]–[4]. Experimental band gap for the L-Alanine solid crystal was reported 4.74eV [5]. They found different solubility in different solvent [6]. Water soluble L-Alanine [7] starts the formation of zwitterions due to transfer of proton from carboxylic group (COOH) to amine group (NH_2) i.e. NH_2 becomes NH_3^+ and COOH becomes COO^-. Their molecules are free, so the structural relaxation can be done here. Therefore in present work, an optical energy band gap, bands, energy states for a L-Alanine single molecule aimed to uncover from the density of state using the DFT method. The work actually and essentially focused on to optimized the geometrical structure of L-Alanine single molecule (shown in Fig.1) in water (H_2O) environment for the relaxation which was initiated from the closely bounded water and L-Alanine molecules.

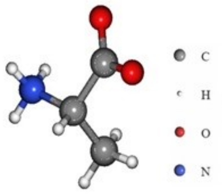

Figure 1. Shows L-Alanine single molecule

II. MATERIAL AND METHODS:

For the single molecule system with bounded water system formation in GUI, the essential data was obtained from the Crystallography Open Database (COD) data card 2104784 in cif form for computation in this paper [8], [9]. A MPI Parallelization runs for four core processors with single thread. The Quantum espresso packages [10] are used as a main tool for the DFT calculation for the ground state L-Alanine. The plain-wave method (PWSCF) is used for probing the system. The PBE exchange functional correlation was used with a projector augmented-wave (PAW) [11] pseudo potential [12] for the DFT calculation in UPF format. The BFGS (Broyden-Fletcher-Goldfarb-Shanno) ionic optimization method was selected for the structural relaxation. The ion's optimization threshold was kept 0.001 Ry/Bohr.

III. RESULT

The geometrical optimization has not converged till 100th iteration as per our criteria i.e for 5th decimal but it is converged for 4th decimal which is enough for present study. (shown in Fig.2). However, the variation of the density of state for the 1st 25th 50th and 100th clearly shows how the changes due to relaxation of the structure in water occurred which are illustrated in Fig.3 for the converged nscf calculations. The system at 100th relaxation of geometrical optimization converged to Hamiltonian -571.55133026 Ry which estimated the 0.030058 Ry/Bohr force per atom.

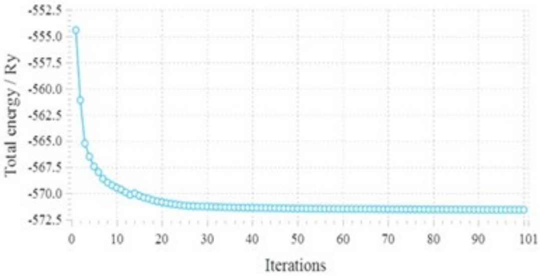

Figure 2. Convergence of relaxation in water

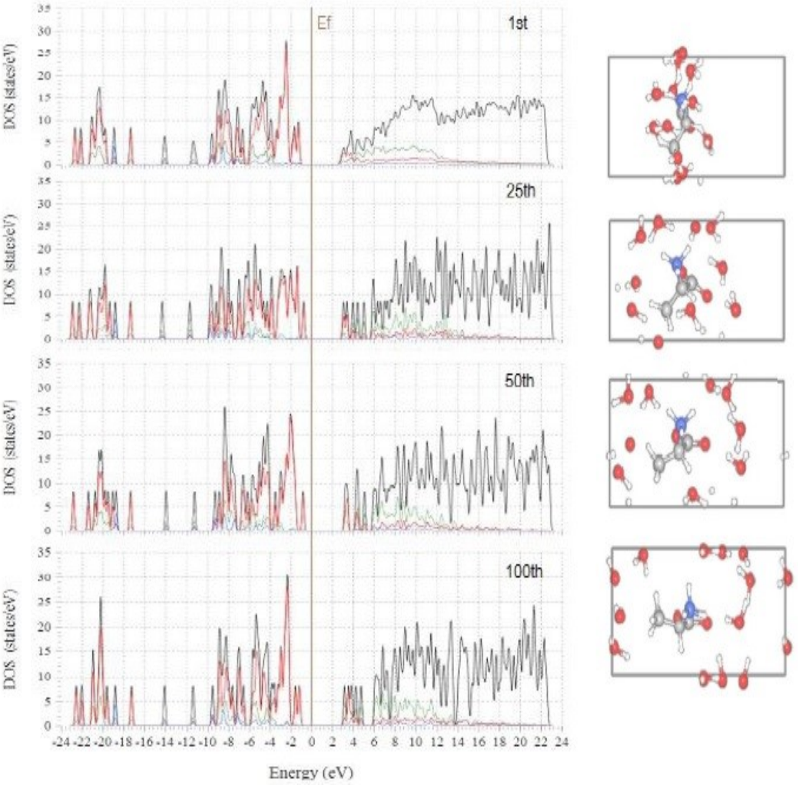

Figure 3. DOS of structural relaxation at 1st, 25th, 50th and 100th iteration for the convergence of Total Energy (Colour indication in a DOS diagram: Black-resultant/total, Orange-Oxygen, Green-Hydrogen, Gray-Carbon, Blue-Nitrogen)

DOS showed the existence of a band gap (E_g) between conduction band and the valance band for the electronic structure of the system. The occurrence of changes in both bands are observable, however, it is smaller in valence band and significantly great in conduction band. The overlapping of energy states in conduction bands were found becoming discrete in nature in the relaxation states with forming three mixed continuum. The shift in Fermi energy (E_f) was also observed. The E_f was increasing for 1st to near to 100th iteration and then showing fall. The variation in E_f (Fermi energy) and E_g (Band gap) are given in Table4.

Table 1. Variation In E_f And E_g With Structural Relaxation In Water

Iteration	**1**	**25**	**50**	**100**
E_f (ev)	-0.2684	-0.4988	-0.5526	-0.3776
E_g (ev)	3.45	3.22	3.41	3.72

IV. DISCUSSION

It is now well established that the effect of salvation has to be included in computer simulation to achieve physical meaningful results [13]. In this work, we were focused on dramatic effect of water on L-Alanine namely the behavior of stable zwitterions of L-Alanine in water environment. For the zwitterionic form of L-Alanine, we started with the most energetically favorable conformer. We performed the simulation of L-Alanine in the bulk water. L-Alanine is the smallest chiral α amino acid with non reactive methyl group (-CH3) as the side chain. It is one of the aliphatic amino acid that has the important property of not interacting favorably with water. This allows the hydrophobic effect to be studied. In this work, salvation shells are formed around L-Alanine molecule in two ways. The first hydration shell stabilizes the structure of a zwitterionic L-Alanine and the second fully covers the L-Alanine along with its first hydration. During second process the methyl group and hydrogen comes over the surface and a process of relaxation occurs. Such simulation methodology successfully been used in recent studies of biological relevance including the modeling of proteins, DNA and liquid water [14]–[17].

Moreover the existence of zwitterions determine the band gap [18] as per Split Charge Equilibrium (SQE) formalism, where at least two electronegative or two electropositive atoms at opposite end of molecule is required. The band gap support the fact that not only spatial arrangement of the L-Alanine molecules in the crystal, but also the type of lateral chain (zwitterionic state) is important to determine whether the energy gap of a L-Alanine crystal is direct or indirect [19]. The band gap of aqueous L-alanine gives semi conducting properties which can be used for making bioelectronics device. Other significance of band gap is the color of a material. The color of material is strongly dependent on the value of band gap as photons with energy lower than the band gap will be reflected, while photons with higher energy will be absorbed. Hence band gap can be used to rationalize the color properties of any organic system using zwitterions impurities [20].

V. CONCLUSION

From the present study, it is confirmed that the free individual L-Alanine molecules in structural relaxation have different DOS. The variations in parameters from nscf calculation are reported. Increase in relaxation in water of a single L-Alanine suggested that how an interaction of it with water molecule decreases and significant changes observed in Fermi and gap energies. The zwitterions are found explainable in connection with the energy band gap in DFT based calculations.

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VII. REFERENCES

[1]. R. M. and R. J. Kumar, G.R., S.G. Raj, "Influence of isoelectric pH on the growth linear and nonlinear optical and dielectric properties of L-threonine single crystals," Cryst. Growth Des., vol. 6, pp. 1308–1310, 2006.

[2]. N. Vijayan, S. Rajasekaran, G. Bhagavannarayana, R. Ramesh Babu, R. Gopalakrishnan, M. Palanichamy, and P. Ramasamy, "Growth and Characterization of Nonlinear Optical Amino Acid Single Crystal: l-Alanine," Cryst. Growth Des., vol. 6, no. 11, pp. 2441–2445, 2006.

[3]. L. Misoguti, A. T. Varela, F. D. Nunes, V. S. Bagnato, F. E. A. Melo, J. M. Filho, and S. C. Zilio, "Optical properties of L-alanine Organic Crystals," Opt. Mater. (Amst)., vol. 6, no. 3, pp. 147–152, 1996.

[4]. R. Destro, R. E. Marsh, and R. Bianchi, "A low-temperature (23 K) study of L-alanine," J. Phys. Chem., vol. 92, no. 4, pp. 966–973, Feb. 1988.

[5]. J. Akhtar, Ferdousi Podder, "A Study on Growth, Structural, Optical and Electrical Characterization of L-alanine Single Crystal for Optoelectronic Devices," Res. J. Phys., pp. 31–40, Feb. 2012.

[6]. T. E. Needham, "The solubility of amino acids in various solvent systems," University of Rhode Island, 1970.

[7]. J. Clark, "an introduction to amino acids," Apr-2004. Online]. Available: https://www.chemguide.co.uk/organicprops/aminoacids/background.html.

[8]. N. A. Tumanov, E. V. Boldyreva, B. A. Kolesov, A. V. Kurnosov, and R. Quesada Cabrera, "Pressure-induced phase transitions in l-alanine, revisited," Acta Crystallogr. Sect. B Struct. Sci., vol. 66, no. 4, pp. 458–471, 2010.

[9]. "COD 2104784," Crystallographic Open Database, 2017. Online]. Available: http://www.crystallography.net/cod/2104784.html. Accessed: 20-Aug-2002].

[10]. P. Giannozzi, S. Baroni, N. Bonini, M. Calandra, R. Car, C. Cavazzoni, D. Ceresoli, G. L. Chiarotti, m. Cococcioni, I. Dabo, A. D. Corso, S. Fabris, G. Fratesi, S. de Gironcoli, R. Gebauer, U. Gerstmann, C. Gougoussis, A. Kokalj, M. Lazzeri, L. Martin-Samos, N. Marzari, F. Mauri, R. Mazzarello, S. Paolini, A. Pasquarello, L. Paulatto, C. Sbraccia, S. Scandolo, G. Sclauzero, A. P. Seitsonen, A. Smogunov, P. Umari, and R. M. Wentzcovitch, "Quantum ESPRESSO: a modular and open-source software project for quantum simulations of materials," 2009.

[11]. P. E. Blöchl, "Projector augmented-wave method," Phys. Rev. B, vol. 50, no. 24, pp. 17953–17979, Dec. 1994.

[12]. "C.pbe-n-kjpaw_psl.1.0.0.UPF, H.pbe-kjpaw_psl.1.0.0.UPF, O.pbe-n-kjpaw_psl.1.0.0.UPF, and N.pbe-n-kjpaw_psl.1.0.0.UPF pseudopotential form http://www.quantum-espresso.org distribution site (accessed in Jan 2018)," 2018. .

[13]. D. Sicinska, P. Paneth, and D. G. Truhlar, "How Well Does Microsolvation Represent Macrosolvation? A Test Case: Dynamics of Decarboxylation of 4-Pyridylacetic Acid Zwitterion," J. Phys. Chem. B, vol. 106, no. 10, pp. 2708–2713, 2002.

[14]. I. Degtyarenko, R. M. Nieminen, and C. Rovira, "Structure and Dynamics of Dioxygen Bound to Cobalt and Iron Heme," Biophysical Journal, vol. 91, no. 6. pp. 2024–2034, Sep-2006.

[15]. M. V Fernandez-Serra and E. Artacho, "Network equilibration and first-principles liquid water," J. Chem. Phys., vol. 121, no. 22, pp. 11136–11144, 2004.

[16]. D. Sanchez-Portal, P. Ordejón, and E. Canadell, "Computing the Properties of Materials from First Principles with SIESTA," in Principles and

Applications of Density Functional Theory in Inorganic Chemistry II, Berlin, Heidelberg: Springer Berlin Heidelberg, 2004, pp. 103–170.

[17]. P. Ordejón, "Linear Scaling ab initio Calculations in Nanoscale Materials with SIESTA," Phys. status solidi, vol. 217, no. 1, pp. 335–356, 2000.

[18]. M. H. Müser, "The chemical hardness of molecules and the band gap of solids within charge equilibration formalisms: Toward force field-based simulations of redox reactions," Eur. Phys. J. B, vol. 85, no. 4, 2012.

[19]. M. Z. S. Flores, V. N. Freire, R. P. Dos Santos, G. A. Farias, E. W. S. Caetano, M. C. F. De Oliveira, J. R. L. Fernandez, L. M. R. Scolfaro, M. J. B. Bezerra, T. M. Oliveira, G. A. Bezerra, B. S. Cavada, and H. W. Leite Alves, "Optical absorption and electronic band structure first-principles calculations of α-glycine crystals," Phys. Rev. B - Condens. Matter Mater. Phys., vol. 77, no. 11, p. 5104, 2008.

[20]. M. Arhangelskis, G. M. Day, A. J. Morris, and W. Jones, "Colour properties of fluorescein : an interplay of tautomerism and crystal packing," p. 3868, 2005.

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Variation with Time of Counts in A Concentric Glass Cylindrical Configuration in Argon

Sushama S. Pimpale
Department of Physics, S S & L S Patkar College of Arts and Science, S.V. Road, Goregaon (west), Mumbai, Maharashtra, India

ABSTRACT

On exposing argon at a constant pressure to an applied potentials viz 0.35 kV (r.m.s.) , the number of counts in dark and under light show a remarkable periodicity with time. On application of the potential, there is always an initial large value of counts, but thereafter the number of counts rises and falls, alternately, throughout the period over which the discharge is continued. The number of counts shows a continuous behavior in that it also varies synchronously with time. However, the count in dark and in light varies in opposite sense. The results point to the occurrence of a periodic effect in the plots of discharge counts versus time of exposure to discharge obtained with and without irradiation has been compared.

Keywords: Silent discharge, Irradiation,

I. INTRODUCTION

An expression for the current in terms of counts produced experimentally by exposing a constant initial pressure of gas to an applied potential for a constant period at a definite pulse height has been derived as

$$I = B.\ V^{2.}\ Vr \quad \text{and} \qquad (1)$$

$$B = 2k\ (R_i/R_o)\ .\ P \qquad (2)$$

where k, R_i and R_o; V and V_r refers to a constant of an ionic mobility; radii of inner and outer glass cylinders of a Siemen's type tube; a potential applied to the system and lastly the reduced potential respectively. Making use of a few assumptions the above equation modified by Pimpale [1] for count rate associated with the over-voltage $(\Delta V) / V_g$ (3) where V_g represents the minimum voltage at which large current occurs at p = 10 torr. The first and the last equations, acting in conjunction with the theory of boundary layer, have been used to establish the conditions for the periodic reversal of the reaction under discharge.

Further, it is interest to study the interaction of visible radiation with the discharge counts and to observe the effect of external irradiation on the reacting vessel in order to understand the basic mechanism of time-variation of pulse rate at a constant potential from activated gas.

II. EXPERIMENTAL

The discharged tube was a Siemen's type all-glass vessel containing pure dry argon at a constant pressure which was excited with a constant potential of 2.45kV (r.m.s.) for a period of 5 minutes to condition the surface. Such tube was used to measure counts (before and after external visible radiation) - time characteristics of the discharge. The experimental arrangement was exactly the same as that described earlier [2].

III. RESULTS AND DISCUSSION

The data presented graphically in Figure 1 are for discharge counts per minute in dark and under light in argon at a constant pressure under discharge due to an applied potential of 0.35 kV (r.m.s.) for a bias of 5 volts. It is seen from the solid curve that the dark count rate falls with time from initially large value to a minimum; after that the number of counts rises rapidly to a maximum. This fall and rise is periodically repeated. This periodic fall and rise in counts is accompanied by a general decrease in the counts in darkness.

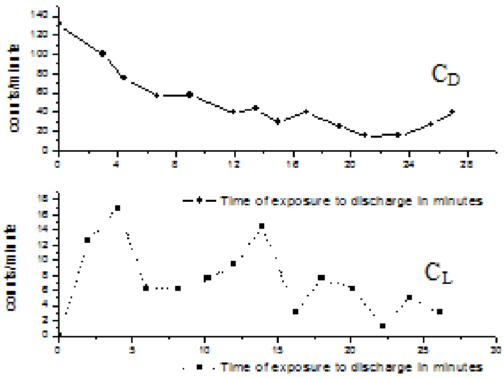

Figure 1. Variation of discharge counts with time of exposure before and after irradiation in Ar at p=10mm, a bias of 5 V and a potential of 0.35 kV (r.m.s)

The amplitude of the pulses also decreases over a period of 24 minutes. This variation with time of counts before visible radiation agrees well with the changes in the functional relationship between current and time studied by several investigators [3-5]. The discharge counts under light show a cupreous behavior in that it also varies synchronously with time but in the opposite sense. Such changes in the spectrum of discharge point out to the occurrence of a periodic reversal of the reaction, as shown in dotted curve of Figure 1. On exposure to external visible light, under otherwise same conditions, the periodicity is however, suppressed. Quantitatively, similar results have been reported by Dr. Pimpale in air [6] and in hydrogen [7]. It may be mentioned here that such a periodic effect was not observed when air was subjected to dc discharge under similar conditions of ageing, applied potential, etc [7, 8].

The influence of other physico-chemical parameters, such as applied field and electrical circuit impedance, temperature of the system, on the effect has been investigated by Pimpale [6,8]. The conditions for the optimum developments of the periodic effect are such that the corresponding changes are slow; about one reversal in about 5 minutes. The behavior of glass walls of the vessel, which form the electrodes in this work, would appear to be important. These, under the effect of applied potential, develop a strained condition as suggested by earlier by Pimpale [9,1]. Presumably, the periodic variation in the resulting current pulses is closely associated with the duration of this strained condition and the time needed for recovery thereform. In the neighborhoods of the surface of glass walls, the magnitude of the characteristics dielectric strength would also be varying periodically which would produce a like change in the time rate of discharge counts in the system as actually observed. As judges from the changes in the spectrum of the discharge during the ascending and descending portion of the period, an alternate condensation and evaporation of one or more of the products of the interaction would appear to be one of the determining factors in the production of the periodic phenomenon.

The finding of a current decrease during excitation of argon in the silent electric discharges, and the further observation that this current decrease was more pronounced under irradiation. The effect is not detected below, V_g, the threshold potential of argon despite the use of intense irradiation of all wave lengths including ultraviolet and x-rays. We are of the view that fields large enough to produce ionization by collision are necessary for the occurrence of the phenomenon.

IV. CONCLUSION

It is found that the rate of heat dissipation in the system is much greater in dark then under light associated with reduced conductivity in light. This indicates that the chief seat of the light effect may be considered to be in the ohmic part of the conductivity as distinct from the displacement components thereof.

V. REFERENCES

[1]. S. G. Pimpale, Contemporary Sci. & Techn. Of Plasma, Ed. by A. K. Gwal, Allied Publishers Ltd, 1998, 415-417.

[2]. S. S. Pimpale, Defence Sci. J., 2006, 56,715-720.

[3]. S. G. Pimpale, 12th Nat. Symp. on Plasma Sci. & Techn. (1976), GP -25

[4]. S. S. Pimpale, Indian J. of Pure & Appl. Phys., 2001, 39, 158

[5]. K. S. Vishvanathan, Preface to D.Sc. Thesis, B.H.U., Sec. I, Part I. 1949, p.7

[6]. S. G. Pimpale, Indian J. of Phys., 1974, 48, 385-393

[7]. S. G. Pimpale, Indian J. of Phys., 1974, 48, 673-683.

[8]. S. G. Pimpale, Indian J. of Phys., 1974, 48, 11-16.

[9]. S. G. Pimpale, Contemporary Sci. & Techn. of Plasma, Ed. By R .P. Singh, Allied Publishers Ltd, 1997.

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Ultrasonic Investigation of Aqueous L-Alanine

A. T. Shende[1], N. D. Chinchkhede[2], V. A. Tabhane[3]
[1]Department of Physics, Dr. S.D.D. Arts College and Commerce and Science College, Wada, Palghar, Maharashtra, India
[2]Dept of Electronics, S.B. Jain Institute of Technology, Management & Research Nagpur, Maharashtra, India
[3]Department of Physics, University of Pune, Maharashtra, India

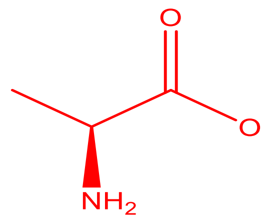
ABSTRACT

Ultrasonic are mechanical waves finds many applications in recent research. The ultrasonic velocity (u), density (ρ), and viscosity (η) of a given material can be used to determine various significant thermo acoustical parameters which can be used for various studies. This paper is deal with acoustical investigation of L-Alanine in water solution by Pulse Echo Overlap (PEO) technique and reporting the value adiabatic (β_a) and isothermal compressibility (β_i) of L-Alanine at different molar concentrations (0.0 to 0.01M) and temperature (283.15K to 323.15K). These values of compressibility may be use for modeling of protein synthesis using Molecular Dynamic Simulation.

Keywords: Adiabatic Compressibility, L-Alanine, Density, Isothermal Compressibility, Ultrasonic velocity.

I. INTRODUCTION

L-Alanine ($C_3H_7NO_2$) is one of the 20 basic amino acids [1]. It is color less , odorless, sweet taste [2,3] with ionization potential of 10.95eV and dissociation constant pKa = 2.34 at 25 ºC[4] occurs in high level in its free states in plasma and found in most proteins and particularly abundant in fibroin, the protein in silk. It is involved in sugar and acid metabolism, increases immunity and provides energy for muscle tissue, brain and the central nervous system [5-8]. It is used as a dietary supplement [9]. It is an important constituent of the vitamin pantothenic acid and is used for its synthesis. It is also used in therapeutic [11] (therapy of acute water diarrhea), pharmaceutical preparation of injection or infusion and flavor compounds in maillard reaction product, stimulant of glucagon secretion [10]. It is used in biochemical research, electroplating, and organic synthesis. The chemical structure of L-Alanine is [1]



L-ALANINE

A recent study reported L –Alanine had number of applications in pharmaceuticals, biochemistry, biotechnology, medicine, etc. [1-11]. In this study an ultrasonic investigation is carried out to find out various acoustical parameter of L-Alanine at different molar concentrations and temperatures. As L-Alanine is basic amino acids and is biologically active compound in all living organisms, it is important to know their basic physical properties. Knowledge of apparent elastic properties such as adiabatic compressibility (β_a), isothermal compressibility (β_i) and elastic modulus of biological materials are important for the prediction of their deformation behavior. These elastic properties could be used to compare the relative strengths of biomaterials and investigation of these technological characteristics could aid in the process of protein synthesis [12], bio engineering, drugs making and testing in pharmaceutical industries. This has led several investigators to study the elastic modulus of biological materials. [13,14]

Theoretically value of adiabatic compressibility and isothermal compressibility can be calculated using following formula

$$\beta_a = \frac{1}{u^2 \times \rho} \quad {m^2}/{N} \text{ ------------(1)}$$

$$\beta_i = \gamma\, \beta_a \quad {m^2}/{N} \text{ --------------(2)}$$

where, β_a and β_i are adiabatic and isothermal compressibility ,u is ultrasonic velocity, ρ is density and γ is adiabatic constant.

II. MATERIALS AND METHODS

L-Alanine was of AR grade (E- Merck). Different concentrations of L-Alanine (0.0 to 0.01M) were prepared by using triple distilled water (Grade I). Densities, viscosities, ultrasonic velocities and attenuation by absorption were measured at different temperatures (278.15K-323.15K) and molar concentrations (0.0 to 0.01 M). Densities were determined by using density bottle with plunger method whereas viscosities with Oswald Viscometer. Ultrasonic velocities and attenuation were measured with Pulse Echo Overlap method by using AUAR-102 (Automatic Ultrasonic Attenuation Recorder). The corresponding observations and calculations are presented in Tables 1-5. The values in tables are reported in SI system.

Table 1. L-Alanine aqueous solution at 283.15K

Con.	**0**	**0.0075**	**0.008**	**0.0085**	**0.009**	**0.0095**	**0.01**
u	1455	1464	1462	1464	1472	1469	1467
ρ	999.70	995.81	997.98	1003.66	1008.17	1003.48	1005.53
β_a	4.723E-10	4.686E-10	4.690E-10	4.652E-10	4.579E-10	4.618E-10	4.619E-10
β_i	6.612E-10	6.560E-10	6.567E-10	6.512E-10	6.411E-10	6.465E-10	6.467E-10

Con. is reported in Molarity (M)

Table 2. L-Alanine aqueous solution at 293.15K

Con.	**0**	**0.0075**	**0.008**	**0.0085**	**0.009**	**0.0095**	**0.01**
u	1481	1459	1469	1491	1535	1513	1512
ρ	998.21	1001.08	1000.98	1001.39	1009.09	1005.10	1005.53
β_a	4.566E-10	4.690E-10	4.632E-10	4.490E-10	4.205E-10	4.349E-10	4.349E-10
β_i	6.392E-10	6.566E-10	6.485E-10	6.285E-10	5.887E-10	6.089E-10	6.089E-10

Con. is reported in Molarity (M)

Table 3. L-Alanine aqueous solution at T= 303.15K

Con.	**0**	**0.0075**	**0.008**	**0.0085**	**0.009**	**0.0095**	**0.01**
u	1503	1485	1491	1506	1525	1516	1516
ρ	995.65	998.82	998.61	999.64	1006.73	1000.11	1000.24
β_a	4.444E-10	4.540E-10	4.508E-10	4.413E-10	4.273E-10	4.349E-10	4.352E-10
β_i	6.222E-10	6.356E-10	6.311E-10	6.179E-10	5.982E-10	6.089E-10	6.093E-10

Con. is reported in Molarity (M)

Table 4. L-Alanine aqueous solution at T= 313.15K

Con.	**0**	**0.0075**	**0.008**	**0.0085**	**0.009**	**0.0095**	**0.01**
u	1522	1514	1520	1530	1544	1539	1540
ρ	992.22	1003.07	1003.98	1005.03	1015.88	1011.58	1011.87
β_a	4.349E-10	4.351E-10	4.312E-10	4.249E-10	4.131E-10	4.173E-10	4.165E-10
β_i	6.089E-10	6.092E-10	6.037E-10	5.949E-10	5.783E-10	5.843E-10	5.831E-10

Con. is reported in Molarity (M)

Table 5. L-Alanine aqueous solution at T= 323.15K

Con.	**0**	**0.0075**	**0.008**	**0.0085**	**0.009**	**0.0095**	**0.01**
u	1540	1539	1540	1540	1546	1541	1543
ρ	988.03	1011.58	1011.59	1014.42	1027.18	1012.57	1020.67
β_a	4.269E-10	4.174E-10	4.171E-10	4.157E-10	4.072E-10	4.160E-10	4.113E-10
β_i	5.977E-10	5.843E-10	5.839E-10	5.819E-10	5.701E-10	5.824E-10	5.758E-10

Con. is reported in Molarity (M)

III. RESULTS

The aqueous system prepared for the present investigation consists of L-Alanine, in triple distilled water (Grade I). The adiabatic compressibility and isothermal compressibility were calculated by using Equation 1 and 2 respectively and the results are depicted in the Tables 1-5. This was expected as the results are in the order of 10^{-10} and is well in agreement with general defined order of compressibility in SI system.

IV. DISCUSSION

The system used for present paper was L-Alanine +Water. When L-Alanine dissolved in water formation of zwitterions takes place due to transfer of proton from carboxylic group (COOH) to amine group (NH_2) i.e. NH_2 becomes NH_3^+ and COOH becomes COO^-. These zwitterions play crucial role when an ultrasonic wave passes though them. From first two rows of Tables 1-5 shows variation in the values of ultrasonic velocity and density of aqueous L-Alanine This is because of ultrasonic waves modifies the positions of the component particles from the propagation space by performing mechanical work against the internal forces. This modification affects the adiabatic compressibility and isothermal compressibility of aqueous L-Alanine. By introducing this value of adiabatic and isothermal compressibility for the studied aqueous L-Alanine it is possible to estimate changes of longitudinal and transverse dimensions of aqueous L-Alanine and this change is important to design the biological constituents in which L- Alanine is involved such as proteins, cells, tissues etc. Also if we know the value of compressibility then we determine the bulk modulus of a system and hence various mechanical properties. These values of compressibility may be use in Protein bioelectronics [15]. Hence, the reported results can be explored its due significance in number of new researches in biological media.

V. CONCLUSION

From the above table 1-5 the value of adiabatic compressibility and isothermal compressibility are in well agreement with general define value. Hence reporting the same for aqueous L-Alanine. This is the first time the values of adiabatic and isothermal compressibility of L-Alanine are being reported.

VI. REFERENCES

[1]. Lehninger "Principles of Biochemistry" Worth publishers, New York(1984)

[2]. O'Neil M.J.(ed). The Merck Index: An Encyclopedia of Chemicals, Drugs, and Biologicals, 13th Edition, Whitehouse Station, N.J: Merck and Co., Inc., (2001), 39

[3]. Lewis R.J. Sax's Dangerous Properties of Industrial Materials, 10th ed. Volume1-3, New York, NY: John Wiley & Sons Inc., (1999), 93

[4]. Araki K, Ozeki T., Kirk-Othmer Encyclopedia of Chemical Technology, , NY: John Wiley & Sons, Amino Acids, (July 18,2003).

[5]. Berg, Jeremy, Tymoczko J., Stryer L. Protein Composition and Structure, Biochemistry (7th Edition). W.H. Freeman and Company. ISBN1-4292-2936-5, (2012)

[6]. Berg, Jeremy M., Biochemistry (6th Ed.) New York City, NY: W.H. Freeman and Company, (2002).

[7]. Hames, Daivd, Hooper, Nigel. Biochemistry, 3rd edition. Taylor and Francis Group. New York. (2005).

[8]. Wise R, David; Thompson B, Craig "Glutamine addiction: a new therapeutic target in cancer" Trends in Biochemical Sciences 35 (2010) 427-433.

[9]. Lewis R.J. Sr (Ed), Hawley's Condensed Chemical Dictionary, 12th ed New York, NY: Van Nostrand Rheinhold Co., (1993), 29

[10]. Gerhartz W.,(exec .ed), Ullmann's Encyclopedia of Industrial Chemistry,5thEd volA1, Deerfield Beach, FL VCH Publishers,(1985 to Present),VA2 80-4

[11]. Patra F.C. et al, Br Med, J 298(1989) 1353-6

[12]. Dadarlat V.M., Post C.B., Insight into Protein Compressibility from Molecular Dynamics Simulation 3(105) (30 Dec. 2000) 715-724.

[13]. Lofqvist T., Niemi J.,Aitomaki Y., Ultrasonic methods in determining elastic material

properties of fibres in suspension , IEEE Ultrasonics Symposium,2007

[14]. Kharakoz D.P. Protien Compressibility, Dynamics and Pressure, Biophysical J. 80(4) (2001) 2037

[15]. Bostick .C.D.,Mukopadhyay S., Pecht I., Sheves M., Cahen D., Lederman D., Protein bioelectronics: A review of what we do and do not know, (Aug 2017)

[16]. S.Thirumaran,K.J. Sabu,Ultrasonic investigation of amino acids in aqueous sodium acetate medium, Indian J. of Pure and Applied Physics,47 (Feb 2009) 87-96

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Interaction of Au Atom on Single Walled Carbon Nanotube: A Density Functional Study

Sangeeta A. Nirmal*, M. R. Sonawane, R. G. Atram
Institute of Science, Mumbai, Maharashtra, India

ABSTRACT

The interaction of Au atom on Single Walled Carbon Nanotube (8, 0) (SWCNT) has been studied using first principal of Density Functional Theory (DFT). In this study we found structural change in surface geometry of SWCNT and electronic variation in its semiconducting nature. To interpret these properties, we performed geometry optimization of pristine SWCNT and Au- SWCNT system for four different sites. Then we performed calculation for band structure (BS), density of state (DOS) and Mulliken population analysis with DMol3 code. Au atom is found chemisorbed on SWCNT on atomic site by binding distance 2.7 Å where it is physisorbed for all other sites by binding distance 2.99 Å at axial, 2.96-3.102 Å at chiral and 3.663-3.520 Å at hexagon respectively. The bond angles between C - C - C bonds were ranging from116^0 to 119.5^0 which is less than 120^0 indicates trigonal structure of bonding and prefers sp2 hybridization . Thus the properties of SWCNT can be modified by the adsorbed Au adatom by minute variation in semiconducting nature and surface geometry.

Keywords: DFT, SWCNT, Adsorption, Au Atom.

I. INTRODUCTION

Physics of nanostructure is new area of science arisen in last decade of twentieth century after discovery of fullerenes and nanotubes. It is an extension of interdisciplinary integrated modern science, now known as nanotechnology which is rapidly developing. The processing, structure and properties of nano materials are differing with their size, ranges from grain size to several hundreds of nanometers. This is main reason of researcher to develop considerable interest over the past fifteen to twenty year on this topic.

A revolution in material science and engineering is taking place as researchers find ways to pattern and characterize material at the manometer length scale. Nanomaterials with transition metal with outstanding electrical, optical, magnetic and mechanical properties are rapidly being developed for use in information technology, bio engineering and environmental applications.

A carbon nanotube (CNT) is a tubular structure made of carbon atoms, having diameter of manometer order but length in micrometers. Although this kind of structures was synthesized, studied and reported by several researchers during 1952–1989, [1–17]. Ijima's detailed analysis of helical arrangement of carbon atoms on seamless coaxial cylinders in 1991, proved to be a discovery report.[18] Since then, CNT has remained an exciting material ever. Its so-called extraordinary properties, many-fold stronger than steel, harder than diamond, electrical conductivity higher than copper, thermal conductivity higher than diamond, set off a gold rush in academic and industrial laboratories, all over the world to find practical uses of CNTs.

Study of isolated and bundled CNTs with transition-metal atom doping shows the richness of the electronic and magnetic properties [19]. However, there is little attention paid to the physical behaviour between element and CNT. In this paper, we study the interaction between the (8, 0) CNT nuclei such as Gold (Au). We compare their electronic characteristics by computing the band structure, density of state (DOS), Binding energy, Band Gap, HOMO-LUMO energy, Homo-Lumo gap, Charge transfer. With these electronic characteristic of CNT we predict the change in its semiconducting nature. As well as we found behaviour of adsorption of Chromium on CNT with the help of Binding energy, iso-surface Charge density distribution and molecular orbital.

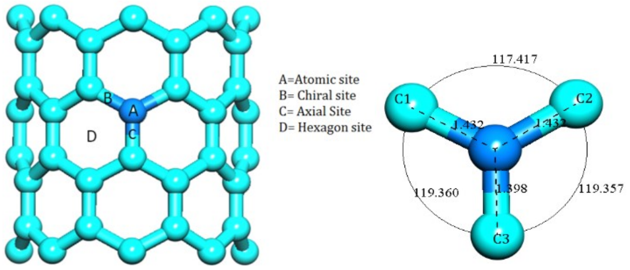
II. COMPUTATIONAL DETAILS

We have chosen (8, 0) SWCNT and Au atom model using material studio by Accelrys which is a molecular dynamics simulation software. The geometrical and electronic properties of the system were derived using quantum mechanical program code Dmol3 (Accelrys). We have also used GGA and PBE functional for optimization.

For Supercell geometries, spin unrestricted calculations were carried out with a double numeric polarized (DNP) basis set with orbital cut-off 4.4 Å. Scalar relativistic effects were included via a pseudo potential for all-electron calculations. 1 × 1 × 2 k-points were used for the Brillioun zone sampling. All the calculations were performed using boundary conditions with 64 atoms within the Supercell. The tetragonal unit cell of 20 × 20 × 8.4 Å dimensions and sufficient separation between tubes is used to avoid interaction between the tubes. The chosen cut off value leads to atomic energies with an accuracy of 0.1eV/atom, allowing calculations without sufficient loss of accuracy. The calculations were performed to find the structural and electronic properties of optimized structures. Milliken population analysis was carried out to predict the charge transfer and spin between Au-Atom and nanotubes.

We have selected (8, 0) zigzag CNT of diameter 6.26 Å and the length 8.52Å as a model to study the adsorption of gold atom. We have examined different site for adsorption of gold atom as shown in figure (1). The sites are 1) Carbon Atom (Site A), 2) Carbon-Carbon Axial Bond (site B), 3) Carbon-Carbon Chiral bond (site C) and 4) Hexagon (site D). In all calculations, the carbon nanotubes along with Au atom were first optimized to occupy their minimize energy state. For each site Au has kept at a finite distance of 3.0 Å to optimize the system to get stable structure. The binding energy (E_b) of adsorption of Au atom on nanotube for all ground state structures were calculated by $E_b = -[E_T(\text{adsorbent + adsorbate}) - E_T(\text{adsorbent}) - E_T(\text{adsorbate})]$.

Where E_T (adsorbent + adsorbate) is the total energy of atom and CNT system, E_T (adsorbent) is total energy of CNT and E_T (absorbate) is the total energy of atom. To verify the computational accuracy of the structure we have calculated the binding energy of CNTs, density of state, band gap Charge Density, HOMO-LUMO, Milliken population analysis for charge [20].



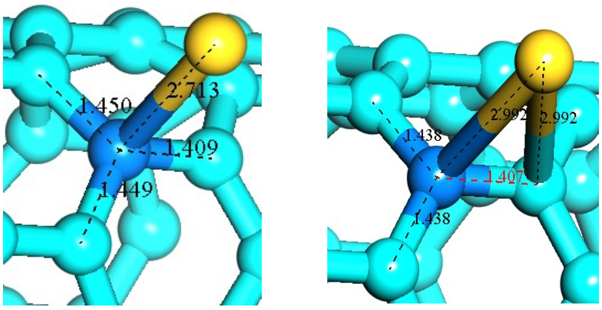
(a) (b)

Figure 1. (a) Structural model of CNT (8, 0) (b)Structural parameter at target (C_T) atom

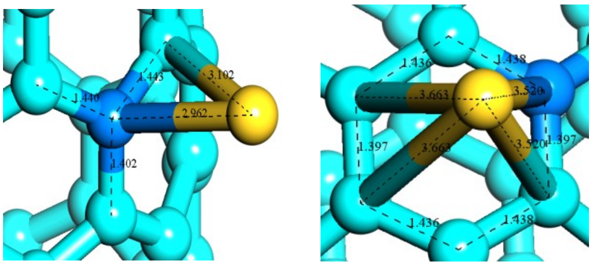
III. RESULTS AND DISCUSSION

Bond Length

The (8, 0) SWCNTs shown in Figure1, has a carbon atom arrangement with an average C-C bond length of 1.432 Å at chiral bond length and 1.398Å for axial bond length. Geometry optimization of the all four positions resulted in slight increase in bond length of chiral and axial positions of SWCNT. Figure 2 and 3 displays the modified carbon-carbon bond length and Au-SWNT bond length, result is tabulated in table 1.

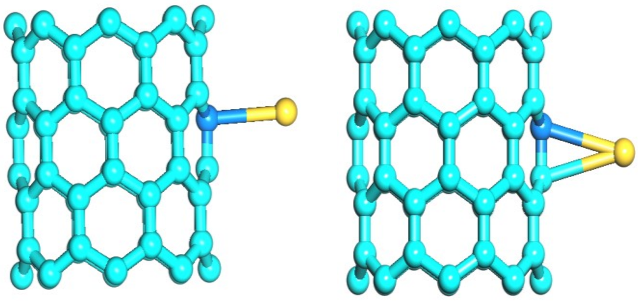


(a) Atomic bond (b) Axial bond

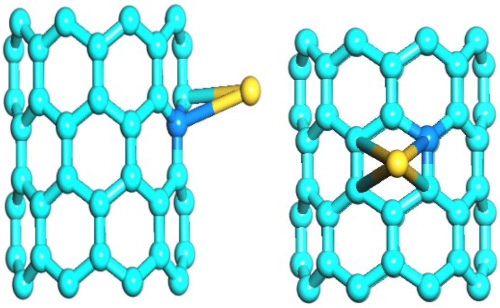


(c) Chiral Bond (d) Hexagon Bond

Figure 2. Structures with bond length in four positions



(a) (b)



(c) (d)

Figure 3. Stable geometry of Au-SWCNT
(a) Atomic bond (b) Axial Bond
(c) Chiral Bond (d) Hexagon Bond

Table 1. Shows bond length between atomic site atom C_T and adjacent carbon atom C and Gold atom Au.

Positions	**Atomic bond Length (Å)**	**Axial Bond Length (Å)**	**Chiral Bond Length (Å)**	**Hexagon Bond Length (Å)**
C_T-C_1	1.449	1.438	1.433	1.440
C_T-C_2	1.450	1.438	1.444	1.443
C_T-C_3	1.409	1.407	1.400	1.402
C_T-Au	2.713	2.991	2.962-3.102	3.663-3.520
Total	7.021	7.274	7.239-7.379	7.948-7.805

Before optimization, in the prepared model the distance of adsorption of Au adatom is about 3.0 Å from carbon atom or carbon-carbon bond. After performing Geometry optimization Au adatom get attached to carbon atom of nanotube by covalent bond of length 2.7 Å at atomic, 2.99 Å at axial, 2.96 - 3.102 Å at chiral and 3.663 - 3.520 Å at hexagon. From bond length it is observed that Au atom is chemisorbed at atomic site and physisorbed on Axial, Chiral and Hexagon site. As shown in table 1, the total length of the c-c at axial and chiral position in pure SWCNT (8, 0) is 1.432+1.432+1.398=4.262Å, but the total bond length for Au-CNT at atomic is 7.021 Å, at axial 7.274 Å, at chiral is variable from 7.239Å to 7.379 Å and at hexagon is variable from 7.948Å to 7.805Å, The bond angles between C - C - C bonds were ranging from116^0 to 119.5^0 which is less than 120^0 indicates trigonal structure of bonding and prefers sp2 hybridization as shown in Table 2.

Table 2. Angles between target atom C_T and adjacent carbon atom C and Gold atom Au

Positions	**Pure CNT (8,0)**	**Atomic bond Angle**	**Axial Bond**	**Chiral Bond**	**Hexagon Bond**
C_1-C_T-C_2	117.417^0	116.664^0	116.664^0	116.664^0	117.724^0
C_1-C_T-C_3	119.36^0	119.163^0	119.163^0	118.984^0	119.186^0
C_2-C_T-C_3	119.357^0	119.156^0	119.156^0	118.885^0	119.431^0
C_3-Au-C_T			27.199	27.415^0	21.980^0, 23.080^0, 24.022^0, 39.785^0
Hybridization Nature	sp^2	sp^2	sp^2	sp^2	sp^2

A. Adsorption Energy

The Binding energy of pure (8, 0) SWCNT, molecule and Au-SWCNT were calculated. The Binding energy shown in Table 3 determines the stability of the system and the higher binding energy shows lower the stability of the system. Table 3 shows the summery of calculated binding energy of the studied system. From value of binding energy for site – A the Au atom is chemisorbed while for all other site it is physisorbed. The binding energy values are supportive to the prior statement of adsorption.

Table 3. Shows the Binding Energy values of Au atom with CNT for all sites.

Structure type	**B.E in eV**
Au-SWCNT(Atomic bond)	- 0.1577
Au-SWCNT(Axial bond)	- 0.1441
Au-SWCNT(chiral bond)	- 0.1142
Au-SWCNT(Hexagon bond)	- 0.1142

B. Charge transfer

Mulliken population analysis was used to calculate the charge transfer between the CNT and Au atom. Pristine carbon nanotube has n-type characteristics. Interaction of Au atom with CNT minutely changes its semiconducting character. Metal atoms Au gains electron from the carbon atoms. The observation Table 4 shows magnitude of partial charge transfer which is more for Site – A due to chemisorptions. The magnitudes of charge transfer for remaining sites are slightly different.

Table 4. Charge Transfer between CNT and Au atom

Structure type	**Mulliken Charge**
Au-SWCNT(Atomic bond)	0.22
Au-SWCNT(Axial bond)	0.189
Au-SWCNT(chiral bond)	0.189
Au-SWCNT(Hexagon bond)	0.16

C. Band Structure (BS), Density of State (DOS) and Energy Band Gap (BG)

The Band Structure (BS) and Density of State (DOS) of pure SWCNT is Shown in figure 4(a). The energy band gap found from BS and DOS for pure CNT is 0.701, which is competent to theoretically and experimentally reported result. Figure 4(b-e) shows BS and DOS for interaction Au atom with CNT at four different sites. BS and DOS for atomic site – A, axial bond site – C and chiral bond site – B shows there is an extra unoccupied states near conduction band. For hexagon site – D there is heavily occupied state near Fermi energy in valance band. The newly formed extra state varying from 0.234eV to 0.2629 in conduction band for interaction of Au atom with CNT is almost reduced and shifted near to Fermi level as compared to CNT. This results in reduction of band gap of CNT from 0.7eV (of pure CNT) to 0.26eV for atomic and axial bond site. For chiral bond and Hexagon position band gap reduced to 0.301eV and 0.28 respectively as shown in Table 5.

Table 5. Shows band gap values of pristine CNT and Au-CNT system

Structure type	**Band gap(eV)**
Pure SWCNT(8,0)	0.701
Au-SWCNT(Atomic bond)	0.258
Au-SWCNT(Axial bond)	0.259
Au-SWCNT(chiral bond)	0.304
Au-SWCNT(Hexagon bond)	0.284

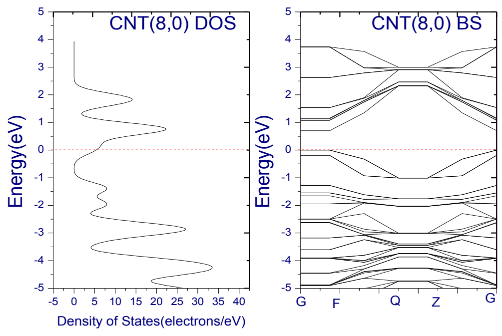


Figure 4. (a) DOS and BS of Pure CNT(8,0)

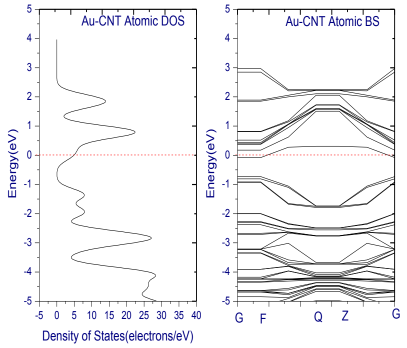


Figure 4. (b) DOS and BS of AU-CNT atomic position

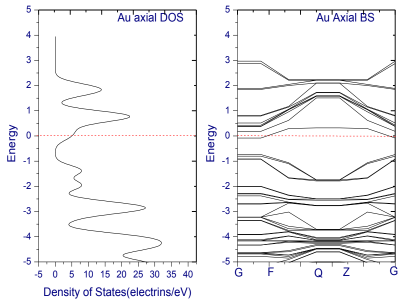


Figure 4. (c) DOS and BS of AU-CNT axial position

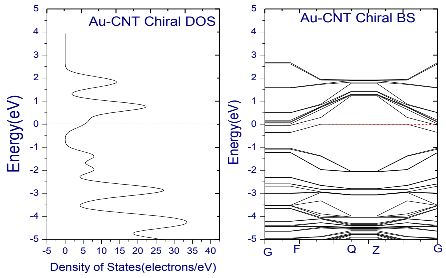


Figure 4. (d) DOS and BS of AU-CNT chiral position

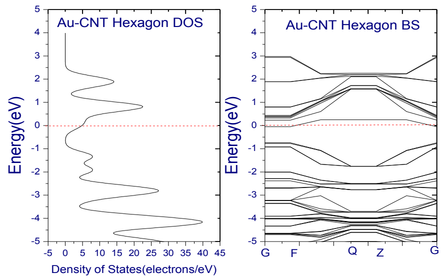


Figure 4. (e) DOS and BS of AU-CNT chiral position

IV. CONCLUSION

In this paper, we have studied the adsorption energies, stable geometries, density of states, Band Structure and Mulliken charge for interaction of Au atoms on SWCNT (8,0) using first-principles density- functional theory. We found reduction of band gap of SWCNT from 0.7eV (of pure CNT) to 0.26eV when Au atom interacts with SWCNT. Au atom is chemisorbed on atomic site while for axial bond, chiral bond and Hexagon sites of interaction Au atom is physisorbed. The Physorption of Au atom also reduces band gap of SWCNT. After interaction we calculating Mulliken charge found that metal atoms gains electron from the surrounding carbon atoms, more amounts of electrons is gain when Au atom is interacting on atomic site. This shows that semiconducting nature of SWCNT becomes P-type.

V. REFERENCES

[1]. L. V. Radushkevich and V. M. Lukyanovich,Zh. Fizich. Khim. (in Russian) 26,88 (1952).

[2]. P. A. Tesner and A. I. Echeistova,Doklady Akad. Nauk USSR 87,1029 (1952)

[3]. W. R. Davis,R. J. Slawson,and G. R. Rigby,Nature 171,756 (1953).

[4]. L. J. E. Hofer,E. Sterling,and J. T. McCartney,J. Phys. Chem. 59,1153 (1955).

[5]. P. L. Walker,J. F. Rakszawski,and G. R. Imperial,J. Phys. Chem. 63,133 (1959).

[6]. T. Baird,J. R. Fryer,and B. Grant,Nature 233,329 (1971).

[7]. T. Baird,J. R. Fryer,and B. Grant,Carbon 12,591 (1974).

[8]. R. T. K. Baker,M. A. Barber,P. S. Harris,F. S. Feates,and R. J. Waite,J. Catalysis 26,51 (1972).

[9]. R. T. K. Baker,P. S. Harris,R. B. Thomas,and R. J. Waite,J. Catalysis 30,86 (1973).

[10]. R.T. K. Baker and R. J. Waite,J. Catalysis 37,101 (1975).

[11]. T. Koyama,M. Endo,and Y. Onuma,Jpn. J. Appl. Phys. 11,445 (1972).

[12]. A. Oberlin,M. Endo,and T. Koyama,J. Cryst. Growth 32,335 (1976).

[13]. R. T. K. Baker and P. S. Harris,Chemistry and Physics of Carbon,edited by P. L. Walker and P. A. Thrower,Marcel Dekker,NY (1978),Vol. p. 83.

[14]. R. T. K. Baker,Carbon 27,315 (1989).

[15]. M. Endo,Chemtech 18,568 (1988).

[16]. M. S. Dresselhaus,G. Dresselhaus,K. Sugihara,I. L. Spain,and H. A. Goldberg,Graphite Fibers and Filaments,Springer-Verlag,Berlin (1988).

[17]. J. S. Speck,M. Endo,and M. S. Dresselhaus,J. Cryst. Growth 94,834 (1989).

[18]. S. Iijima,Nature 354,56 (1991)

[19]. Surface complexation modeling of Sr(II) and Eu(III) adsorption onto oxidized multiwall carbon nanotubes " (Chang lun Chen,Jun Hu,Di Xu,Xiaoli Tan,Yuedong Meng,Xiangke Wang ,2008,p.33–41)

[20]. "Generalized gradient approximation for the relativistic exchange-only energy functional"(E. Engel,S. Keller, and R. M. Dreizler,1996,p.1367)

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Mathematics in Everyday Life

Manisha Sheelam, Komal Kadam, Vaishnavi Rokade, Kavita Karapurkar
Smt. K. G. Shah Department of Computer Applications Dr. B. M. N. College of Home Science, Mumbai, Maharashtra, India

ABSTRACT

Mathematics is a vast topic. It is the study of topics such as quantity, structure, space and change. Mathematics is essential in many fields, such as natural science, engineering, medicine, finance and the social sciences. The origins of mathematical thought lie in the concepts of number, magnitude, and form. Maths is everywhere we go, it is all around us. Not only maths underline every process and pattern that occurs in the world around us, but also, a good understanding of it will help enormously in our everyday life. But usually mathematics is considered as a tough or boring subject. Actually it plays an important role in our daily life. Knowingly or unknowingly each and every person on this earth uses maths in his/her routine life. Our research is all about the various branches of mathematics and it's applications in everyday life. Mathematics is the backbone for many fields. It is used in various fields such as cooking, farming, astronomy, robotics, etc. In this research we have taken different branches of mathematics namely algebra, geometry, graph theory and it's applications in everyday life.

Keywords : Mathematics, Interior Design, Gameplay scripting, Graph theory

I. INTRODUCTION

ALGEBRA

Algebra is one of the broad parts of mathematics. It is the study of mathematical symbols and the rules for manipulating these symbols. It is a unifying thread of almost all of mathematics. It includes everything, from elementary equation solving to the study of abstractions such as groups, rings, and fields. Let's consider three applications of Algebra, i.e. Computer Science, Cooking and Architecture.

1.Computer Science

Algebra provides concepts that are crucial to many areas of computer science. Whenever you take a digital photo with your phone or transform the image in Photoshop, whenever you play a video game or watch a movie with digital effects, whenever you do a web search or make a phone call, you are using technologies that are built on algebra.

Areas where algebra is used in computer science:

- ✓ Network Model
- ✓ Computer Graphics
- ✓ Cryptography

2. Cooking

Use of mathematics is in every kitchen and in every recipe. The mathematics of cooking often goes unnoticed, but in reality there is a large quantity of maths skills involved in cooking and baking. It is important to understand how maths affects the quality of culinary in order to make the most delicious meals and treats. All phases of cooking require maths such as grocery shopping, baking, storing, freezing food, etc.

To be very specific, algebra is used in cooking as:

- ✓ To set temperature of oven.(in Degrees/Celsius/Fahrenheit)
- ✓ To measure the ingredients.(in teaspoons/tablespoons/cups)
- ✓ To estimate the cost of certain recipe.

3. Architecture

Algebra is used in architecture in calculating the weight and dimensions of certain buildings to make sure they are sturdy. Architects use proportions to make scale models of the structure they are designing. If it is done incorrectly, the building will not be sturdy. Mathematics and architecture are much related to each other.

Areas where algebra is used in architecture:

- ✓ Interior Design.(Floor plan for the inside of a house)
- ✓ Scale Drawing.
- ✓ Slopes.

GEOMETRY

Geometry is a branch of mathematics concerned with questions of shape, size, relative position of figures, and the properties of space. Earlier geometry was a collection of empirically discovered principles concerned with lengths, angles, areas, and volumes, which were developed to meet some practical need in surveying, construction, astronomy, and various crafts. Geometry has applications in many fields, including art, architecture, physics and chemistry. Robotics, Video game developer and Astronomy are discussed here as the areas where geometry is used.

1.Robotics

The configuration of a robotic system can rarely be described without geometry. Robot kinematics applies geometry to the study of the movement of multi-degree of freedom kinematic chains that form the structure of robotic systems.

Areas where geometry is used in robotics:

- ✓ Motion Queries, Planning and Simulation.
- ✓ Manipulation in unknown environments.
- ✓ Motion Planning and Kinematics.

2. Video Game Developer

Mathematics is everything when it comes to games. A character cannot walk up a slope, slide down a slide, fire a bullet from a gun, or even jump without the help of the mathematics. A lot of geometry in gameplay scripting is fairly simple, but geometry used in game engine architecture is far more complex and a lot more taxing mentally.

Areas where geometry is used in video games developing:

- ✓ Animation.
- ✓ Gameplay scripting.(walking, shooting, jumping)
- ✓ Game engine architecture.

3. Astronomy

Geometry is used in astronomy in many ways. It is used in astronomy to determine the properties of stars and other objects in space. It is developed to be a practical guide in measuring the velocity, area, volume and length of heavenly bodies such as stars, planets etc. The science of actually measuring positions of celestial objects in the sky is known as astrometry.

Areas where geometry is used in astronomy:

- ✓ To find the distance between the celestial objects.(such as stars and planets)
- ✓ To measure the speed and velocity of planets orbiting other stars.
- ✓ To measure angle of planets.

GRAPH THEORY

Graph theory in simple words is the study of graphs. A graph in this context is made up of vertices, nodes, or points which are connected by edges, arcs, or lines. Many practical problems can be represented by graphs. The development of technology increased the use of graph theory. In order to communicate, to operate a computer etc.

1. Electrical engineering

Graph theory is helpful in electrical engineering in various practical problems solving in circuit or Network Analysis and Data Structure. Electric network problem can be represented by drawing graphs. A graph representation of electrical network is done in terms of line segments or arc called as edges or branches and points called as vertices or terminals.

Areas in electrical engineering where graph theory is used:

- ✓ Wireless Sensor Networks.(WSN)
- ✓ Distributed Fault Detection.
- ✓ Consensus Based Systems.

2. Database Designing

Graph database uses graph structures for semantic queries with nodes, edges and properties to represent and store data. Database design is the methodology for developing the various objects that make up a database. This graph structure has key role in designing database, because it gives fast implementation process using different functionality and properties of graph structure.

Areas in database designing where graph theory is used:

- ✓ Storage system that provides index free adjacency.
- ✓ Analysing tool for interconnection.
- ✓ Powerful tool for graph like-query.

3. Image Processing

Image analysis is the methodology by which information from images is extracted. Image analysis is mainly performed on digital image processing techniques. A graph theoretic approach can be used to improve these image processing techniques. With the explosive growth in image production, in everything from digital photographs to medical scans, there has been a drastic increase in the number of applications based on digital images.

Areas in image processing where graph theory is used:

- ✓ To calculate the alignment of the picture.
- ✓ Finding distance transforms of the pixels and calculates the distance between the interior pixels by using shortest path algorithms.
- ✓ To find mathematical constraints such as entropy by using minimum spanning tree.

Let's take an example of a video game as discussed earlier and understand that where and which maths is used in it.

One operation that is very useful in video game developing is the Inverse of a matrix. A vector defines a position in space. A matrix transforms the coordinate system of a vector. When a vector is rotated or scaled, its coordinate system is transformed into a new coordinate system.

For example, if a matrix rotates a vector about the x-axis by 50 degrees. Then the matrix-inverse rotates the vector about the x-axis by -50 degrees.

Further being more specific, in Counterstrike, when you deal with a camera and a world entity. Imagine the world entity contains several buildings. To orbit about these buildings, you have two options:

a) You can orbit the camera about the centre of the world by keeping the world static
or
b) You can rotate the world in front of the camera.

Each option is the inverse operation of the other. You can switch between one or the other by computing an inverse transformation.

II. CONCLUSION

In this research it is clearly concluded that various branches of mathematics are used widely in our day to day life whether it is cooking, gardening or playing video games. Thus mathematics expresses itself everywhere, in almost every facet of life. It is there in nature all around us and also in the technologies in our hand.

III. REFERENCES

[1]. https://www.unbc.ca/math-statistics/real-life-applications-mathematics

[2]. http://www.science.edu.sg/exhibitions/Pages/Mathematics.aspx

National Conference on Recent Trends and Developments in Environmental and Basic Sciences (RTDEBS-2018)
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Comparative Study on Composition and Adulteration of Milk Sold at Thane

R. P. Chavan[*1], **V. T. Bendale**[2], **C. L. Patil**[3]
[*1]Dnyanasadhana College, Thane, Maharashtra, India
[2]A. Vartak College, Vasai, Maharashtra, India
[3]corresponding author: B.N.N. College, Bhiwandi, Maharashtra, India

ABSTRACT

The study was conducted to evaluate physiochemical quality of milk samples and adulteration in milk sold in Thane City during the year 2017. Ten loose buffalo milk samples were collected from selected dairy shop of Thane City. The samples were analyzed for fat, solid-non-fat (SNF), protein, acidity, specific gravity, PH, neutralizers and adulterants. Our analysis showed that the milk samples analyzed were free from adulterants like detergent, sugar, starch, salt, hydrogen peroxide, urea, ammonia, nitrates. Acidity ranges from 0.117 to 0.146%, fat from 2.7 to 6.0%, Protein from 2.46 to 2.90%, SNF from 7.11 to 9.37%, Specific gravity from 1.023 to 1.032. The statistical analysis showed that the fat, protein, SNF of these samples were significantly different.

Keywords: buffalo Milk, physical and chemical examination, Adulterants, Comparison.

I. INTRODUCTION

Milk is an almost ideal food. It has high nutritive value. It supplies body-building proteins, bone-forming minerals and health-giving vitamins and furnishes energy giving lactose and milk fat. Besides supplying certain essential fatty acids, it contains the above nutrients in an easily digestible and assimilable form. (1) Milk is good source of calcium, phosphorus and fat-soluble vitamins (A, D, E and K). (2) All these properties make milk an important food for pregnant mothers, growing children, adults and patients.

On average milk is made up of 87.4% water and 12.6% milk solids (3.7% fat, 8.9% milk solid non-fat). The milk solid non-fat contains protein (3.4%), lactose (4.8%) and minerals (0.7%). (3)

Adulteration of milk is one the most serious issue, which not only causes major economic losses for the processing industry, but also a major health risk for the consumers. Milk dealers may either dilute the milk or extract valuable component and there after add cheap substances to maintain its compositional parameters. Some of the chemicals, adulterants and malpractices result in public health concern and malnutrition. (4)

Keeping in view the above facts, the present study was conducted to achieve the following objectives.

i) To determine the chemical composition of the loose buffalo's milk available in the market of Thane city.
ii) To detect various adulterants in market milk.
iii) To check the hygienic status of market milk.

II. METHODS AND MATERIALS

Ten fresh milk samples of loose buffalo milk were collected for analysis from the selected dairy shop from following areas of Thane City during the year 2017:

(1) Kopri
(2) Majiwada
(3) Vartak Nagar
(4) Naupada
(5) Vrundavan
(6) Kolshet
(7) Manpada
(8) Vasant Vihar
(9) Patlipada
(10) Owale

Each sample was collected in sterilized plastic bottle with cap, labelled, kept in icebox and immediately brought to the laboratory for analysis. Each sample is tested for physical examination, chemical composition, physicochemical properties, hygienic status and detection of adulterants. The following analysis was carried out:

Physical Examination: Each sample was observed for color and flavor.

Chemical Composition: Parameters like percentage protein, fat and SNF of milk was determined by using standard procedure according to Fssai Manual 2015. Milk fat was determined by Gerber method. Protein was determined by Kjeldahl method. Solid non-fat (SNF) content of milk was determined using a formula: SNF = (Fat % x 0.21) + 0.36 + L.R/4

Physicochemical Properties: Acidity in terms of percentage lactic acid was determined by standard procedure (Fssai Manual 2015). Specific gravity was determined by formula:

Specific Gravity = (lactometer reading /1000) + 1

P^H of milk is determined by using P^H meter. Neutralizers are added to milk to neutralized the developed acidity of milk. Presence of neutralizer was determined using standard procedure. (5)

Hygienic Status: Hygienic status of milk was determined by Methylene Blue Reduction Test (MBRT), COB (Clot on Boiling) Test and phosphatase Test. (5)

Adulterants: Various adulterants like detergent, sugar, starch, salt, hydrogen peroxide, urea, ammonia, nitrates were detected by using standard procedures (Fssai Manual 2015).

Statistical Analysis: Data collected on different parameters was analyzed statistically. The standard deviation was calculated to control the precision of examination and provide the possibility of comparing the contamination of milk. The mean, minimum and maximum values were also calculated.

III. RESULTS AND DISCUSSION

Physical Examination:

Color: The color of all samples was creamy white.

Flavor: The pleasant samples contributed to 20%, not good contributed to 30% and good contributed to 50% in flavor category.

Chemical Composition:

Fat: Result showed that maximum fat observed in sample S_5 and S_6 (6.0%) while minimum was observed in sample S_4 (2.7%). The values of fat content in samples S_1 to S_{10} were 4.8, 5.5, 5.2, 2.7, 6,0, 6.0, 5.3, 3.6, 5.4, 3.5% respectively. The difference in fat content may be due to the difference in feeding pattern, breed of animal & season. The fat values may differ due to dilution of milk with water. The result showed that the sample S_4, S_8, S_{10} (2.7%, 3.6%, 3.5% fat respectively) has not maintained the standard Fssai Specification (Figure 1). (6)

Protein: Result showed that maximum protein content was observed in sample S_7 (2.90%). The minimum protein content was observed in sample S_3 (2.46%). The values of protein in samples S_1 to S_{10} were 2.55, 2.80, 2.46, 2.55, 2.72, 2.80, 2.90, 2.90, 2.55, 2.80% respectively. All sample has shown below standard protein level of 3% (Figure 2).

SNF: Maximum SNF was recorded in sample S_6 (9.37%). The minimum was observed in S_1 (7.11%). The SNF content of sample S_1 to S_{10} were 7.11, 8.39, 8.32, 7.42, 9.12, 9.37, 8.65, 8.62, 8.99, 9.09% respectively. The result showed that the amount of SNF recorded for 80% sample is similar to Fssai Standards (Figure 3).

Physicochemical Properties:

Acidity: Minimum acidity observed in sample S_2 (0.117%) followed by S_5 (0.054%). The maximum was observed in S_7 (0.146%). The acidity of samples S_1 to S_{10} were 0.126, 0.117, 0.126, 0.126, 0.126, 0.140, 0.146, 0.120, 0.130%. The titrable acidity of buffalo milk varies from 0.14 to 0.15%. (Figure 4)

Specific Gravity: Specific gravity of sample S_{10} (1.032) is maximum. The minimum was observed in S_1 (1.023). The specific gravity of samples S_1 to S_{10} were 1.033, 1.0275, 1.022, 1.0262, 1.0301, 1.031, 1.030, 1.030, 1.030, 1.032. The average specific gravity ranges (at 60° F) from 1.030 to 1.032 for buffalo milk. Specific gravity is influenced by the proportion of constituents of milk. (1)

P^H: 70% samples showed P^H value 6.8 and 3% samples showed P^H value 6.7. P^H of fresh buffalo milk varies from 6.7 to 6.8. Higher values indicate udder infection and lower values bacterial action. (1) From present study it was observed the P^H of all milk samples was within the normal range.

Neutralizers: The test for neutralizers was carried out for the samples under studied. The result showed absence of neutralizers.

Hygienic Status:

COB (Clot on Boiling): The result of COB test showed that all the samples have shown negative result. Therefore, all the samples are of good quality.

MBRT (Methylene Blue Reduction Test): one sample (10%) was found to be of very poor quality, three samples (30%) of poor quality, four samples (40%) found to be of fair quality and two samples (20%) were found to be good quality. (Figure 5) (7)

Adulterants: Milk samples were tested for adulterants like sugar, starch, salt, detergent, hydrogen peroxide, urea, ammonia, nitrates. No Sample was found to be adulterated.

Compositional properties of milk analysis results were presented in the Table 1. In our samples, Fat (4.8% ± 1.336%), Protein (2.70% ± 0.1473%), SNF (8.51% ± 0.7385%), Acidity (0.1285% ± 0.00864%), Specific gravity (1.029±0.00272) were found. All the values were found satisfactory.

Table 1

Nutrient	Samples (n = 11 Mean + SD	Max. Value	Min. Value
Fat	4.8% ± 1.336%	6.0%	2.7%
Protein	2.70% ± 0.1473%	2.90%	2.46%
SNF	8.51% ± 0.7385%	9.37%	7.11%
Acidity	0.0.1285%±0.00864%	0.146%	0.117%
Specific Gravity	1.029±0.00272	1.032	1.023

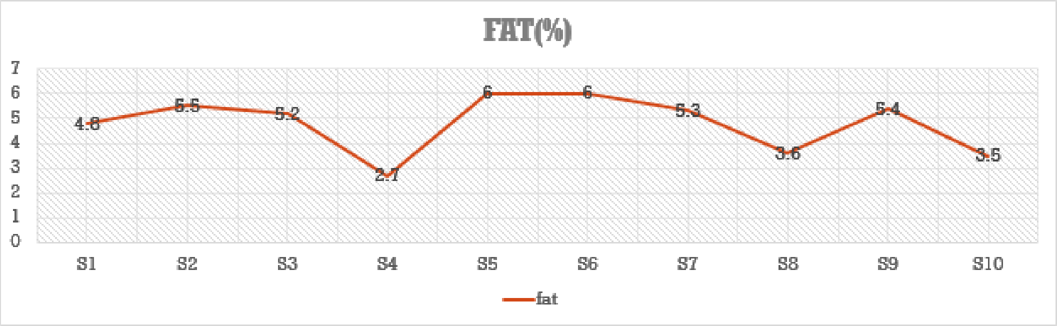


Figure 1

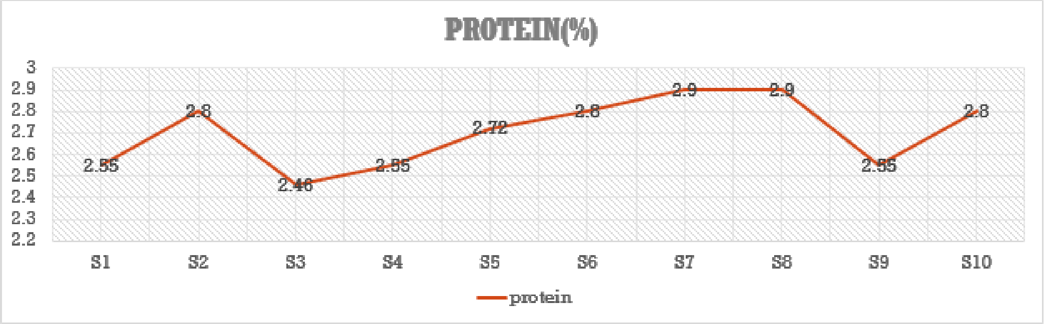
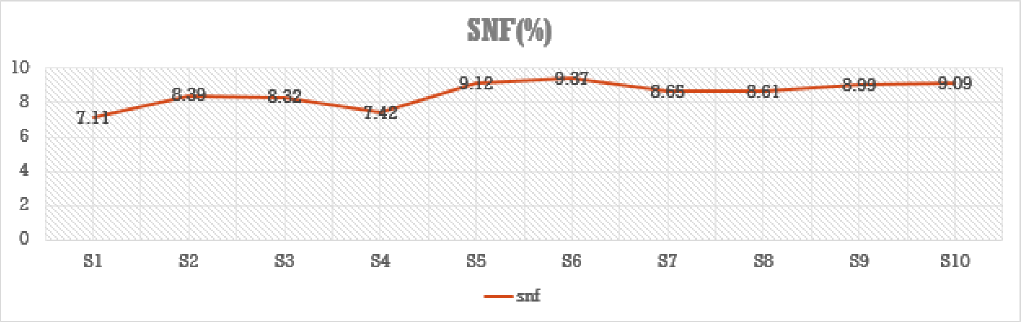


Figure 2



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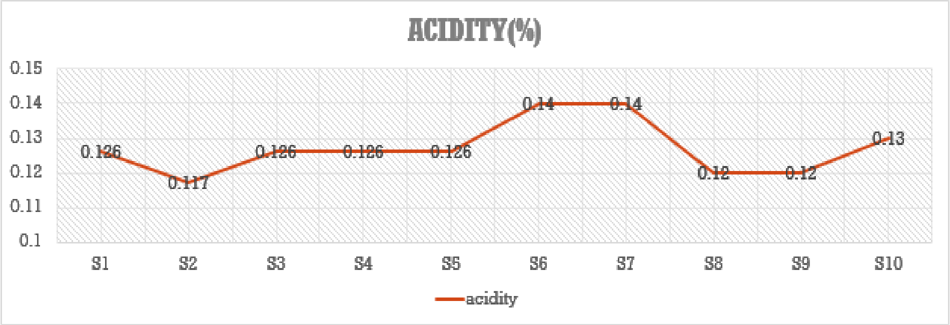

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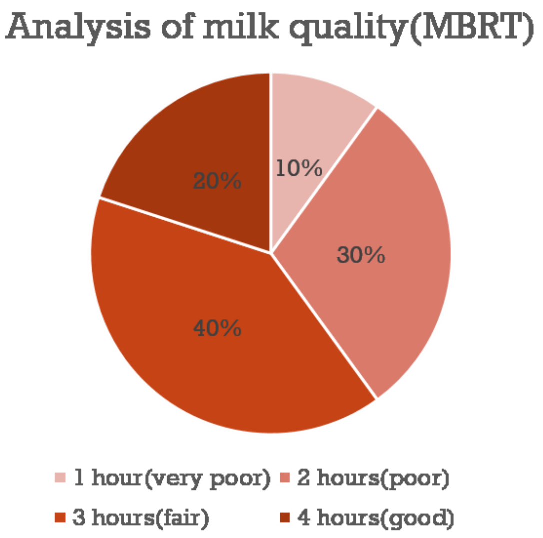

Figure 5. Analysis of milk quality(MBRT).

IV. CONCLUSION

The statistical analysis showed that the fat, protein, SNF of samples were significantly different from each other. The physicochemical properties like P^H, specific gravity and acidity of milk samples were within the recommended level as per WHO standards. The milk samples showed absence of the adulterants.

V. ACKNOWLEDGEMENT

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VI. REFERENCES

[1]. Sukumar De, 2004, Outline of dairy technology,20,21.

[2]. M.F. I. Kajal, A. Wadud, M. N. Islam and P. K. Sarma 2012. Evaluation of some chemical parameters of powder milk available in Mymensingh Town, 95.

[3]. Mo. Ayub, Q. Ahmed, M. Abbas, I. M. Qazi, I.A. Khattik, 2007, Composotion and adulteration analysis of milk samples, 1127-1128.

[4]. Faraz, A.M. Lateef, M.I. Mustafa, P. Akhtar, M. Yaqoob and S. Rehman, 2013. Detection of Adulteration Chemical Composition & Hygienic Status of milk supplied to various places in Faisalabad 120-121.

[5]. FSSAI Manuel of Methods of Analysis of Foods, Milk & Milk Products, Govt. of India, 2015: 9,11,15,17,19,20,34,36,46.

[6]. M. Bellal Hossain, Sima Rani Dev 2013, Physiochemical Characteristics of various raw milk samples in a selected Diary Plant of Bangladesh, 92-95.

[7]. Shrishti Nirwal, Rakesh Pant & Nishant Rai, 2013, Analysis of milk quality, adulteration & mastitis in milk sample collected from different regions of Deharadun. 361-362

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Experimental Determination of Emission Factors of Vocs from Burning Commonly Used Biomass Fuels in India

Mrigank Saurav[1], Sahu S. K*[2], Ajmal P.Y.[2], Bhangare R. C.[2], Rathod T. D.[2], Tiwari M.[2], P. V. Rao[1], Pandit G. G.[2]

[1]National Institute of Technology Warangal, Telangana, India
[2]Bhabha Atomic Research Centre, Trombay, Mumbai, Maharashtra, India

ABSTRACT

Biomass fuel is the prime fuel for cooking purpose especially in the developing countries like India. The fuels used in India are mainly biomass fuels in rural area and LPG in urban areas. Burning of domestic fuels emits gases such as CH_4, CO_2, CO, VOCs and some other trace compounds. The co-emission of VOCs has got attention in recent times due to their proved toxicity and carcinogenicity. Quantity and quality of VOCs in indoor environment depends on the choice of household fuels and combustion conditions. Apart from their health hazards, VOCs in environment also lead to the formation of ozone, secondary organic aerosol and other photo oxidants.

A lab-scale experiment was carried out for analysis of combustion generated VOCs by burning the common domestic fuels in India. Three types of fuels viz. wood, dung cake and LPG were used in this study. The fuels were burned in a specially designed setup and the generated exhaust gases were collected in special bags known as tedlar bags. The method of whole air sampling with Solid Phase Micro-extraction (SPME) technique followed by detection with Gas chromatography coupled with Flame Ionisation Detector (GC-FID) was developed and the concentrations of different VOCs in the sampled gases were determined. Major Volatile organic compounds which were present in gaseous samples were benzene, Toluene, cis-1,2- Dichloromethane, Ethyl benzene, o- Xylene, m- Xylene, p- Xylene, Styrene etc. CO and CO_2 concentrations were determined with special sensors. Emission Factors (EF) for NMHC in wood, dung cake and LPG were calculated by using Carbon mass balance methods. And the value obtained were 5.6, 17.5, 0.68 g/kg of dry mass for wood, dung cake and LPG respectively.

Keywords: Whole Air sampling; SPME; GC-FID; MCE, CE, EF, NMHC

I. INTRODUCTION

Globally, almost 3 billion people rely on biomass (wood, charcoal, crop residue, and dung) as their primary source of domestic energy [1, 2]. Smoke generated due to biomass burning contains a large number of pollutants including particulate matter, carbon monoxide, nitrogen dioxide, sulfur oxides and volatile organic compounds [3, 4]. Exposure to indoor air pollution (IAP) from the combustion of solid fuels has been implicated, with varying degrees of evidence, as a causal agent of several diseases including acute respiratory infections (ARI) and otitis media (middle ear infection), chronic obstructive pulmonary disease (COPD), lung cancer (from coal smoke), asthma, cancer of the nasopharynx and larynx, tuberculosis, perinatal conditions and low birth weight, and diseases of the eye such as cataract and blindness [4, 5]. VOCs and their public health impacts are drawing increasing concern from the environmental health research community, environmental regulatory agencies, industries, as well as the public. Adverse health effects of VOCs include headache, nausea, eye/throat/nose irritation,damage to liver, kidney and central nervous system. Benzene, toluene, ethylbenzene, o-, m- and p-xylene (BTEX) form an important group of aromatic VOCs. Among these, Benzene is classified by the International Agency for Research on Cancer as Group 1 human carcinogen. Toluene, ethylbenzene, o-, m-, and p- xylenes have been found to develop adverse health impacts on respiratory and neurological effects [6].

VOCs include a variety of chemicals, some of which may have short- and long- term adverse health effects. The quantity and quality of VOCs in indoor environment depends on the choice of household fuels and combustion conditions. The co- emission of VOCs along with other trace gases from combustion of biomass may further degrade the indoor air quality. As per census 2011, in India 67.2% households are using biomass and coal as a fuel for cooking. Dependency on biomass as cooking fuel is very much high in rural area as compared to urban area. Due to awareness and availability of other fuels like biogas and LPG, rural area people are encouraged to use LPG as cooking fuel. The figures from census 2001 and 2011 shows that the most significant increase in absolute number in LPG/PNG is at 109.6 percent followed by figures for no cooking with 26.5 percent. As per census 2011, use of firewood for cooking purposes by households is highest at 49.0 percent followed by LPG/PNG occupying a percentage share of 28.5 percent in the country. [7]

This paper focuses on determination of emission factor for volatile gases which are emitted from burning of wood, dung cake and LPG. Also a comparative study about modified combustion efficiency (MCE), of biomass and LPG combustion has been carried out.

II. MATERIALS AND METHODS

Firewood, dung cake and LPG fuels were purchased locally from Trombay, Mumbai.All solid samples were oven dried to reduce their moisture content at 60^0 C for one hour prior to experiment (Fig.1). The carbon percent in each fuels were determined using TC analyser (PrimacsSNC, Skalar). The carbon percentage obtained for dung cake, wood and LPG was 39, 50 and 82.44% respectively.

Figure 1. Photographs of collected fuels viz. firewood, dung cake and LPG stove

2.1 Experimental setup design

A combustion chamber was specially designed so that sufficient oxygen was available during burning of fuels.

The experiment was repeated five times for each fuel type for correct estimation of the emission. The combustion chamber (Fig. 2) was designed in three parts A, B, and C. Part A having a volume 0.0243 m3 was used for keeping the cooking stove, few holes were provided in wall for continuous availability of air during combustion of fuel. Part B, an upper cut pyramidal shape of volume 0.0130 m3was designed to provide dilution of gaseous emission prior to analysis. Part C a cylindrical shape of volume 0.0018m3was designed to sampleaportion of smoke for analysis and stack out the remaining. Sampling point was drawn from part C at a height of 0.90 m which is the breathing height in squatting posture. Sampling was forced through part C with using motor.

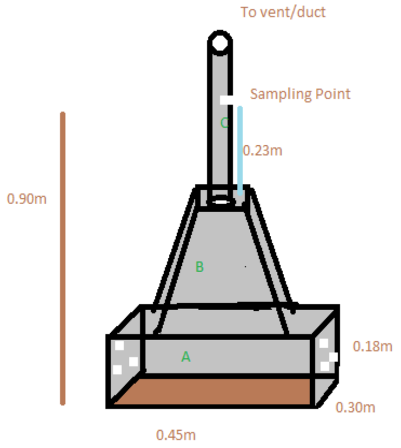

Figure 2. Combustion chamber design: part (A) of setup design to contains stove, part (B) was provide a space to combustion emission gases get cool and dilute prior to analysis while part (C) contain sampling point.

The experimental setup for collection of gas samples in tedlar bag from sampling point of combustion chamber is shown in Figure 3. Gas sample which are coming out from sampling point of combustion chamber are allowed to pass through the filter paper.

Filter papers were used to separate particulate matter from gas sample. After removal of particulate matter gas samples were passed through dilution chamber and then from dilution chamber filled in tedlar bag with the help of pump.

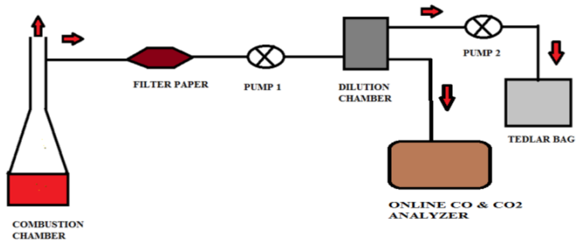

Figure 3. Experimental set up for collection of gas sample

Purposes for providing dilution chamber was to lower down the temperature of gaseous emission and also to make homogenous mixture. Inlets for CO & CO_2 monitor were directly taken from dilution chamber.

2.2 Extraction and sampling

After collecting the gas sample in Tedlar bag, SPME technique was used for extraction and sampling of gases from tedlar bags. Solid-phase micro extraction (SPME) is a simple and effective adsorption and desorption technique, which eliminates the need for solvents or complicated apparatus, for concentrating volatile or non-volatile compounds in liquid samples or headspace. SPME is compatible with analyte separation and detection by Gas chromatography [8]. This method was invented by Pawliszyn in 1989 [9]. In this technique, sampling, extraction and pre concentrations are incorporated into a single step and the use of solvents, where possible environmental pollutants may reside, is eliminated. A fused-silica fibre, coated with a polymer, is exposed to the gaseous sample or immersed in an aqueous sample to extract the analytes. The fibre is then injected into the gas chromatography injection port for thermal desorption and analysis. 50/30μm, DVB/CAR/PDMS (Divinylbenzene/Carboxen/Polydimethylsiloxane) SPME fibre was used in this study due its high response for volatile organic The Analytical detail of SPME fibre are given in Table 1.

Table 1. Analytical information about SPME (DVB/ CAR/ PDMS)

Fiber coating	**DVB/CAR/PDMS(Divinylbenzene/Carboxen/ Polydimethylsiloxane)**
Fiber core	Stable Flex(1cm)
Hub description	Gray/plain
Film Thickness	50/30μm
Maximum temperature (◦C)	270
Recommended Operating Temperature(◦C)	230-270
Exposure time(min)	5
Desorption time(min)	2

2.3. Analysis of VOCs using GC-FID

Analytical gas standards were prepared using volumetric injection. A known amount of VOCs standard gas mixture (DW-VOC Std. #2 200 μG/ml, P&T Methanol,) from RESTEK was loaded into 300ml glass container through a septum using a gas-tight syringe. After the sample preparation, the SPME syringe needle was inserted into glass container filled with standard gas mixture through a septum. The DVB/CAR/PDMS SPME fiber was then lowered into the standard gas by depressing the plunger. Target VOCs were partitioned into the polymeric coating of the fiber until equilibrium was reached. The plunger was then withdrawn, and the needle was removed from the standard gas container. After exposing for 5 min, the fiber was directly injected into GC inlet port with desorption for 2min at 250 ◦C in the GC injector. The gas samples collected in Tedlar bag were extracted using the same procedure followed in SPME extraction from a standard gas glass container. Analysis were carried out on a Gas chromatograph model GC- 2010 plus, Shimadzu make which was connected to a Flame Ionization Detector. The GC injection port was maintained at a temperature of 250◦C for thermal desorption. Separation was carried out on a 60 m × 0.25 mm × 0.25 μm capillary column while column oven temperature was initially held at 50 ◦C for 1 min, programmed to 280 ◦C at a rate of 15◦C/min. High-purity helium (99.995%) was used as a carrier gas at a flow-rate of 1 mL/min. In FID H_2 flow rate, air flow rate and make up gas (helium) flow rates were 30ml/min, 400ml/min, 30ml/min respectively.

2.4. CO and CO_2 measurements

For carbon dioxide and carbon monoxide, sample was taken directly from the dilution chamber. Both Carbon monoxide and dioxide were measured by using individual online monitors which are coupled with Non Dispersive Infra Red (NDIR) detector.

III. RESULT AND DISCUSSION

Samples of exhaust gases generated from burning of biomass and LPG were collected in tedlar bags. Samples were classified based on phase of combustion (flaming and smoldering). Concentrations of carbon dioxide, carbon monoxide, methane, and non-methane hydrocarbons (VOCs)were determined in the collected samples. On the basis of this analysis data, emission factors for individual VOCs emitted in the combustion were calculated for each fuel (wood, dung cake and LPG).

Combustion efficiency (CE) is defined the as the ratio of carbon (C) emitted as CO_2 to the total amount of carbon emitted. By definition the combustion efficiency is the fraction of fuel carbon emitted by the fire that is completelyoxidized to CO_2. Modified combustion efficiency is defined as ratio of CO_2 to the sum of CO plus CO2 concentration [10].

Modified combustion efficiency depends only on the CO_2 and CO concentration in gas sample. Due to complete combustion Modified combustion efficiency (MCE) value was maximum in LPG as compared to other fuels. (As shown in figure 4). Dung cake was having least MCE due to incomplete combustion of dung cake and impure quality.

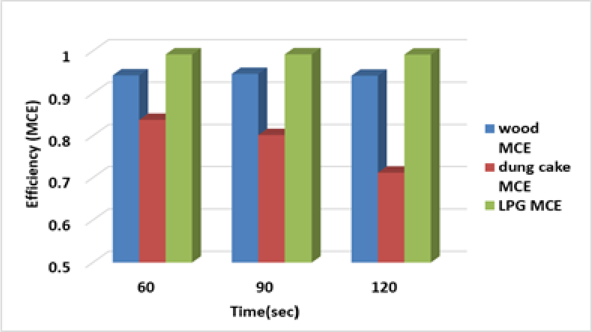

Figure 4. modified combustion efficiency of fuels

Burning of biomass takes place in 4 stages: Dehydration, Pyrolysis and gasification, flaming and smoldering. In this study only flaming and smoldering cases are discussed. The CO_2 and CO Concentrations for wood, dung cake and LPG are shown in Figure 5. In wood, CO_2 showed increasing trend up to flaming phase and after that due to prevailing of smoldering phase over flaming CO_2 value started decreasing. While in case of CO the concentrations showed increasing trends throughout burning of fuels. In dung cake smoldering phase prevails during the entire combustion. Due to incomplete combustion in dung cake, carbon monoxide (CO) value was high compared to wood and LPG. In LPG, due to complete combustion only flaming phase exists during entire combustion. It was found that in LPG, Carbon monoxide concentration was 100 to 200 times lower than CO_2 concentration.

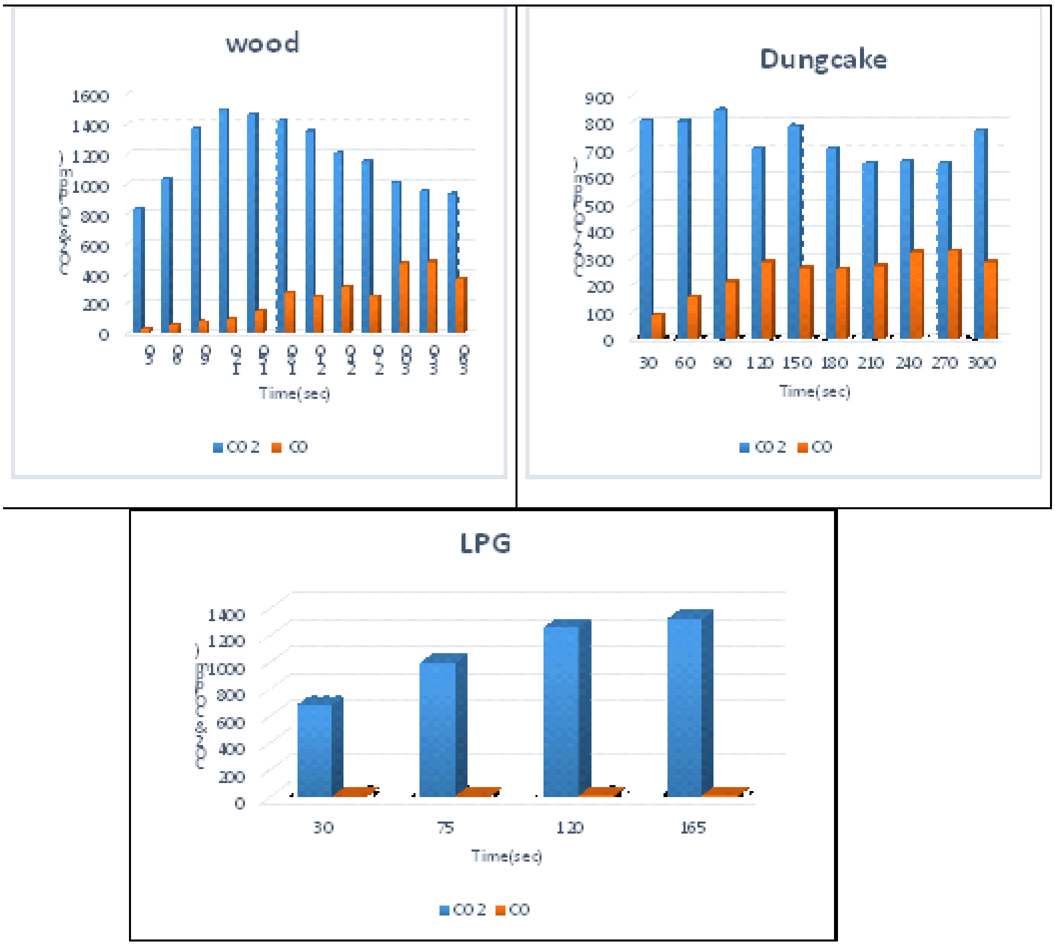

Figure 5. Carbon monoxide and carbon dioxide concentration for wood, dung cake and LPG

Emission factor is determined by Carbon Mass Balance (CMB) method. The underlying premise of this method is that all of the carbon combusted in a fire is emitted into the measurable portions of a smoke plume in five forms: CO2, CO, CH4, non-methane hydrocarbons, and particulate carbon in smoke particles. The emission factor of a species, *n*, is then calculated from the ratio of the mass concentration of that species to the total carbon concentration emitted in the plume [10]

$$EFn = \frac{[n]}{[C]CO2 + [C]CO + [C]CH4 + [C]NMHC + [C]PC} \quad (1)$$

Where, the subscript CO2 is for carbon dioxide, CO is for carbon monoxide, CH4 is for methane, NMHC is for non- methane hydrocarbons, and PC the particulate carbon emitted. The emission factor is expressed in units of mass of species n emitted per unit mass of carbon burned. To convert this emission factor to the more commonly used grams n produced per kg dry matter burned, EFn is multiplied by the mass fraction of carbon in the fuel.

Table 2. Emission factor (g/kg of dry mass) for gaseous compounds

Fuel type	Cis-1,2-Dichloroethene	Toluene	Chloro benzene	Ethyl benzene	P&m Xylene	o-Xylene + Styrene	Benzene	NMHC
Wood								
Flaming	0.1140	1.0336	0.0688	0.1574	0.1739	0.2971	0.0008	1.8459
Smoldering	0.1160	4.3768	0.6668	0.68669	1.8819	1.0042	0.0023	8.7350
Dung cake flaming	0.1804	5.9428	1.2981	2.01908	5.2225	2.8001	0.0017	17.4648
LPG smoldering	0.0042	0.2002	0.1664	0.07565	0.1574	0.0709	0.00003	0.6749

In Eq. (1) <EF_n> needs to be a mass average over the entire life of the fire. However, emission factors are typically determined at instantaneous measurements. A carbon budget is formulated from specific samples as opposed to being constructed from a continuous measurement. Since flaming and smoldering combustion are the two distinct phases of combustion, <EF_n> could be weighted by emission factors for these two distinct components (EF_{nf} and EF_{ns}, for flaming and smoldering combustion, respectively) by the fraction of biomass consumed by each process. [10]

Emission factor for gaseous compounds depends upon the combustion efficiency of fuels. According to experimental data given in Table 2 emission factor for VOCs in dung cake was 25 times larger than LPG. This shows that combustion efficiency for LPG is more as compared to dung cake. As given in Table 2 emission factor for VOCs in smoldering phase of wood burning was 5 times more than the flaming phase, it shows that in smoldering phase, the combustion efficiency is less compared to flaming phase.

IV. CONCLUSION

It was observed that emission factor for NMHC depends upon type and quality of fuels. In dung cake, emission factor for NMHC was maximum. It showed that dung cake is not good fuels for household purposes. LPG showed very low Emission factor for

NMHC as compared to wood and dung cake. It shows that LPG is safest and environmental friendly fuel for household purposes.

V. REFERENCES

[1]. Reddy AKN, Williams RH, Johansson TB, eds. Energy after Rio: Prospects and Challenges. New York: United Nations Publications, 1996.

[2]. World Resources Institute, United Nations Environment Programme, United Nations Development Programme, World Bank. World Resources 1998-1999: A Guide to the Global Environment. New York: Oxford University Press, 1998.

[3]. H. W. de Koning, K. R. Smith.1985. Bull WHO 63:11-26(1985)

[4]. Kirk R Smitha and Jonathan M Samet .2000. Thorax 55:518-532

[5]. M Ezzati and D M Kammen .2001. Environ Health Perspect. 2001 May; 109(5): 481-488.

[6]. Iyad Kheirbek and Sarah Johnson. 2012. Environmental Health (2012), 11:1-12

[7]. Chapter 5, Analytical report on houses, household amenities and assets

[8]. Maria de Fatima Alpendurada.2000.Journal of Chromatography A, 889 (2000) 3-14

[9]. J. Pawliszyn, Solid Phase Microextraction: Theory and Practice. Wiley-VCH: New York, 1998

[10]. R.Koppmann and K.V.Czapiewski .2005. Atmospheric chemistry and physics discussions, (5), 10455-10516.

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Determination of Extraction Efficiency of Different Solvents for Organic Carbon Content in Biomass Combustion Aerosols

Anupam Pragya[1], Sahu S. K[*2], Tiwari M.[2], Rathod T. D.[2], Bhangare R. C.[2], Ajmal P. Y.[2], Ajey Kumar Patel[1], Pandit G. G.[2]
[1]National Institute of Technology Warangal, Telangana, India
[2]Bhabha Atomic Research Centre, Trombay, Mumbai, Maharashtra, India

ABSTRACT

Biomass combustion is a major source of organic carbon (OC) aerosols found in the atmosphere. In this study OC generated from biomass combustion was sampled and treated with different solvents to determine their extraction efficiency. Commonly used biomass fuels (wood and dung cake) were combusted in a temperature controlled chamber and the generated aerosols were sampled on Quartz filter paper. The dried filter paper pieces were analysed for their OC content in **Total Carbon and Nitrogen Analyzer (PrimacsSNC, Skalar). From the obtained OC data extraction efficiencies were determined.** The extraction process was repeated with four different solvents viz. deionised water, hexane, acetone and methanol. The extraction efficiency of each solvent was determined using difference in OC of filter paper before and after extraction. Extraction efficiency for OC samples obtained from wood combustion in water, hexane, acetone and methanol were 54, 30, 83 and 92 % respectively. And for dung cake, it is observed as 20, 37, 76 and 80 % respectively. The extraction efficiency depended on the polarity index of the solvent used.

I. INTRODUCTION

Carbonaceous aerosols are ubiquitous in troposphere with biomass combustion as one of its major source [1]. Various types of organic carbon and black carbon are components of carbonaceous aerosol. Carbonaceous aerosols are important in direct Radiative forcing because of their prevalence in the ambient atmosphere and the ability of BC and some OC to absorb solar radiation which could warm the atmosphere [2]. From the combustion of biomass, 60% of the primary BC and 91% of primary OC are emitted globally. Biomass combustion includes biofuel combustion (biomass used for heating or cooking) and open vegetative burning (uncontrolled combustion of forests, croplands and grasslands) [3]. estimated the global annual emissions of BC and primary OC as 8 Tg (10^{12}g) and 34 Tg respectively. The contribution of biofuel and open vegetative burning are 19% and 74% respectively to total primary OC, and 19% and 41% to total primary BC.

Black carbon (BC) is the refractory and most strongly light-absorbing component of soot, which is mainly emitted from the incomplete combustion of fossil fuels and biomass burning [4]. Airborne BC is the most significant particulate absorber of solar radiation in the atmosphere and an important contributor to both global and regional-scale climate forcing [5]. While, OC accounts for a large fraction of atmospheric aerosols and has profound effects on air quality, atmospheric chemistry and climate forcing [6]. OC is 3-12 times greater than BC by mass [7] and in atmosphere it accounts for 10-70% of total dry mass [8]. Mostly OC compounds absorbs IR & UV radiation strongly but are relatively transparent to visible and near-IR wavelength. However, certain types of OC absorb radiation efficiently in near-UV visible ranges. For such type of OC, a new term “brown carbon” (BrC), has emerged [9]. Primary sources of BrC are forest fires & biomass burning, residential heating of wood, coal & biogenic release of fungi, plant debris & humic matter [10]. The magnitude of BrC contribution to radiative forcing of climate by absorption of incoming solar radiation on a planetary scale is estimated to be in the range of 0.1-0.25 w/m^2, which is approx. 25% of the radiative forcing by BC (1.07 w/m^2) [11]. Humic like substance (HULIS) and Tar ball found an important component of BrC. Atmospheric HULIS formation occurs during cloud processing of smoke from biomass burning, these are also produced through multiphase chemistry of organic constituents derived from other anthropogenic & natural sources such as vehicle exhaust, fossil fuel combustion in urban areas, biogenic & marine emission. [6] While Tar ball, commonly detected in smoke emission from smoldering burns of biofules. And these are the most absorbing and refractory BrC material that can be easily observed under the vacuum condition of an electron microscope [13]. Although OC could have an important contribution to radiative forcing, its treatment in global models to date has been simplistic; it has been treated as a compound that primarily scatters light and has invariant properties [14]. In fact, chemical and optical properties of OC may differ due to the nature of the OC source [15]. The present paper aims to contribute to understanding the variable behaviour of BrC regarding its polarity. BrC constituents exhibit characteristic of polar molecules and contain both water soluble & insoluble components. For that purpose, in current study four different solvents used for qualitative study of brown carbon composition.

II. METHODS

Sample generation

The OC aerosols are often studied using filter paper based method in which the OC are sampled on filter paper and extracted using suitable solvent for further analysis. For that purpose, OC aerosol samples were generated at lab scale by pyrolyzing small pieces of biomass in an adjustable, electrically-heated enclosed combustor. The combustor created a temperature-controlled environment using resistive heating principle. The dimension of the combustor was 13 cm X 13 cm X 24 cm. The combustor contains no flame source and formation of BC can be avoided by preventing flames when no oxygen enters the combustor. A nitrogen carrier gas (7 lpm) kept the combustor at a slight positive pressure. Smoke escaped through combustor and was sampled. The combustor simulates the release of volatile matter at realistic biomass temperatures. The schematic diagram of experimental setup is shown in figure 1.

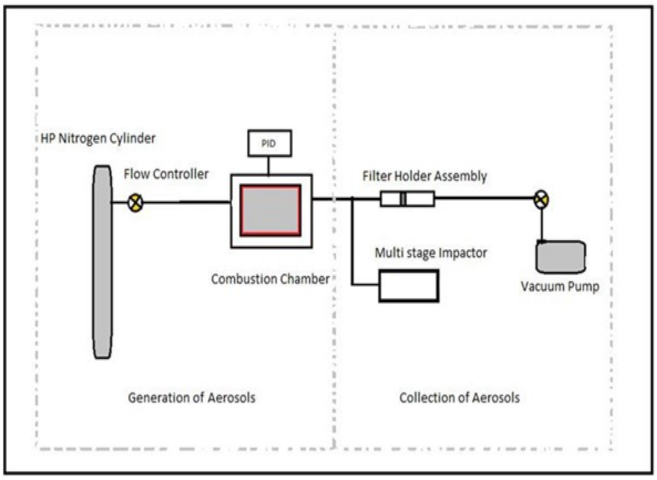

Figure 1. Schematic diagram of experimental setup

The sampling unit consisted of filter holder casing to house quartz filter and multi stage impactor. A vacuum pump constantly maintained negative pressure for aerosols collection. Prior to start of experiment the combustor was continuously flushed with nitrogen gas for 30 minutes to ensure nitrogen environment. Biomass samples were placed in the bottom centre of the combustor, and temperature was measured near the exterior of the biomass pieces. The measured temperature represents the temperature of the biomass surface. The internal temperature of the biomass would be lower than the surface temperature when it was just put into the combustor [16]. modelled the heat transfer into biomass (wood) and found that under smoldering conditions for the biomass size, the internal temperature can reach the surface temperature in less than 10 minutes. The time is relatively short compared with a normal overall test which generally lasted for 1-2 hours. It was observed that combustor took some time to reach the set temperature at the rate of 10°C/min.

Filter holder assembly collected total organic carbon aerosols escaping from the combustor chamber at the outlet. Then filter papers were stored in Petri dishes lined with baked aluminium foil prior to sampling. At the end of the sampling period, the filters were returned to the dishes immediately and stored in a freezer (-4 °C) until further analysis.

Sample extraction:

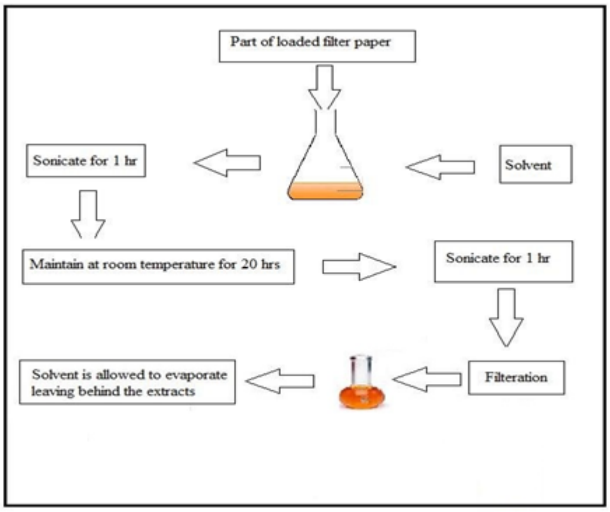

Figure 2. Schematic diagram of extraction procedure for organic carbon

Sampled quartz filter paper was extracted with 20mL deionized water and organic solvents: methanol (A.C.S. certified, Fisher Scientific), hexane (Fluka) and acetone (A.C.S. certified, Fisher Scientific). A punch (1/8th) of filter paper and solvent were sonicated (Ultrasonic Cleaner, Cole Parmer 8892) for 1 hour, kept at room temperature for 20 hours to let the solution reach equilibrium, and sonicated for 1 additional hour [17]. reported that sonication increases extraction efficiencies by 10-15%. All extracts were filtered by syringe through a 25mm diameter filter with a 0.2*m*m pore size (Whatman, Anotop* Disposable Syringe Filters, Fisher Scientific) to remove impurities during the extraction process. Residual filters were taken out of the solutions, dried in a fume hood and then kept in the freezer for further analysis. Schematic diagram of extraction setup shown in figure 2.

III. RESULT AND DISCUSSION

Sample collected on quartz filter paper showed brownish colour as shown in figure 3, which ensures the presence of BrC in the collected samples.

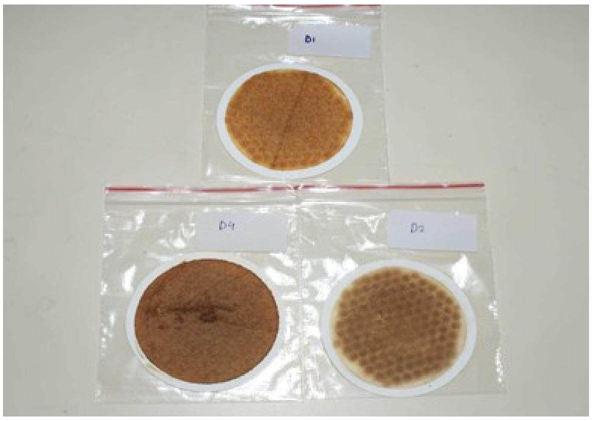

Figure 3. Brown carbon loaded quartz filter paper

Total organic carbon was analysed in **Total Carbon and Nitrogen Analyzer (PrimacsSNC, Skalar make), which consists a** Combustion furnace, Peltier cooler, Halogen scrubber, and NDIR (Non Dispersive Infrared detection). For organic sample TC direct method was used in which sample initially passes through combustion furnace where carbon is completely oxidized to CO_2, by continuously circulating the sample through the combustion furnace. The CO_2 is measured by (NDIR) for Total Carbon. The instrument was calibrated with the standard result in which EDTA taken as standard, which contain 41% of carbon. Absolute carbon value was calculated before and after extraction to calculate solubility of wood and dung cake sample obtained on fillter paper in water, hexane, acetone and methanol. Figure 4 shows typical spectra of carbon analysis.

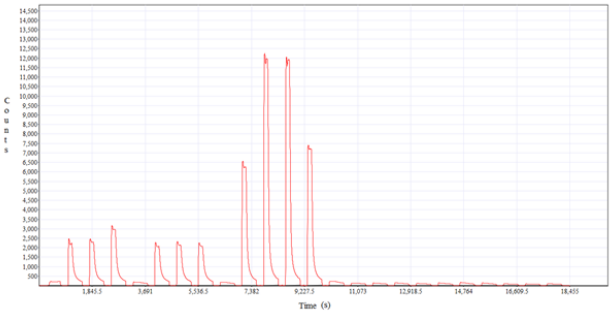

Figure 4. A typical Carbon analysis spectrum in TC analyser

Extraction Efficiency:

Based on polarity index, solvents with extreme and mid values were chosen for sample extraction (for water, hexane, acetone and methanol polarity index values are 10.2, 0.1, 5.1 and 5.1 respectively).

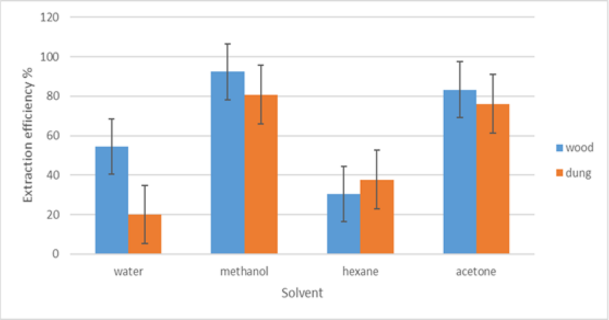

Figure 5. Extraction efficiency of solvents (%)

After calculation of absolute carbon value before and after extraction, efficiency of all four solvents was calculated. For wood and dung cake sample maximum extraction efficiency was obtained with methanol and least extraction efficiency for wood sample obtained in hexane whereas for dung cake sample lowest efficiency was observed in water. This shows that BrC constituents behave differently towards polarity on the basis of their source (fig. 5).

Dependance of Extraction efficiency on relative polarity:

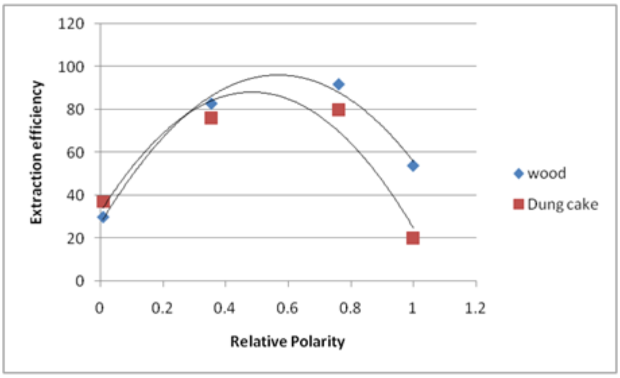

Figure 6. Extraction efficiency of solvents w.r.t. relative polarity (%)

The extraction efficiency depends on the polarity of the solvents. The extraction efficiency increased with increasing polarity, reached maxima and then decreased. As seen in fig 6, the extraction efficiency can be stated to be maximum in the relative polarity range of 0.4 to 0.8. This polarity dependence behaviour of OC is related to the nature of compounds present in the OC samples. It has been shown that OC aerosols generated from biomass combustion are mixture of fused polycyclic aromatic hydrocarbons, HULIS, tar, and other high molecular weight organic compounds.

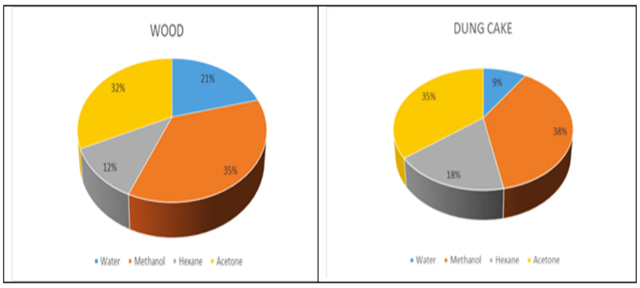

Figure 7. Absolute soluble carbon value for wood and dung cake (%)

Many studies have been done to know water soluble and water insoluble fraction of brown carbon. Chen, Y et al [17] observed that water soluble fraction of BrC is usually less (below 70%) than polar solvents (nearly 90%). In the present study, as shown in fig. 7, it is observed that Methanol has maximum relative extraction contribution amongst all the used solvents. Both Methanol and acetone shared maximum relative extraction efficiency in both the fuels. However water showed more relative efficiency in wood than in dung cake.

IV. CONCLUSIONS

Acetone and Methanol whose polarity index is in range of 5-6. showed highest efficiency for both fuels. The extraction efficiency showed an increasing trend with increase in relative polarity initially up to the value of 0.8 and then decreased with further increase. This shows that the BrC component in the biomass have a mid-polarity characteristic.

V. REFERENCES

[1]. Gelencser, Andras.,2005 Carbonaceous aerosol. Vol. 30. Springer Science & Business Media.

[2]. Y. Chen and T.C. Bond,2010 atmospheric chemistry and physics,10,1773-1787.

[3]. Bond, T. C., Streets, D. G. et al., 2004. Journal of Geophysical Research-Atmospheres, 109, D14203, 10.1029/2003jd003697.

[4]. Tianhai Cheng, Yu Wu et al., 2015. Optics express, 23(8), 10808-10821.

[5]. Ramanathan et al., 2001. Journal of Geophysical Research: Atmospheres, 106(D20), 24097-24105.

[6]. Chemistry of atmospheric Brown Carbon, Alexander Laskin, Julia Laskin, and Sergey A. Nizkorodov; 2015.

[7]. Molnar A., Meszaros, E. et al.,1999 Atmospheric Environment, 33, 2745-2750.

[8]. Murphy D. M., Cziczo D. J. et al., 2006 Journal of Geophysical Research., 111, D23S32, doi:10.1029/2006JD007340.

[9]. Alexander Laskin, Julia Laskin et al., 2015. Chemical reviews 115.10 (2015): 4335-4382.

[10]. Andreae, M. O., and Gelencser, A, 2006, Atmospheric Chemistry and Physics, 6, 3131-3148.

[11]. Feng Y.; Ramanathan, V.; Kotamarthi et al., 2013, Atmospheric Chemistry and Physics, 8607.

[12]. Yang, M.; Howell, S.G.; Zhuang, J. et al.; 2009, Atmospheric Chemistry and Physics 9,2035.

[13]. Liousse C., Penner, J. E., Chuang, C. et al.,1996 Walton, J. J., Journal of Geophysical Research 101, 19411– 19432.

[14]. Y. Chen and T.C. Bond,2010 atmospheric chemistry and physics,10,1773-1787.

[15]. Roden, Christoph A. Parameterizing Climate-Relevant Properties of Biofuel and Biomass Particulate Emissions Based on Combustion Conditions. Diss. University of Illinois at Urbana-Champaign, 2008.

[16]. Polidori, Andrea, Barbara J. Turpin, Cliff I. Davidson, Lisa A. Rodenburg, and Francesco Maimone. "Organic PM 2.5: fractionation by polarity, FTIR spectroscopy, and OM/OC ratio for the Pittsburgh aerosol." Aerosol Science and Technology 42, no. 3 (2008): 233-246.

[17]. Chen, Y.; Bond, T.C. 2012, atmospheric chemistry and physics 12,6067, Zhang, X; Lin, Y.H.; Surratt, J.D.; Weber, R. J. Environ. Sci. Technol. 2013, 47,3685.

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"Synthesis of Metal Sulfadoxine Complexes and Studying Their Properties"

Mukesh Kadam [1], Mahesh Aute[2]
[1]LGM ACS College, Mandangad Ratnagiri, Maharashtra, India
[2]Dr.S.D.D.Arts, Commerce and science college, Wada, Maharashtra, India

ABSTRACT

The metal like Mn (II), Fe (II), Ni (II) & Cu (II) are the essential elements to the human being. These metal used for the synthesis of complex with Sulfadoxine the color, state and solubility of complex can be determine. Anti-microbial activity of these coordination check against E.coli and staphylococcus aureus bacteria.

Keywords: Sulfadoxine, conductance, antimicrobial, ligand, complex etc.

I. INTRODUCTION

The co-ordination chemistry is important branch of inorganic chemistry. A many co-ordination compound have great importance in living organism. Among them chlorophyll and hemoglobin are important. Chlorophyll is chief constituent of green plants. It is a co-ordination compound which is formed by combination of Mg and Porphyrin and has important in synthesis the carbohydrate in a green plant.

Hemoglobin is a chief constituent of blood, it is formed by combination of Fe and Porphyrin ligands and has importance in transportation of Co_2 and O_2 in animal circulatory system. The earliest recorded co-ordination compound is Prussian blue obtained by Disbranch & Rosset. A compound that interacts with a biological system to produce a biological response is called drug.

The fundamental & classical investigation in co-ordination chemistry were carried out by Danish Chemist S.M. Jorgensen & the Swiss Alfred Werner. They prepare thousands of compound s. Werner postulated a theory to explain the nature & formation of co-ordination compounds. He received Noble prize in 1913 for his work in co-ordination chemistry.

According to Werner co-ordination are those comp. Which are formed due to the combination of metal & ligand. The ligand donate a pair of electrons to metal & form an active bond. According to Werner's theory, in co-ordination compound central metal atom possess two types of valences primary & secondary. Primary valiancy is ion sable and secondary valiancy is non ion sable. Secondary valiancy of many metal is fixed .In co-ordination compound primary valiancy is satisfied by –vie ligand & denoted by dotted lines. The secondary valance is satisfied by –ve ligand & denoted by think line. The secondary is in a space around the central metal atom. Therefore the geometry of co-ordination compound is depends upon secondary valences. Every metal tend to satisfy both its primary & secondary valences in order to meet this requirement a negative ion may perform a dual function of satisfying both type of valances .

When two or more than two stable salts or compound combine together in a stoichiometric (equimolar) proportion form new compound there are two types of molecular compounds. These are

1. Double salt &
2. co-ordination compounds.

Double salt is compound or molecular compound. It always exist in crystal lattice & retain their identity but it dissolve in water it break down into their constituent & loss their identity .e.g. Mohr salt $FeSo_4(NH_3).SO_4\ 6H_2O$. Co-ordination compounds are those which exist in crystal-like lattice as well as in solution. It retain their identity in solids state as well as in solution. E.g. potassium hexocynopherate $K4(Fe(CN)_6)$.

Cisplatin or cis- diamine dichloroplatinum (II) names platoon. It is chemotherapy drug is used to treat various types of cancer. Compound cis-platin was first described by M.Peryone in 1845 & known for long time as Perion salt Its structure was given by Alfred Werner.

A drug is a substance, which is used in the cure treatment prevention or diagnosis of disease in man or in animals. Treatment of diseases with chemical substances has been known since the fifteenth century. I have taken sulfadoxine drug for the synthesis of complex with metal like Ni(II), Mn (II),Fe(II) & cu(II).Sulfadoxine is used in malarial treatment.

Preparation of complexes:

All the complexes were prepared using same general procedure. Approximately 10 m moles of partially dehydrated salts were dissolved in minimum amount of anhydrous ethanol. The ligand in excess over 1:2 metal to ligand ratio, was dissolved in the minimum amount of ethanol, the mixture was refluxed for 4 hrs. The product was filtered through Whatmann filter paper. The complexes were recrystallized from suitable solvents.

$$\text{M +Sulfadoxine} \longrightarrow \text{M (Sulfadoxine)}_2$$

(M = Ni(II), Mn (II),Fe(II) & cu(II).)

Conductance:

Operational Procedure:

Their electrolyte conductance of an electrolyte is measured in "conductivity cells" which are specially designed vessels of suitable size and shape in which two plates of inert metal (Pt or gold) are provided to serve for the flow in and flow out of electrons. The electrolyte whose conductivity is to be measured is taken in fused state or in aqueous solution.

First we connect the conductivity cell to the conductometre. Switch on the conductometre. Then keep the conductometre on calibration known. The conductivity cell is then dipped in the test solution .Then calibration is change to measure because at this position we want to measure the conductivity. After some time we get the table reading of observed conductometre. In this way we can measure the conductivity of any solution.

CONDUCTIVITY OF COMPLEX

Table 1

Sr. No.	Name of Metal Complex	Conductivity
1	Sulfadoxine Manganese Chloride complex	0.05
2	Sulfadoxine nickel nitrate complex	0.03
3	Sulfadoxine Ferrous nitrate complex	0.02
4	Sulfadoxine copper chloride complex	0.05

ANTIMICROBIAL CTIVITIES

All living organisms are chemically dynamic systems. The presence of a "foreign" chemical within a living system can readily upset this balance by enhancing, inhibiting or otherwise interacting with one or more of the chemical reactions or compounds on which its integrity depends. Such a chemical can be said to possess some form of biological activity.

Biological activity can take many different forms and may be measured in different ways depending on the level at which the investigation is conducted, when the critical site and mechanism of action of a chemical are known, biological activity can be measured directly in terms, for example, of the degree of inhibition or enhancement of an enzyme system as measured in vitro. More usually, however, biological activity is measured in an indirect manner through in vivo observations of the end results of the chain of events initiated by the interaction of chemical with some unknown biochemical components. In the case of a pesticide, for instance, it is customary to measure biological activity in terms of the percent mortality of an organism without necessarily having any knowledge of the mode of action of the material at the molecular level. More strictly defined this should be termed biological effect or response.

Microbial Testing:

The literature survey of the antimicrobial activity of metal complexes of sulfadoxine have shown that many of them are useful as the best bactericides and fungicides against the various gram positive and gram negative bacteria and fungi. Some of the representative compounds synthesized in the present investigation were screened for their antibacterial and antifungal activities. *Escherichia coli* (*E. coli*) is one of the main species of bacteria living in the lower intestines of mammals, known as gut flora. When located in the large intestine, it actually assists with waste processing, vitamin K production, and food absorption.

Test organism:

The test organisms were selected from both gram positive and gram negative to test.The stock cultures were collected from the culture unit of the Department of Microbiology, D.S.M. College Parbhani. These organisms were cultured on agar slants and incubated for 24 hrs. at 32–34 °C. From these slants a suspension were made using sterile saline solution (saline solution was prepared by dissolving 0.9 gm of sodium chloride in 100 ml distilled water and then sterilized).

Method of testing:

Bactericidal activities were evaluated by the paper disc plate method15. The nutrient agar medium and 5mm diameter paper discs (Whatmann No. 1) were used. The compounds were dissolved in DMSO making known stock solution. A known volume of stock solution is diluted in ethanol making 500 ppm concentration. The filter paper discs were soaked in different solutions of the compounds and then placed in the petri-plates previously seeded with the test organisms (*Staphylococcus aureus* and *Escherichia Coli*). The plates were incubated for 24-30 hrs. at 28 ±1°C and the inhibition zone around each disc were measured. The standard drug streptomycin (500 ppm) was tested for its activity under the same conditions. All these experimental procedures were repeated thrice with three replicates for each compound.

Table 2

Sr. No.	**Name of Metal Complex**	**Activity[mm]**
1	Sulfadoxine Manganese Chloride complex	6mm
2	Sulfadoxine nickel nitrate complex	8mm
3	Sulfadoxine Ferrous nitrate complex	13 mm
4	Sulfadoxine copper chloride complex	12mm

CHARACTERISATION OF COMPLEX

Table 3

Sr. No.	Name of complex	Mol. Wt. Of complex	Percentage of each element
1	Sulfadoxine Manganese Chloride complex	646.5	C=36.785%, H=4.53%,N=8.58%, O=18.39%,S=9.80%, Mn=9.73% Cl=10.88%
2	Sulfadoxine nickel nitrate complex	652.5	C=36.785%, H=4.53%,N=8.58%, O=18.39%,S=9.80%, Ni=9.73% Cl=10.88%
3	Sulfadoxine Ferrous nitrate complex	648.5	C=36.785%, H=4.53%,N=8.58%, O=18.39%,S=9.80%, Fe=9.73% Cl=10.88%
4	Sulfadoxine copper chloride complex	654.5	C=36.785%, H=4.53%,N=8.58%, O=18.39%,S=9.80%, Cu=9.73% Cl=10.88%

II. RESULT AND DISCUSSION

As number of authors were interested to investigate the biological and medicinal properties of transition metal complexes. The ligands with nitrogen and oxygen donor systems inhibit enzyme production. Complex formation reduces the polarity of the metal ion due to the partial sharing of its positive charge with the donor groups and delocalization of pi electrons. This process increases the lipophilic nature of the central metal atom, which is responsible for increasing the hydrophobic character and liposolubility of the molecule in crossing cell membrane of the microorganism, and hence enhances antibacterial activity. The of drugs shows moderate antibacterial activity, but their metal (II) complexes show more antibacterial activity than corresponding ligands. It was found that the Mn (II) complexes are more active than the free ligands and Co (II) complexes. The increase in antibacterial activity is due to faster diffusion of metal complexes as a whole through cell membrane or due to the combined activity effect of the metal and ligand.

III. REFERENCES

[1]. SP Gupta; OP Malik; J Singh.J.Indian Chem. Society.,1975,52, 656.

[2]. S Chandra; D Jain; AK Sharma; P Sharma,Molecules,2009,40, 174.

[3]. K Lal; SP Gupta; J Singh,J.Inorg. Nucl. Chem.,1978, 40, 359.

[4]. SJ Kim; T Takizawa,Bull.of Jpn,1975, 48, 2197.

[5]. PS Patel; RM Ray; MM Patel,Indian J. Chem.,1993, 32A, 597.

[6]. L Mishra; A Jha; H Itokawa; K Takeya,Indian J. Chem.,1998, 37A, 747.

[7]. Takei; Nishibayashi; Yoshlaki,Chemical Communication,2001, 22, 2360-2361.

[8]. AZ EL Sonbati; AA EL Bindary; MA Diab; SA Marrouh,Monatshelfe Fur Chemie,1993, 124, 793-801.

[9]. KT Joshi; AM Pancholi; KS Pandya; KK Singh; ASThakar,Asian J. Chem.,2010,22,7706-7712.
[10]. AS Thakar; KK Singh; K T Joshi; AM Pancholi; KS Pandya,E-J Chem.,2010,7(4),14071411.
[11]. KT Joshi; AS Thakar; AM Pancholi; KS Pandya,E-J Chem.,2011, 8(4), 1556-1565.
[12]. AS Thakar; KT Joshi; AM Pancholi; KS Pandya,E-J Chem.,2011,8(4), 1750-1764
[13]. KT Joshi; AM Pancholi; KS Pandya; AS Thakar,J. Chem. Pharm. Res.,201, 3(4) 74749.
[14]. KT Joshi; AM Pancholi; KS Pandya; AS Thakar,Int. J. Res. Chem. Environ.,201, 63-69.
[15]. BN Figgis. Introduction to ligand fields, Interscience,1966New York.
[16]. PP Dholakiya; MN Patel,Synth. React. Inorg. Met.-Org and Nano-met. Chem.,200132,
[17]. N Deb; SD Barudh; N Sen Savma; NN Das,Thermochim.Acta.,1998,53, 320.
[18]. AA Soliman,J. Therm. Anal.Cal.,2001, 221.Synth. React. Inorg. Met.-Or

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To Study the Current Status, and Future Challenges of Green Chemistry

Megha Gawade, Sunita Pawar, Shivprasad Mahadkar
Dr. S. D. Devsey Arts College and Commerce and Science College, Wada, Palghar, Maharashtra, India

ABSTRACT

Green chemistry emerged from 1990s, in the increasing attention to problems of chemical pollution and resource depletion. The development of green chemistry was linked to a shift in environmental problem-solving strategies i.e. a movement from command and control regulation and mandated reduction of industrial emissions by the active prevention of pollution through the innovative design of production technologies themselves. The concepts now recognized as green chemistry and "sustainable" chemistry. Attempts are being made not only to quantify the greenness of a chemical process but also to factor in other variables such as chemical yield, the price of reaction components, safety in handling chemicals, hardware demands, energy profile and ease of product workup and purification. Green chemistry is increasingly seen as a powerful tool that researchers must use to evaluate the environmental impact of nanotechnology. As nanomaterials are developed, the environmental and human health impacts of both the products themselves and the processes to make them to ensure their long-term economic viability. Green solvents are generally derived from renewable resources and biodegrade often a naturally occurring product. Green technology (greentech) is the application of one or more of environmental science, green chemistry, environmental monitoring and electronic devices to monitor, model and conserve the natural environment and resources, and to curb the negative impacts of human involvement. Bioengineering is also seen as a promising technique for achieving green chemistry goals. A number of important process chemicals can be synthesized in engineered organisms. Over the course of the past decade, green chemistry has demonstrated how fundamental scientific methodologies can protect human health and the environment in an economically beneficial manner.

Keywords: CFC(chlorofluorocarbon), PLA (poly lactic acids)

I. INTRODUCTION

Green Chemistry is defined as the “design of chemical products and processes to reduce or eliminate the use and generation of hazardous substances.”

Principles

In 1998, Paul Anastas and John C. Warner published a set of twelve principles to guide the practice of green chemistry which help to reduce the environmental and health impacts of chemical production, and create the opportunities in the development of green chemistry technologies.

The principles cover such concepts as:

1) The design of processes to maximize the amount of raw material that ends up in the product.
2) The use of renewable material feedstocks and

energy sources

3) The use of safe, environmentally benign substances, including solvents, whenever possible
4) The design of energy efficient processes
5) Avoiding the production of waste, which is viewed as the ideal form of waste management.
6) Prevention:Preventing waste is better than treating or cleaning up waste after it is created.
7) Atom economy: Synthetic methods should try to maximize the incorporation of all materials used in the process into the final product.
8) Less hazardous chemical syntheses:Synthetic methods should avoid using or generating substances toxic to humans and/or the environment.
9) Designing safer chemicals: Chemical products should be designed to achieve their desired function while being as non-toxic as possible.
10) Safer solvents and auxiliaries:Auxiliary substances should be avoided wherever possible, and as non-hazardous as possible when they must be used.
11) Design for energy efficiency:Energy requirements should be minimized, and processes should be conducted at ambient temperature and pressure whenever possible.
12) Use of renewable feedstock:Whenever it is practical to do so, renewable feedstocks are preferable to non-renewable ones.

- ✓ Design for degradation-Chemical products should be designed so that they do not pollute the environment; when their function is complete, they should break down into innocuous products.
- ✓ Real-time analysis for pollution prevention-Analytical methodologies need to be further developed to permit real-time, in-process monitoring and control before hazardous substances form.
- ✓ Inherently safer chemistry for accident prevention-Whenever possible, the substances in a process, and the forms of those substances, should be chosen to minimize risks such as explosions, fires, and accidental releases.

Synthetic techniques

Novel techniques can often provide improved environmental performance of green chemistry. A 2005 review identified three key developments in green chemistry in the field of organic synthesis.

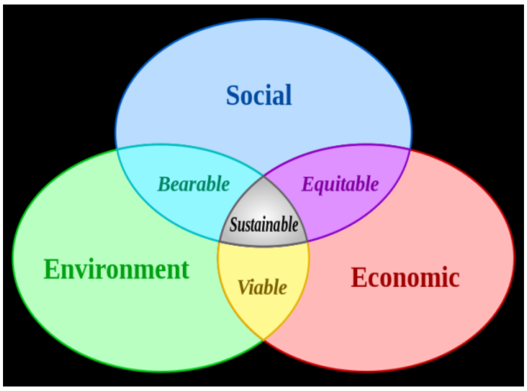
- ✓ Use of supercritical carbon dioxide as green solvent,
- ✓ Use of aqueous hydrogen peroxide for clean oxidations
- ✓ the use of hydrogen in asymmetric synthesis.

The concept of 'green pharmacy' has recently been articulated based on goals of green chemistry.

- ✓ **Carbon dioxide as blowing agent**-In 1996, Dow Chemical won the 1996 Greener Reaction Conditions award for their 100% carbon dioxide blowing agent for polystyrene foam production which is a common material used in packing and food transportation. Traditionally, CFC and other ozone-depleting chemicals were used in the production process of the foam sheets, presenting a serious environmental hazard. Flammable, explosive.Dow Chemical discovered that supercritical carbon dioxide works equally as well as a blowing agent, without the need for hazardous substances, allowing the polystyrene to be more easily recycled. The CO_2 used in the process is reused from other industries, so the net carbon released from the process is zero.
- ✓ **Hydrazine-** The Peroxide Process for producing hydrazine without cogenerating salt.It is traditionally produced by the Olin Raschig process.The net reaction produces one equivalent of sodium chloride for every equivalent of the targeted product hydrazine.
- ▪ $NaOCl + 2\ NH_3 \rightarrow H_2N\text{-}NH_2 + NaCl + H_2O$
- ✓ In the greener Peroxide process hydrogen peroxide is employed as the oxidant, the side

product is water.

- ✓ **1,3-Propanediol**-It is a green route to 1,3-propanediol, which is traditionally generated from petrochemical precursors. It can be produced from renewable precursors via the bioseparation of 1,3-propanediol using a genetically modified strain of E. coli. This diol is used to make new polyesters for the manufacture of carpets.
- ✓ The Nature Works PLA process substitutes renewable materials for petroleum feed stocks, does not require the use of hazardous organic solvents typical in other PLA processes, and results in a high-quality polymer that is recyclable and compostable.
- ✓ **Carpet tile backings**:Research indicated that separation of the fiber and backing through elutriation, grinding, and air separation proved to be the best way to recover the face and backing components, but an infrastructure for returning post consumer has to the elutriation process was necessary. The post consumer carpet tile had a positive economic value at the end of its useful life.
- ✓ **Bio-succinic acid:**In 2011, the Green Chemistry by a Small Business Award went to BioAmber Inc. for integrated production and downstream applications of bio-based succinic acid. Succinic acid is a platform chemical of everyday products. It is produced from petroleum-based feedstocks. BioAmber has developed process and technology that produces succinic acid from the fermentation of renewable feedstocks at a lower cost and energy expenditure than petroleum equivalent while sequestering CO_2 rather than emitting it.
- ✓ The green technology, which is focusing on green chemistry will cooperative for the use of energy and resource sustainably and uplipment to avoid biodegradation of energy resources as social ,environmental and economic.
- ✓ **Energy resources as Social ,Environmental and Economic.**



Sustainable engineering:
It is the process of designing or operating systems such that they use energy and resources sustainably.

Energy Conservation: The green building is energy conservation. By implementing passive design, structural insulated panels (SIPs), efficient lighting, and renewable energy like solar energy and geothermal energy, a home can benefit from reduced energy consumption.

Indoor Environmental Quality: A much healthier environment can be created through avoiding hazardous materials found in paint, carpet, and other finishes. It is also important to have proper ventilation and ample day lighting.

The toxic material: The heavy metals like nickel, lead, cadmium, and mercury from batteries, and organic compounds found in pesticides and consumer products, such as air freshener sprays, nail polish, cleaners, and other products When burned or buried, toxic materials also pose a serious threat to public health and the environment. A good garbage prevention strategy would require that everything brought into a facility be recycled for reuse or back into the environment through biodegradation.

Green building refers to a structure and the application of processes that are environmentally responsible and resource-efficient throughout a building's life cycle: from planning to design, construction, operation, maintenance, renovation, and demolition. A 2009 report by the U.S. General Services Administration found 12 sustainably-designed buildings that cost less to operate and have excellent energy performance.

The next beneficial goal of green chemistry is renewable energy resources:

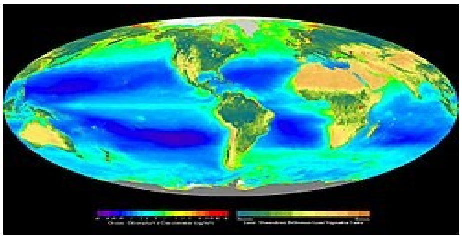
Renewable energy is generally defined as energy that comes from resources, which are naturally replenished, on a human timescale such as sunlight, wind, rain, tides, waves and geothermal heat. Renewable energy replaces conventional fuels in four distinct areas: electricity generation, hot water/space heating, motor fuels, and rural (off-grid) energy services.

Solar cookers use sunlight as energy source for outdoor cooking.

It exist wide geographical areas. In international public opinion surveys, there is strong support for promoting renewable sources such as solar power and wind power. At the national level, at least 30 nations around the world already have renewable energy contributing more than 20 percent of energy supply. The Intergovernmental Panel on Climate Change has said that there are few fundamental technological limits to integrating a portfolio of renewable energy technologies to meet most of total global energy demand. Mark Z. Jacobson says producing all new energy with wind power, solar power, and hydropower by 2030 is feasible and existing energy supply arrangements could be replaced by 2050.

Wind mill as an energy resource

Significant progress of methodological green chemistry is being made in several key research areas, such as catalysis, the design of safer chemicals and environmentally benign solvents, and the development of renewable feedstocks. Current and future chemists are being trained to design products and processes with an increased awareness for environmental impact. Outreach activities within the green chemistry community highlight the potential for chemistry to solve many of the global environmental challenges we now face.



Global environmental challenges

The origin and basis of green chemistry designing for achieving environmental and economic prosperity inherent in a sustainable world as mechanics ,statics, hydrology and fluid dynamics. Sustainable engineering is the process of operating system to use the renewable energy and resources.

Green Chemistry is a relatively new emerging field that strives to work at the molecular level to achieve sustainability. The field has received widespread interest in the past decade due to its ability to harness chemical innovation to meet environmental and economic goals simultaneously.

Framework of Green Chemistry:

The three main points about the Green Chemistry framework can be summarized as:

1. Green Chemistry designs across all stages of the chemical life-cycle.
2. Green Chemistry seeks to design the inherent nature of the chemical products and processes to reduce their intrinsic hazard.
3. Green Chemistry works as a cohesive system of principles or design criteria.

Education:

A masters level course in Green Technology, has been introduced by the Institute of Chemical Technology, India. There are also websites focusing on green chemistry, such as the Michigan Green Chemistry Clearinghouse at www.migreenchemistry.org.

II. CONCLUSION

For generations, molecular scientists have invented the molecules, materials, and manufacturing processes that have allowed economic and societal development. Green Chemistry is ensuring that all of that creative ability that is the long tradition of the field of chemistry is practiced in a way that builds in impact on people and the planet as a design criterion. Green Chemistry has shown that through innovation companies can be economically more profitable and more environmental at the same time. The Green Chemistry work hard around the world and the achievements of the past by comparison to the power and potential of the field such as advanced mathematics, thermodynamics,computer modeling etc.

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Effect of Particle Size and Moisture on Emission of Organic Carbon from Vehicular Exhaust

Ebin Johnson[1], Sahu S. K[2*], Rathod T. D.[2], Ajmal P. Y.[2], Tiwari M.[2], Bhangare R. C.[2], P. V. Rao[1], Pandit G. G.[2]
[1]National Institute of Technology Warangal, Telangana, India
[2]Bhabha Atomic Research Centre, Trombay, Mumbai, Maharashtra, India

ABSTRACT

For decades, the concentration of aerosols in the lower atmosphere has increased steadily primarily owing to anthropogenic sources such as industrial activity, vehicular emission, biomass burning, and also to secondary aerosol formation. As a consequence of urbanization, a phenomenal surge has been observed in the vehicular population in India, giving rise to elevated levels of traffic related pollutants like carbon monoxide, nitrogen oxides, hydrocarbons, and particulates in urban centers. These pollutants can have both acute and chronic effects on human health. The vehicular emissions are governed by various factors such as purity of the fuel, capacity and health of vehicle, type of fuel etc. Alongwith others, moisture is one of the major product of vehicular emission. The effect of moisture plays an important role not only in the physical characteristics of aerosols emitted from the vehicular exhaust, but also in the chemical characteristics. The tail pipe emission of automobiles mainly consists of soot (black carbon), some organic compounds, and moisture. The interactions between the organic compounds with or without the presence of moisture need to be effectively studied.

In this study, the effect of size distribution and moisture on the emission of carbon in vehicular exhaust was studied. The size distribution of was carried out using variable configuration cascade impactor (VCCI). Additionally, a denuder of activated silica gel was designed to trap the moisture and to study the effect of moisture. The quantification of carbon was carried out using a TC-TN analyzer. The average emission of organic carbon aerosols from both diesel and petrol vehicles were maximum in the lowest particle size i.e. nucleation mode. Both diesel and petrol exhaust showed tri-modal distribution over the range of studied particle sizes. In both diesel and petrol vehicular exhaust, organic carbon was less in moisture free environment (with denuder) in the accumulation mode.

Keywords: VCCI, TC-TN analyzer, denuder, particle size

I. INTRODUCTION

Vehicular emissions continue to attract the attention of environmentalists and toxicologists not only because greenhouse gases are known to have adverse effects on global climate, but also because many organic compounds found in automobile emissions have high ozone forming potential or health effects on humans and other living organisms. As the number of in-service vehicles continues to grow around the world, several remedial measures including, stringent emission regulating legislation have been employed to reduce the impact of vehicular emissions on the environment and its ecosystems [1].

Motor vehicles comprise a significant source of atmospheric pollutants. Exhaust emissions from vehicles consist of a hot and complex mix of both gaseous and particle phases. The gaseous emissions include carbon dioxide (CO_2) which plays a major role in global warming. The particles emitted are mostly carbonaceous spherical submicron agglomerates formed as a result of incomplete combustion in the engine and are very often coated with various organic compounds [2-4].

Several adverse health and environmental effects have been attributed to emissions from urban vehicular traffic. Epidemiological studies have linked particulate matter in urban environments with mortality, hospital admission increases and various cardiovascular and respiratory diseases [5-7]. The size distribution of these particles plays an important role as, during inhalation, the smaller particles penetrate deeper into the human respiratory system and are more likely to be retained there, enhancing harmful toxicological effects [8, 9]. A knowledge of the organic compounds and the effect of moisture on particles in vehicle emissions, particularly in relation to different types of vehicle used, is therefore of great importance in the understanding of these adverse effects.

According to diameter, particles can be classified in three modes: nucleation mode (particle diameter <50 nm) Aitken mode (particle diameter between 50 nm to 100 nm) and accumulation mode (particle diameter >100 nm) [10]. Particles emitted from vehicular exhaust are mostly in the all three modes.

The aim of the present study was to measure the organic carbon and total carbon emissions from petrol and diesel vehicles and to draw conclusions regarding any differences in the emissions using the two types of vehicles and any difference in emission due to the moisture conditions. A silica gel denuder designed and was used to trap the moisture and to study effect of moisture on carbon emission from the vehicular exhaust.

In present study near source, size fractionated aerosols from exhaust of vehicles of different fuel types (Petrol and Diesel) were collected in >21 µm to <0.1 µm size range in twelve stages using a variable configuration cascade impactor (VCCI).

II. MATERIALS AND METHODS

2.1 Collection

Various models of both diesel and petrol vehicles were selected for the study. Each vehicle's exhaust was collected with the help of Variable configuration cascade impactor (VCCI) for a sampling time of 15 minutes. Samples were collected on glass fiber filter papers. Filter papers were desiccated and weighed prior to the experiment. The final weight was also measured to know the loading and mass size fraction of organic compounds from exhaust aerosols. For the second set of experiment, a specially designed denuder was connected before the VCCI to trap the moisture. Deposition of aerosols from a vehicular exhaust in different stages of VCCI is shown in Figure 1.

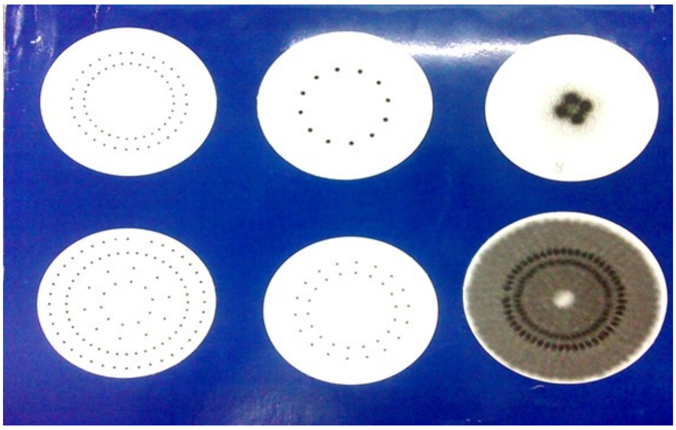

Figure 1. Deposition of aerosols from vehicular exhaust in different stages of VCCI.

1.2 Experimental setup

The experimental setup for determination of particle size distributions of aerosols from vehicular exhaust is shown in the Fig 2. It consists of a funnel shaped pipe which was kept close to the exhaust pipe of vehicles. It allows all the exhaust to pass through the denuder. A denuder of activated silica gel was used to trap the moisture and to study the effect of moisture on the organic and total carbon from the exhaust. It was followed by a variable configuration cascade impactor (VCCI) for size fraction and Anderson pump to maintain the air flow.

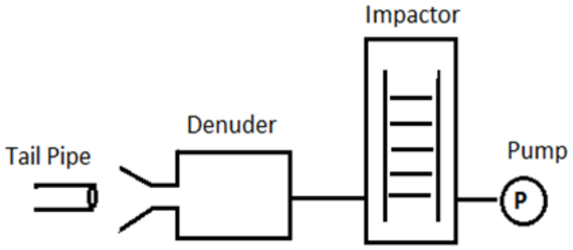

Figure 2. Setup for collection of size fractionated carbonaceous aerosols from vehicular exhaust

2.3 Cascade impactor

Mass size distribution of carbonaceous aerosol from vehicular exhaust was assessed on variable configuration cascade impactor (VCCI) [11]. Glass fiber paper discs (EPM 2000, Whatman) were used as an impaction surface for particles as well as a backup filter in the cascade impactor. Glass fiber paper were dried in an oven at 100 °C for 2 h, kept in a desiccator for 24 h and weighed prior to sampling. Air flow rate of 10 lpm was maintained in the impactor. The size ranges (μm) collected from the different stages of cascade impactor were as follows; >21.3, 21.3–15.1, 15.1–11.2, 11.2–7.38, 7.38–5.47, 5.47–2.23, 2.23–1.13, 1.13–0.75, 0.75–0.50, 0.50–0.30, 0.30–0.10 and <0.10. The pressure at the last stage was continuously measured through the course of sampling so that the flow rate and stage cut off can be monitored. Sampling time was 15 minutes for each type of vehicle which passed about 0.15 m^3 volume of air approximately.

2.4 TC-TN analyzer

Total carbon (TC) and total organic carbon (OC) was analyzed with help of TC-TN Analyzer (Primacs SNC-100). According to different temperature profiles, the total carbon and total organic compounds of samples are directly given by the instrument with the help of standard curves. Standard curves were prepared with EDTA standard. In TC method the sample is automatically introduced into the combustion oven and combusted at given temperature. At the end of the combustion procedure, the gas mixture is directly led to the Non dispersive infra-red (NDIR) detector. NDIR measures the amount of CO_2 gas released after combustion. At 600ºC instrument gives the total organic carbon present in the sample and at 1200 ºC, it will give total carbon content of the sample.

III. RESULTS AND DISCUSSION

The average emission of organic carbon aerosols from both diesel and petrol vehicles were maximum in the lowest particle size i.e. nucleation mode. Both diesel and petrol exhaust showed tri-modal distribution in different particle sizes. In both diesel and petrol, organic carbon was less in moisture free environment (with denuder) in the accumulation mode.

The total carbon aerosols from both diesel and petrol vehicles were maximum in the lowest range or nucleation mode. The moisture free condition i.e. with denuder condition showed less emission of total carbon than with the denuder.

3.1 Mass size distribution of OC aerosols from diesel vehicles

The distribution of mass concentration with particle size (aerodynamic diameter) of the aerosols from exhaust of diesel vehicles is shown in Fig.3. The average total mass concentrations of organic carbon in all the size fractions were found to be 68.32 mg/m^3 without denuder and 81.99 mg/m^3 with denuder. A multi modal mass size distribution was observed in which a maximum mass concentration was seen in <1 μm in particle size in both with and without denuder cases. The mass percentage of organic carbon particles was 56% in without denuder case and 78% in with denuder case.

The mass percentage of organic carbon aerosols having particle size <11.2μm (respirable size) [11] of the total organic carbon aerosols was found to be 77% in without denuder and 74% in with denuder case, which specifies that major part of organic carbon mass emitted from the diesel vehicles is capable of getting into respiratory track. The mass percentage of fine particles (<2.23μm aerodynamic diameter) [11], which are capable of deep pulmonary infiltration and alveolar deposition, was found to be 46% and 56% in without and with denuder cases respectively. The contribution of ultrafine particles (aerodynamic diameter < 0.1 μm) to the total organic carbon mass emitted as exhaust was around 30% in without denuder and 28% in with denuder case.

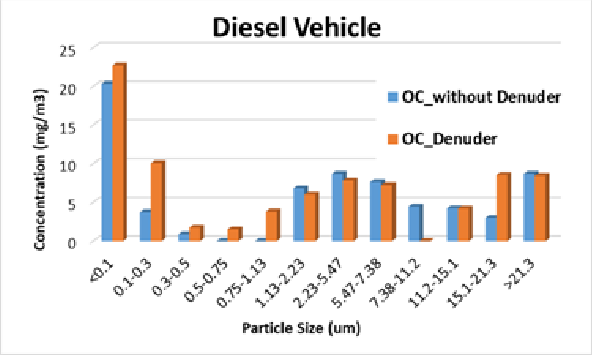

Figure 3. Mass size distribution of OC aerosol from diesel vehicles

3.2 **Mass size distribution of OC aerosol from exhaust of petrol vehicles**

It is well understood from the literatures that aerosols from vehicular exhaust have a tri-modal mass size distribution. The fine mode is about 0.1 μm (also referred to as submicron mode, ultrafine mode, vaporization mode, condensation mode, etc.) while the coarse mode is often larger than 1 μm (also referred to as super micron mode, coarse mode, residual mode, etc.). The mass size distribution of OC aerosol generated from exhaust of petrol vehicle in present study is shown in Fig 4. The distribution pattern was found multimodal and maximum concentration was at size <1 μm. A third mode was found in coarser size range i.e. 11.2 to 15.1 μm. The mass percentage of organic carbon particles was 68% in without denuder case and 73% in with denuder case.

The average total mass concentration of the organic carbon aerosols at the sampling point of setup was observed 105.42 mg/m3 in without denuder (with moisture) case and 100.53mg/m^3 in with denuder case. The mass percentage of particle having aerodynamic diameter <11.2μm to the total organic carbon aerosols was 74% and 81% in without denuder and with denuder cases respectively, which indicates that a major part of OC mass emitted from the exhaust is going to respiratory track. The mass percentage of fine particle to the total particle mass was found 53% and 60% in with moisture and without moisture case respectively. The contribution of ultrafine particle i.e. particle having aerodynamic diameter < 0.1 μm to the total mass emitted was found to be 19% with moisture and 25% in without moisture.

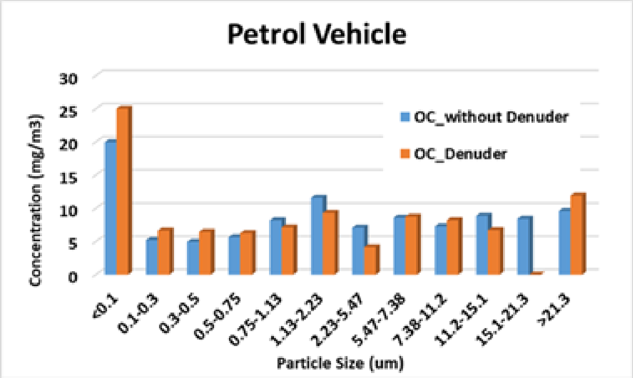

Figure 4. Mass size distribution of OC aerosol from petrol vehicles

3.3 Mass size distribution of total carbon aerosol from exhaust of diesel vehicles

The average total mass concentration for TC aerosols from exhaust of diesel vehicles was observed to be 121.83 mg/m^3 in without denuder (with moisture) case and 105.34mg/m^3 in with denuder (without moisture). The mass size distribution of carbon aerosol generated from exhaust is represented in Fig.5. Maximum mass concentration was found in size

<0.1μm which contributed to 24% of total mass emitted in all size ranges. This indicates that mass of TC is mostly concentrated in fine particulate size range. The mass percentage of particles having aerodynamic diameter < 11.2μm to the total mass was found to be 79%, which shows that a major part of TC emitted from exhaust can reach to the respiratory tract. The mass percentage of particles having < 2.23μm aerodynamic diameter to the total carbon mass was found 53%. The contribution of particle having aerodynamic diameter < 0.1 μm to the total mass emitted as exhaust was found 24%. Mass concentration of TC in with denuder condition was found 79%, 61%, 23% in < 11.2μm, < 2.23μm and <0.1 μm sizes respectively.

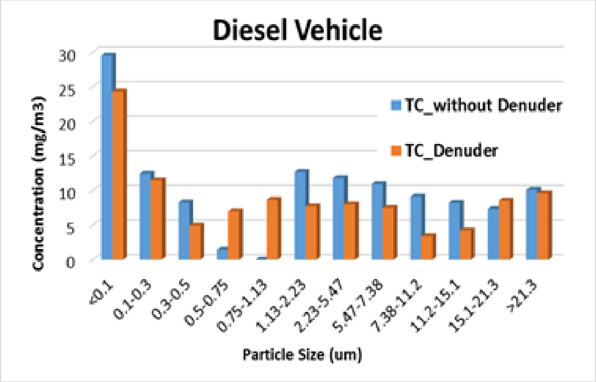

Figure 5. Mass size distribution of TC aerosol from diesel vehicles

3.4 Mass size distribution of total carbon aerosol from exhaust of petrol vehicles

Petrol vehicles are mostly preferred as personal vehicles than diesel vehicles by the people. Total mass concentration emitted from exhaust of petrol vehicles was found to be 156.19mg/m^3 at the sampling point of setup. The mass size distribution of total carbon aerosols is represented in Fig.6. The mass percentage of particles having aerodynamic diameter < 11.2μm (respirable size) to the total mass was found 79%. The mass percentage of particles having < 2.23μm aerodynamic diameter to the total particle mass was calculated as 56%. The contribution of particles having aerodynamic diameter < 0.1 μm to the total carbon mass emitted as exhaust was found 21%. Mass concentration of total carbon in the with denuder condition was found 78%, 57%, 19% in < 11.2μm, < 2.23μm and <0.1 μm sizes respectively.

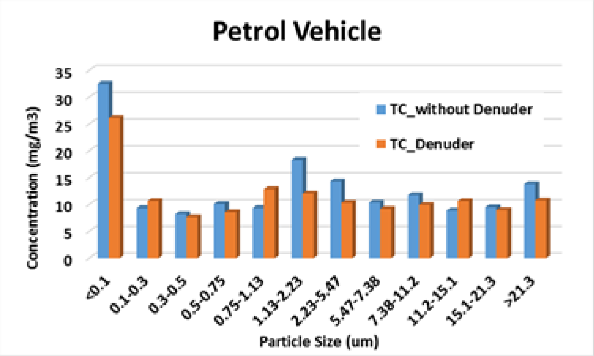

Figure 6. Mass size distribution of TC aerosol from petrol vehicles

IV. CONCLUSION

Results show that in majority of size ranges, the carbon emissions from both Petrol and diesel vehicles were reduced when the moisture from the exhaust was trapped. The reason may be that some carbonaceous aerosols were dissolved in moisture and were removed along with it. It has been also noted that other than nucleation mode most carbonaceous aerosols are accumulated in the size range 1.13-5.47 μm in the accumulation mode. In nucleation mode petrol vehicle is having less mass concentration than diesel vehicles, while in accumulation mode petrol vehicle is having more mass concentration than in diesel vehicles and in coarse mode mass concentration in both diesel and petrol vehicles was found to be almost same. However, the differences are not always statistically significant owing to the large variation in emissions from different vehicles powered by the same type of fuel.

V. REFERENCES

[1]. M. C. Lim and G. Ayoko. 2006. Atmospheric Environment, 40(17), 3111-3122.

[2]. L. M. Hildemann and G. R. Markowski. 1991. Environmental Science & Technology, 25(4), 744-759.

[3]. Z. D. Ristovski and L. Morawska et al. 1998. Environmental Science & Technology, 32(24), 3845-3852.

[4]. M. J. Kleeman and J. J. Schauer et al. 2000. Environmental science & technology, 34(7), 1132-1142.

[5]. A. Seaton and D. Godden et al. 1995. The lancet, 345(8943), 176-178.

[6]. S. Vedal. (1997). Journal of the Air & Waste Management Association, 47(5), 551-581.

[7]. C. Pope and S. Ziebland et al. 2000. BMJ: British Medical Journal, 320(7227), 114.

[8]. J. Ferin and G. Oberdorster et al. 1992. American Journal of Respiratory Cell and Molecular Biology, 6 (5), 535-542.

[9]. K. Donaldson and X. Y. Li et al. 1998. Journal of Aerosol Science, 29(5-6), 553-560.

[10]. F. Raes and R. Van Dingenen et al. 2000. Atmospheric environment, 34(25), 4215-4240.

[11]. M. Tiwari and S. K. Sahu et al. 2013. Microchemical Journal, 106, 79-86.

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Biodiversity of Foraminifera Occurring at Alibag and Nearby Coastal Area

Advait C. Ghatpande[1], A. S. Pansare[2]
[1]Department of Zoology, Janata Shikshan Mandals College, Alibag, Raigad, Maharashtra, India
[2] Department of Botany, Dr. S.D.D. Arts College & Commerce & Science College, Wada, Wada, Palghar. Maharashtra, India

ABSTRACT

The foraminifera are hole bearers. They are single celled protists with shells. Their many forms are aquatic, primarily marine. They belong to class of amoeboid protists. About 275,000 species are recognized, both living and fossil. They are usually less than 1mm in size, but some are much larger. The largest species may reach up to 20cm. The biodiversity, coloration index and microscopic observational studies on foraminifera gives information regarding biostratigraphy, ocean acidification patterns etc. of the respective coastal region. The foraminifera can also act as pollution indicator. In the present study various sand samples from different coast near alibag area were studied for biodiversity and coloration index analysis. Alibag coastal area shows remarkable diversity of foraminifera including different species like Bathysiphon, Elphidium, Textularia, Saccorhiza, Saccamina, Spiroloculina etc. The coloration index and visual analysis test indicate that most varieties of foraminifera shows average age of 10 years giving light on the sand life pattern of Alibag coastal region.

Keywords: Foraminifera, Alibag, Biodiversity.

I. INTRODUCTION

The foraminifera are hole bearers single celled protists with shells having many aquatic, primarily marine forms. Their shells are called as "test", because in some forms, the protoplasm covers the exterior of the shell. The foraminiferan shells are mainly made up of Calcium Carbonate. Some shells are made up of organic compounds, sand grains and other particles. [1] They belong to phylum or class of amoeboid protists. About 275,000 species are recognized, both living and fossil. They are usually less than 1mm in size, but some are much larger. The largest species reaching up to 20cm. [2]

The foraminifera have typically been included in the phylum Protozoa or Protista but Some taxonomists wrongly classify them in other groups. Foraminifera are closely related to the Cercozoa and Radiolaria, both of which also include amoeboids with complex shells. These three groups make up the Rhizaria. However, the exact relationships of the forms to the other groups and to one another are still not entirely clear. [3]

The foraminiferal colouration index (FCT) is a tool for assessing the thermally induced colour change of organic matter in these buried organisms. This empirical method is based on finding colour variation in the fossil by visual observation and comparison with available standard chart. [4] Present article reports the pilot research work indicating commonly occuring varieties of foraminifera in and around Alibag and their tentative colouration index values.

II. METHODS AND MATERIAL

15 Sand samples from 07 different beaches of Alibag were collected by random sampling method. Collected samples brought to the laboratory where they were studied by making sand smear on clean glass slide with glycerin. Smears were studied using simple light microscope. Visual analysis, general identification and comparative coloration index studies were done using standard available resources. [5]

III. RESULTS AND DISCUSSION

The sand smear study of different samples showed certain common type of foraminifera which were recorded as commonly occuring foraminifera at alibag beaches. [Table 1]

Table 1. Commonly occuring foraminifera in alibag region.

Alibag Beach	Revas Beach	Nagaon Beach	Akshi Beach	Kihim Beach	Versoli Beach	Revdanda Beach
Bathysiphon	Elphidium	Bathysiphon	Bathysiphon	Bathysiphon	Textularia	Cyclamina
Cyclamina	Saccamina	Saccamina	Textularia	Elphidium	Elphidium	Saccamina
Textularia	Bathisiphon	Textularia	Saccorhiza	Saccorhiza	Saccorhiza	Textularia
Elphidium	Textularia	Cyclamina	Elphidium	Cyclamina	Bathysiphon	Bathysiphon

For colouration index study, 'FCI of McNeil et al (1996) relative to standard colors of Munsell soil colour chart' is used as refernce chart and anaysis were performed which revealed that the average indicated age of most of the samples is 10 years and more. This information suggests relatively young sand life patterns at Alibag coast.

IV. CONCLUSION

The Alibag costal sand life pattern is of young type and average biodiversity of foraminifera is common at nearby places. As this was the pilot study report, a more detail study of foraminiferan diversity and abundance is required using more sophisticated tools and techniques.

V. REFERENCES

[1]. Giere, Olav (2009). Meiobenthology: the microscopic motile fauna of aquatic sediments (2nd ed.). Berlin: Springer. ISBN 978-3540686576.

[2]. Ald, S.M. et al. (2007) Diversity, Nomenclature, and Taxonomy of Protists, Syst. Biol. 56(4), 684–689, DOI: 10.1080/10635150701494127.

[3]. Cavalier-Smith, T (2003). "Protist phylogeny and the high-level classification of Protozoa". European Journal of Protistology. 34 (4): 338–348. doi:10.1078/0932-4739-00002

[4]. McNeil, D.H., 1997, Diagenetic regimes and the foraminiferal record in the Beaufort-Mackenzie Basin and adjacent cratonic areas. Annales Societatis Geologorum Poloniae (1997), v. 67, p. 274-286.

[5]. Website-www.foraminifera.eu, species identification guide.

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Genetic Diversity and Collection of Bamboo: an Approach for The Ex-Situ Conservation in A Narrow Geographical Range of Central Forest Nursery Wadali, Amravati.

Ashiq Hussain Khanday[1], Prashant Ashokrao Gawande[1*],Avinash Narayan Darsimbe[1],Sayed Salim Ahemad[2]

[1]Molecular Biology Laboratoy, Department of Botany, Sant Gadge Baba Amravati University, Amravati, Maharashtra, India

[2]Central Forest Nursery, Wadali, Amravati, Department of Forest, Government of Maharashtra, India

ABSTRACT

India is home to a colossal band of bamboos resources. Bamboo is an important genetic resource provide lively hood for millions of people around globe. Due to increasing populations pressure, industrial demand, indiscriminate cutting resulted in the overexploitation, burning cultivation which is common practice in North East States of India has been resulted in the genetic erosion of several bamboo species. This has driven the attention of various organizations for this ecological, economic and social resource. An amalgamated approach to collect characterize and conserve bamboo has been put forward in Central Forest Nursery Wadali Amravati. This collective approach has bought together a number of bamboo species from different area of country. Fifty two species representing thirteen genus are present in the forest nursery. A master characterization manual has been prepared according which all the species have been fully characterized. These species presents a variation among the bamboo at species as well as at generic level. This germplasm may act as a soul resource for further development, research and sustainable management of bamboo resource in this particular area.

Keywords: Germplasm, Bamboo, Conservation

I. INTRODUCTION

India is home to 145 species representing 23 genera of bamboos (INBAR, 2005), which covers about 17 % of total forest (Lobovikov, 2007). North-Eastern states and Western Ghats contributes more than 66% of total bamboos resources available in India (Sarmah et al., 2000; Rai and Chauhan, 1998; Sharma and Richa, 2002). An estimated annual bamboo demand in india is 5 million tones during the recent past (Das et al. 2005). Maharashtra is one of the least bamboo diverse states in india. Three major bamboos species found in state are viz Bambusa bambos, Dendrocalamus strictus, Pseudoxytenanthera species and estimated area under bamboo occupation would be 0.85 million hactiors (Tewari, 1992).

As commonly found in moister habitats in old-growth forests bamboos are intrinsically vulnerable to deforestation. Restricted potential range is shown by various Asian bamboo species, probably due to poor dispersal mechanisms as well as low seed setting rate and segregation of populations in dissected, terrain, mountainous. This insinuates that many uncultivated forest bamboos may be predominantly susceptible to loss of habitat, and erosion of their genetic diversity and may become threatened (Bystriakova et al. 2003). Being a versatile and renewable resource bamboo has been overexploited to such an extent that concern is being expressed over the erosion of this gene pool (Renuka, 1996). Apart from mundane flowering, overexploitation influences regeneration of bamboo in their wildness and tender shoots some edibale are consumed over a prolonged time is a probable reason for decrease in population of germplasm (Hore, 1998).

Absence of quality planting material and continued supply of bamboo to paper and pulp industry has significantly affected the lively hood of the humans. Such continued extraction could also be limit the natural regeneration potential, perhaps threatening their survival, therefore, conservation of this valuable gene pool is of prime importance. Preservation of bamboo germplasm has become necessary not only for conservation and collection but also for the classification and characterization because of prevailing worldwide overexploitation and genetic erosion of this gene pool (Bahadur 1979). Germplasm characterization is an important link between the utilization and conservation. Study of the local distribution and investigation of bamboo resource is important to maintain the germplasm for the conservation of biodiversity (Goyal et al., 2012), which is recorded to be limited till date. Therefore, conservation is important for the valuable utilization within the country as well as for exports to south Asian countries to earn the foreign exchange.

II. METHODS OF COLLECTION

Reproductive propagation in bamboo is not usual because of monocrpic nature and long term flowering in bamboo. Flowering is a peculiar feature of bamboos which is a cyclic phenomenon and the cycle varies between 3-120 years which depends on the species (Janzen, D.H., 1976; Tewari, 1992). Owing to such a reason bamboo propagation depends on vegetative plant body. Each species was collected from a particular region with the help of an expert having sufficient knowledge about that specimen. Either rhizome or Culm cuttings with node were collected and brought successfully to Central Forest Nursery, Wadali, Amravati. All this is done at a specific time during the months of March to May which is the best period for taking cuttings. Culm segments were cut with a sharp knife or saw keeping 5–10 cm on either side of the node. The cuttings were transported to the propagation bed as early as possible. Depending up on the length of the internodes the segment can be 1–2 or 3 noded. If the cuttings were two or more noded, approximately 2 cm long and 1 cm wide opening was made in the centre of the internode. A particular concentration of hormones was given before the plantation. Usually Gibberlic acid with a concentration of 200 ppm was used. Regular maintenance, multiplication was carried out following the yearly plan guide. The identification has been done by using various authentic resources such as official material housed in the nursery and various other books and literature available on different related websites and by the help of different experts.

III. RESULT AND DISCUSSION

Conservation of bamboos in India is practiced like other higher plants both in-situ and ex-situ by traditional methods with the aim to harness the potential of bamboo crops in country. The ex-situ conservation of bamboo species is an ideal example. Under such a kind of ex-situ conservative program a significant number of bamboo species representing various genus of bamboos have been conserved and diversified. A total number of thirteen genus including: Bambusa, Dendrocalamus, Dinochloa, Gigantochloa, Guadua, Melocanna, Ochlandra, Oxytenanthera, Pseudsas, Pseudoxytenanthera, Phyllostachys, Schizostachyum and Thyrsostachys have been collected from different parts of country. These genus include different species such as Bambusa with sixteen species genus Bambusa include the highest number of species whish are Bambusa affinis Munor, Bambusa assamica Barooah & Borthakur, Bambusa balcooa Roxb, Bambusa bambos (L.) Voss, Bambusa bambos (L.) Voss, Bambusa cacharensis R. B. Majumdar, Bambusa jaintiana R.B.Majumdar, Bambusa burmanica Gamble, Bambusa longispiculata Gamble, Bambusa multiplex (Lour.) Raeusch. ex Schult., Bambusa multiplex f. alphonsekarrii (Mitford ex Satow) Nakai, Bambusa nutans Wall. ex Munro, Bambusa nana Roxb., Bambusa oliveriana Gamble, Bambusa pallida Munro, Bambusa teres Munro, Bambusa tulda Roxb., Bambusa polymorpha Munro, Bambusa vulgaris Schrad., Bambusa ventricosa and Bambusa vulgaris var. striata (Lodd. ex Lindl.) Gamble . Genus Dendrocalamus includes ten species is the second largest genus. Species described and conserved under this genus are :, Dendrocalamus brandisii (Munro) Kurz, Dendrocalamus giganteus Munro, Dendrocalamus somdevae H. B. Naithani, Dendrocalamus calostachyus (kurz) kurz, Dendrocalamus longispathus (Kurz) Kurz, Dendrocalamus asper (Schult.)Backer, Dendrocalamus membranaceus Munro, , Dendrocalamus hamiltonii Nees & Arn. ex Munro, Dendrocalamus sikkimensis Gamble ex Oliv. and Dendrocalamus strictus (Roxb.) Nees. Genus Gigantochloa includes five species such as Gigantochloa atter (Hassk.) Kurz., Gigantichola albociliata (Munro) Kurz. Gigantochloa atroviolacea Widjaja, Gigantochloa macrostachya Kurz and Gigantochloa rostrata K.M.Wong. Genus Phyllostachys having four species which includes Phyllostachys assamica Gamble, Phyllostachys aurea Rivière & C.Rivière, Phyllostachys edulis (Carrière) J.Houz., Phyllostachys mannii Gamble and Phyllostachys nigra (Lodd. ex Lindl.) Munro. Genus Schizostachyum having four species are Schizostachyum brachycladum (Kurz) Kurz, Schizostachyum dullooa (Gamble) R.B.Majumdar., Schizostachyum pergracile (Munro) R.B.Majumdar and Schizostachyum polymorphum (Munro) R.B.Majumdar. Genus Ochlandra having three species which are as Ochlandra ebracteata Raizada & Chatterji, Ochlandra scriptoria (Dennst.) C.E.C.Fisch., Ochlandra travancorica (Bedd.) Gamble, Genus Dinochloa including two species which are Dinochloa macclellandii (Munro) Kurz., and Dinochloa andamanica Kurz. Genus Oxytenanthera having two species which are Oxytenanthera abyssinica (A.Rich.) Munro and Oxytenanthera parvifolia Brandis ex Gamble. Genus Pseudoxytenanthera having two species which are Pseudoxytenanthera ritcheyi (Munro) H.B Naithani and Pseudoxytenanthera stocksii (Munro) T.Q.Nguyen. Genus Thyrsostachys include two species which are Thyrsostachys oliveri Gamble and Thyrsostachys regia (Munro) Bennet. All other three genus having only a single species. Guadua angustifolia Kunth., Pseudosasa japonica (Steud.) Makino and Melocanna baccifera (Roxb.) Kurz.

The primary vital step in conserving and organizing threatened species is exact identification and delimitation of the particular species (Amaral, W., 2004). This germplasm constitutes one of the 12 rear and endangered bamboo species of India. Different training programs are also been conducted in concern with the conservation and diversification of bamboos in the vidharba region. Multiplication and diversification of bamboos are being conducted under a well planed annual program. Every year new species are being added to the germplasm.

Sharma, M.L. and Nirmala, C., 2015, placed Maharashtra state at 19th position in bamboo diversity with number of species 7 + 1 Var. An effort has made to gather the valuable germplasm of bamboo focused on the conservative and commercial values. Bamboo being one of the fastest growing grass and can proved to be an alternative crop for the barren areas. Identification on basis of morphological character in case of bamboo is so random and isn't considered as compatible one. Vegetative character based genetic relatedness and phylogenetic relationship of eighteen bamboo species from central forest nursey wadali Amravati has reported (Khanday, AH., 2015). This huge germplasm also plays a key role in comparative identification of some particular species. Furthermore the work on molecular phylogenetic aspects of bamboos from this particular area has already been carried on, so this may be helpful to correlate the bamboo relation with other species and with the possible near vegetation. Molecular marker based assessment may help in identification of species so that to remove the ambiguities of identification. DNA barcoding is a potential technique to overcome these identification challenges (Hebert, P.D., 2003).

IV. CONCLUSION

This conservation program works as a stepping stone, an approach for the conservation and identification of flora particularly bamboos. It was a projected view to multiply and to produce the potentially fastest growing bamboos for commercial purpose. This is also being used as a destination to attract the attention of people. The main focus of present the work was to let the people know about this huge collection and conservation approach. This will not only assure the availability of this important natural resource in near future but also will help in understanding the ecology and improving for higher productivity.

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VI. REFERENCES

[1]. Amaral W, Kjaer ED, Yanchuk A, Graudal L., ; 2004. Research needs. In: FAO , FLD , IPGRI , editors. Forest Genetic Resources: Conservation and management. 1. Rome, Italy: International Plant Genetic Resources Institute, p. 37-48.

[2]. Bahadur, K.N., 1979. Taxonomy of bamboos. Indian J. For, 2: 222-224.

[3]. Bystriakova, N., Kapos, V., Lysenko, I. and Stapleton, C.M.A., 2003. Distribution and conservation status of forest bamboo biodiversity in the Asia-Pacific Region. Biodiversity & Conservation, 12(9), pp.1833-1841.

[4]. Das, M., Bhattacharya, S. and Pal, A., 2005. Generation and characterization of SCARs by cloning and sequencing of RAPD products: a strategy for species-specific marker development in bamboo. Annals of Botany, 95(5), pp.835-841.

[5]. Goyal, A.K., Ghosh, P.K., Dubey, A.K. and Sen, A., 2012. Inventorying bamboo biodiversity of North Bengal: a case study. Int J Fund Appl Sci, 1(1), pp.5-8.

[6]. Hebert, P.D., Cywinska, A. and Ball, S.L., 2003. Biological identifications through DNA barcodes. Proceedings of the Royal Society of London B: Biological Sciences, 270(1512), pp.313-321.

[7]. Hore, D.K., 1998. Genetic resources among bamboos of Northeastern India. Journal of Economic and Taxonomic Botany, 22, pp.173-181.

[8]. INBAR. 2005. International Network for Bamboo and Rattan (available at www.inbar.int.).

[9]. Janzen, D.H., 1976. Why bamboos wait so long to flower. Annual Review of Ecology and systematics, 7(1), pp.347-391.

[10]. Khanday, A.H., Sayed, S.A., Gawande, P.A., 2015. Assessment of taxonomic affinity through character based cluster analysis: a novel approach towards taxonomic discrimination of some genera under bambusoideae complex. World journal of pharmaceuticals and life sciences, 2, p170-183.

[11]. Lobovikov, M., Ball, L., Guardia, M. and Russo, L., 2007. World bamboo resources: a thematic study prepared in the framework of the global forest resources assessment 2005(No. 18). Food & Agriculture Org..

[12]. Rai, S.N. and Chauhan, K.V.S., 1998. Distribution and growing stock of bamboos in India. Indian Forester, 124(2), pp.89-98.

[13]. Renuka, C., 1996. Rattan of Northeastern India-A cause for great concern. Arunachal Forest News, 14(2), pp.8-11.

[14]. Sarmah, A., Thomas, S., Goswami, M., Haridashan, K. and Borthakur, S.K., 2000. Rattan and bamboo flora of North-East India in a conservation perspective. Sustainable Management of Forests, pp.37-45.

[15]. Sharma, M.L. and Nirmala, C., 2015. Bamboo diversity of India: An update. In 10th World Bamboo Congress Korea (p. 12).

[16]. Sharma, M.L. and Richa 2002. Foreign elements in bamboo diversity of North-East India. In: Plant Genetic Diversity: Exploration, Evaluation, Conservation (eds., Vij, S.P., Kondo, K., Sharma, M.L. and Gupta, A.), pp. 91-95. Affiliated East- West Press, New Delhi, India.

[17]. Tewari, D.N., 1992. A monograph on teak (Tectona grandis Linn. f.). International book distributors.

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Synthesis of Ag-ZnO by Seed Mediated Hydrothermal Method and its Characterization.

S. S. Malvankar [1], A. T. Shende[2]

[1]Department of Physics, G.B. Tatha Tatyasaheb Khare Commerce& Parvatibai Gurupad Dhere Arts & Shri Mahesh Janardan Bhosale Science College, Guhagar, Ratnagiri, Maharashtra, India

[2]Department of Physics, Dr. S.D. Devsey Arts College and Commerce and Science College, Wada, Palghar, Maharashtra, India

ABSTRACT

Metal nano composite finds key position in many bioengineering and biomedical field. Metal nano composite also shows good catalytic efficiency, optical, thermal and electrical properties than pure nano crystal. In this regard the current paper deals with controlled synthesis and characterization of Ag-ZnO. The synthesis of Metal nano composite Ag-ZnO based on Wet Chemical Method (seed-mediated hydrothermal method) and size was found to be 14 nm and characterization were carried by XRD, TEM, PLE, absorption spectra by using UV-Vis spectrophotometer. The catalytic activity of metal nano composite have discussed as supporting explanation.

Keywords: Ag-ZnO, Catalytic activity, Seed-mediated hydrothermal method, Metal nano composite, nano crystal, Wet Chemical Method

I. INTRODUCTION

Metal nano composites gain much interest in today scientific, research and industrial era. Nano compositeis a combination or matrix, in which different materials combine to develop new properties of the materials ensuring that one of the materials have size in range of 1-100nm[1-2]. Nano composite can be prepared from any combination of materials that can be categorized into three basic building blocks i.e. metals, ceramics and polymers)[1, 3]. The nano composite hence can have a combination or have markedly different mechanical, electrochemical, electrical, catalytic, thermal and optical properties from the component materials [1, 4-7]. These NC have gained the attention of scientists, researchers and engineers, which had led to the sudden raise in number of publications related to these materials. Further, these NC have number of technological and business breakthroughs in all the sectors of life. This paper regarding synthesis of Metal nano composite namely Ag-ZnO using Wet Chemical Method basically Seed-mediated hydrothermal method and study of its structure using XRD ,TEM ,PLE and characteristic optical absorption using UV-Vis spectrometer.

II. MATERIALS AND METHODS

The synthetic methods are frequently classified in to three classes i.e. solution based synthesis, vapor phase synthesis and gas phase synthesis [8]. wet chemical methods give uniformity in size of nano composites as controlled particle size can be achieved easily. There are different wet methods for synthesis of metal nano particles and nano composites but co-precipitation, sol gel and hydrothermal methods are cost effective as compared to other methods. We use hydrothermal method for preparation of Ag-ZnO

2.1 Seed-mediated hydrothermal Method

The Seed-mediated hydrothermal method involves the heterogeneous chemical reaction in a solvent (aqueous or non-aqueous) occurring above room temperature and at pressure more than 1atm in a closed system [9]. To modify the size and properties the use of surfactants, capping agents, mineralizer is a common practice [10-13] The new trend is to use this technique in combination with microwave [14], sol-gel [15] that can not only vary the physiochemical and structural properties of the materials but in addition to that can result in formation of single phased materials with enhanced stability [15]. Further just by altering the temperature, time and pressure of the reaction particle size, phase changes morphology and properties as presented in Figure 12.4 [13, 16].

2.2 Characterization of Metal Nano composites

The Metal nano composites are characterized using different techniques to get insight into the morphology, particle size, phase, and composition, optical, magnetic, electrical and thermal properties.

2.2 (a) X-ray Diffraction (XRD)

X-ray diffraction, used to study the structure, composition, and physical properties of materials. Powder X-ray Diffraction (XRD) is used for phase determination and unit cell information of the nanocomposites under investigation [17].

2.2(b) Microscopic techniques – TEM

TEM technique has gained much attention as compared to SEM because of its better resolution i.e. 0.1-0.2nm and wealth of information that can be extracted from it and especially from high resolution TEM (HRTEM) [18, 19] The core-shell structure of the nano composites [20] doping effects on morphology [21], layering in structure [22], particle size [23] gelling agents impact [24], surface roughness [25], nano particle dispersion [26] etc. can be determined. In this regard use of dark field and bright field images can help in getting more information about the structural changes. The main limitation of the technique is in sample preparation which requires low film thickness.

2.2 (c) Absorption techniques (UV-Vis Spectrophotometer)

Absorption spectroscopy refers to spectroscopic techniques that measure the absorption of radiation, as a function of frequency or wavelength, due to its interaction with a sample. The sample absorbs energy, i.e., photons, from the radiating field. The intensity of the absorption varies as a function of frequency, and this variation is the absorption spectrum. Absorption spectroscopy is performed across the electromagnetic spectrum.

Absorption spectroscopy is employed as an analytical chemistry tool to determine the presence of a particular substance in a sample and, in many cases, to quantify the amount of the substance present. Infrared and ultraviolet-visible spectroscopy are particularly common in analytical applications. Absorption spectroscopy is also employed in studies of molecular and atomic physics, astronomical spectroscopy and remote sensing.

There are a wide range of experimental approaches for measuring absorption spectra. The most common arrangement is to direct a generated beam of radiation at a sample and detect the intensity of the radiation that passes through it. The transmitted energy can be used to calculate the absorption. The source, sample arrangement and detection technique vary significantly depending on the frequency range and the purpose of the experiment.

2.2 (d) Photoluminescence excitation (abbreviated PLE)

Photoluminescence excitation (abbreviated PLE) is a specific type of photoluminescence and concerns the interaction between electromagnetic radiation and matter. It is used in spectroscopic measurements where the frequency of the excitation light is varied, and the luminescence is monitored at the typical emission frequency of the material being studied. Peaks in the PLE spectra often represent absorption lines of the material. PLE spectroscopy is a useful method to investigate the electronic level structure of materials with low absorption due to the superior signal-to-noise ratio of the method compared to absorption measurements.

III. RESULTS

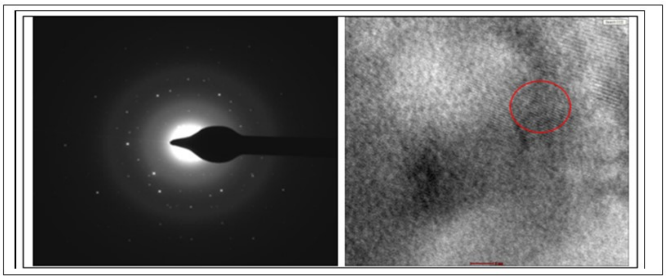

Figure 1. TEM images of ZnO The selected area diffraction (SAED) pattern shows diffraction rings with separate dots, which indicates good crystallinity and growth of ZnO nanoparticles

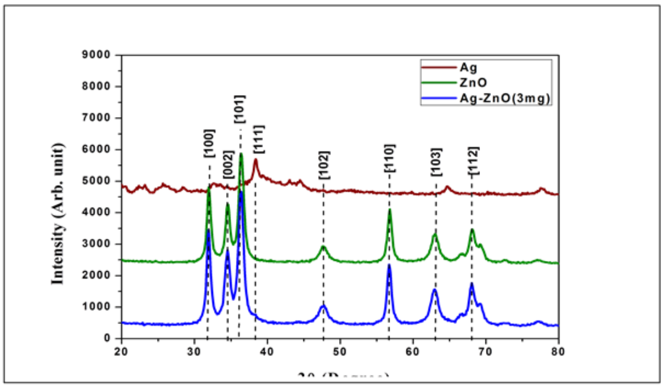

Figure 2. XRD Ag, ZnO &Ag-ZnO (3mg)

Figure 1. shows the TEM images of ZnO. The size of Ag-ZnO was found to be 14nm. Figure 2. shows the XRD of Ag, ZnO and Ag-ZnO at 3mg conc. Figure 3 and 4 shows absorption spectra of Ag at two different conc. 300μL and 400μL respectively. While figure 5 shows the absorption spectra of ZnO , Ag-ZnO at 2mg conc and at 3mg conc and figure 6 shows Photoluminescence excitation (PLE) of ZnO , Ag-ZnO at 2mg conc and at 3mg conc respectively..

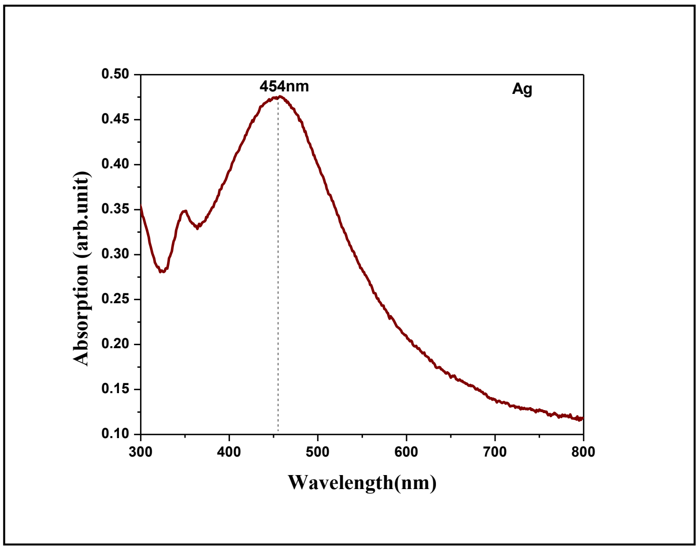

Figure 3. Absorption spectra of Ag (Conc. 300μl)

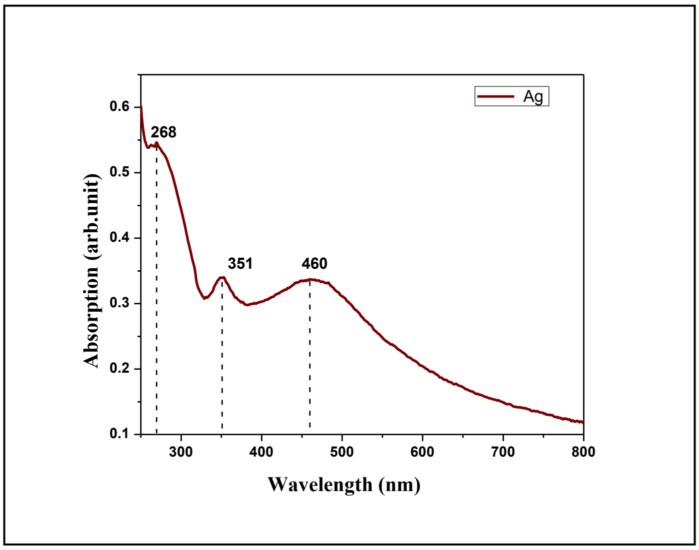

Figure 4. Absorption spectra of Ag (Conc. 400μl)

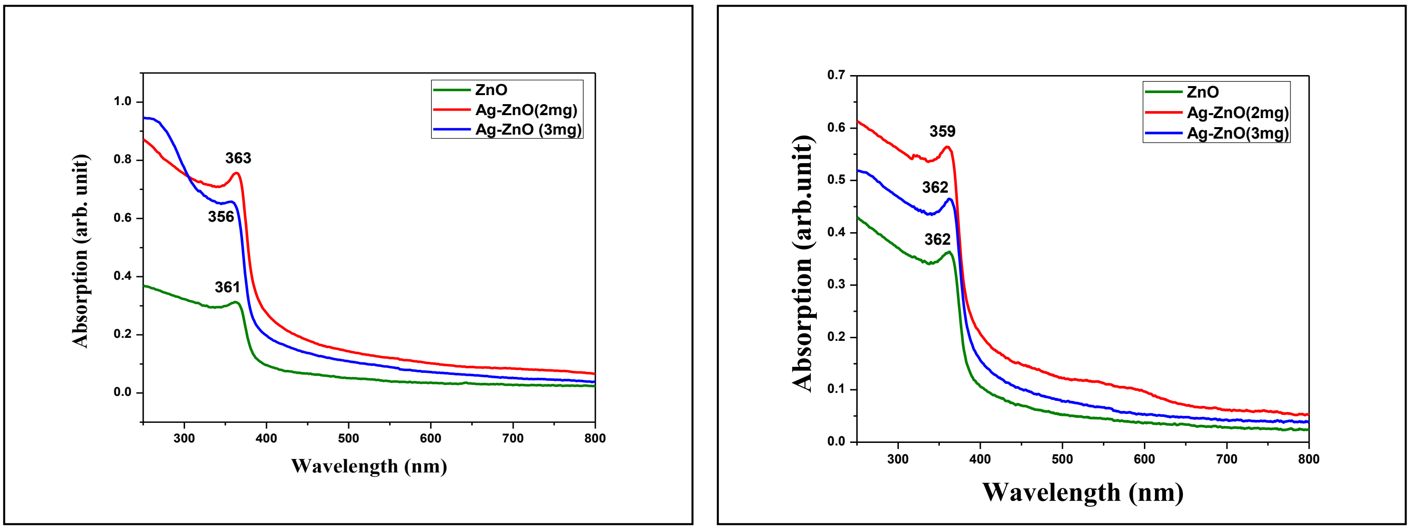

Figure 5. Absorption Spectra ZnO, Ag-ZnO (2mg) & Ag-ZnO (3mg)

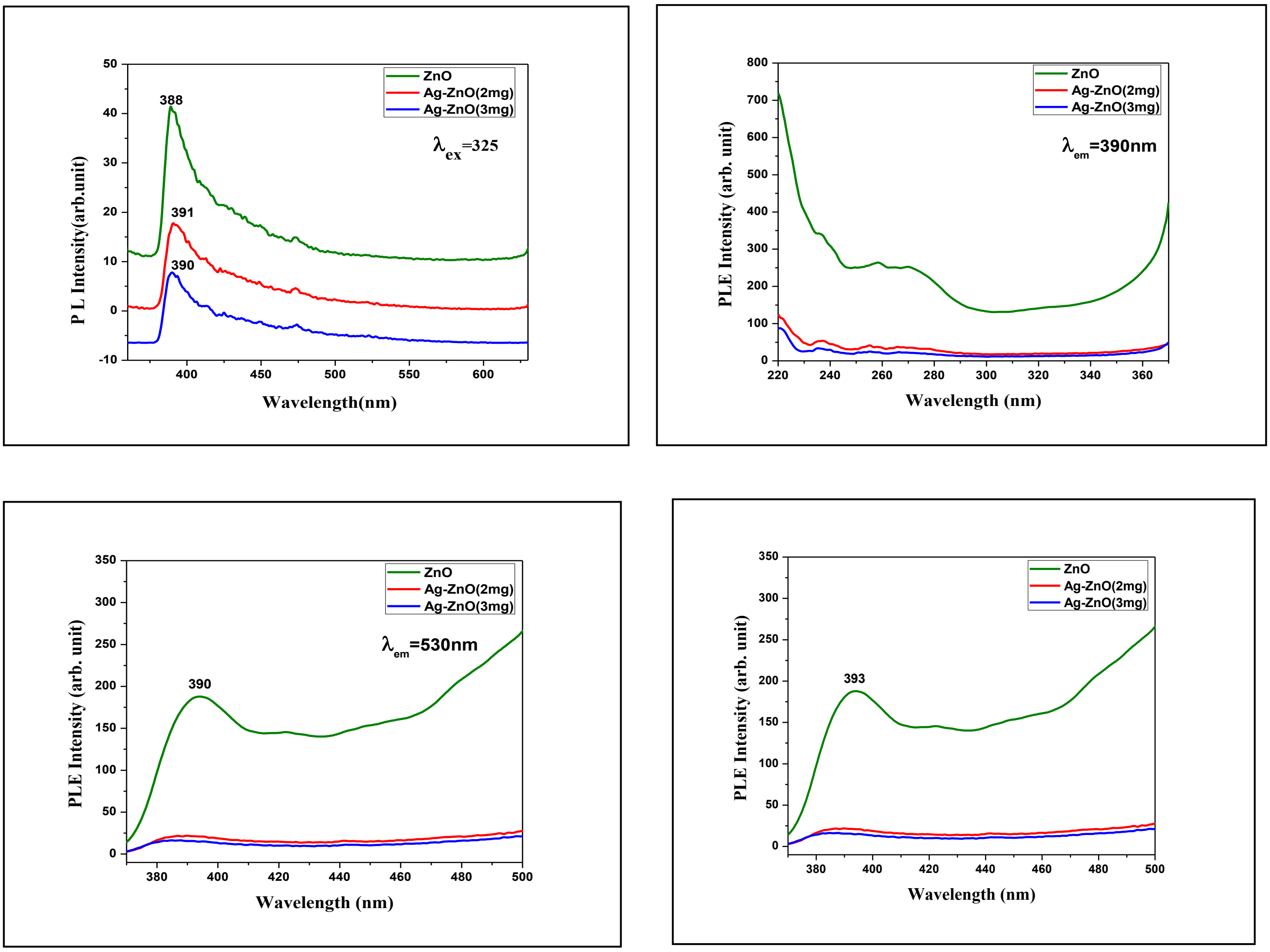

Figure 6. PLE spectra of ZnO, Ag–ZnO (2mg) & Ag-ZnO (3mg)

From the Figure 2 it shows that X ray diffraction pattern for Ag is different than that of ZnO and Ag-ZnO while the X-ray diffraction pattern for ZnO and Ag-ZnO is nearly same. This is because in principle A nano composite is a multiphase solid material, and hence the XRD pattern should show diffraction peaks assignable to (at least) two crystalline solids and A doped material should show only the diffraction peaks corresponding to the major component. Fig 2 also shows that doping of Ag with ZnO does not change the composition of ZnO hence this property of Ag can be used as a catalyst in many chemical reactions. Also observe that in case of nano particles the base of XRD peaks are broad owing to their small size because material is a solid solution, but the crystal lattice has a high concentration of defects. Then the effects of broadening can "mask" the peak's shift, so you won't be able to discern exactly whether you have pure compound or solid solution and material is a composite, but the particles of the second phase are either extremely small (for example, atomic clusters in mechanochemically synthesized pseudo-alloys) or are in a small number (less than 2-5%). XRD won't usually be able to detect such phases. Hence use TEM.

In case of doping the XRD pattern will shift for the host, (without any extra pattern from dopant material) but in case of composite or alloy you will get XRD pattern for all the material in that sample. Alloy or composite just mixture of materials, so you will see xrd pattern for all the materials.Doping is replacement of atoms in original matrix, so you will see alteration in XRD pattern of matrix material. There will be no doped material's pattern. A nanocomposite is a mixture of different material with different phases, and doping is also a mixture of differential material but single phase, hence the XRD pattern should show diffraction peaks related to all the phases for nano-composities but in case of doping peak shift is observed from the host material. Further, peak broadening for both the cases is mostly depends upon particle size (some other reason also possible).

Figure 3 and Figure 4 indicate that that absorption peak by pure Ag at particular wavelength changes with respect to concentration. We have seen from Fig 3 and Fig 4 that absorption peak shifted towards lower wavelength as the concentration increase. Similarly Figure 5 shows that absorption peak occur for nano composite (ZnO) and Metal nano composite (Ag-ZnO) at different wavelength. Figure 5 also shows that wavelength at which peak observed shifted to lower wavelength as the concentration of Ag-ZnO increases. This shifting with concentration can be used for calibration purpose in many chemical reactions. This variation in absorptions shows that formation of Metal nano composite (Ag-ZnO) by our methods hence give validation of hydrothermal method. Similarly the PLE graphs Figure 6 also show the formation of metal nano composite using hydrothermal method.

IV. CONCLUSION

With above all discussion we found that the using Wet Chemical Method i.e. Seed mediated hydrothermal method is one of good method for synthesis of Metal nano composite and all the methods use for characterization supports that by above method Metal nano composite have formed.

V. REFERENCES

[1]. Twardowski TE. Introduction to Nanocomposite Materials: Properties, Processing, Characterization: Destech Publications, Incorporated; 2007.

[2]. Di Ventra M, Evoy S, Heflin JR. Introduction to Nanoscale Science and Technology: Springer; 2004.

[3]. Camargo PHC, Satyanarayana KG, Wypych F. Nanocomposites: synthesis, structure, properties and new application opportunities. Materials Research. 2009;12(1):1-39

[4]. Pina S, Oliveira JM, Reis RL. Natural-Based Nanocomposites for Bone Tissue Engineering

and Regenerative Medicine:A Review. Advanced Materials.2015;27(7):1143-69.

[5]. Rafiee MA, Rafiee J, Wang Z, Song H, Yu Z-Z, Koratkar N. Enhanced mechanical properties of nanocomposites at low graphene content. ACS nano. 2009;3(12):3884-90.

[6]. Mariano M, El Kissi N, Dufresne A. Cellulose nanocrystals and related nanocomposites: review of some properties and challenges. Journal of Polymer Science Part B: Polymer Physics. 2014;52(12):791-806.

[7]. Hu H, Onyebueke L, Abatan A. Characterizing and modeling mechanical properties of nanocomposites-review and evaluation. Journal of minerals and materials characterization and engineering. 2010;9(04):275.

[8]. Stankic S, Suman S, Haque F, Vidic J. Pure and multi metal oxide nanoparticles: synthesis, antibacterial and cytotoxic properties. Journal of Nanobiotechnology. 2016;14(1):73.

[9]. Byrappa K, Yoshimura M. Handbook of Hydrothermal Technology: Elsevier Science; 2012

[10]. Akhtar MS, Khan MA, Jeon MS, Yang OB. Controlled synthesis of various ZnO nanostructured materials by capping agents-assisted hydrothermal method for dye-sensitized solar cells. Electrochimica Acta. 2008;53(27):7869-74.

[11]. Koseoğlu Y, Bay M, Tan M, Baykal A, Sozeri H, Topkaya R, et al. Magnetic and dielectric properties of Mn0. 2Ni0. 8Fe2O4 nanoparticles synthesized by PEG-assisted hydrothermal method. Journal of Nanoparticle Research. 2011;13(5):2235-44.

[12]. Wang Y, Xu G, Ren Z, Wei X, Weng W, Du P, et al. Mineralizer-Assisted Hydrothermal Synthesis and Characterization of BiFeO3 Nanoparticles. Journal of the American Ceramic Society. 2007;90(8):2615-7.

[13]. Wang WW, Zhu YJ, Yang LX. ZnO–SnO2 hollow spheres and hierarchical nanosheets: hydrothermal preparation, formation mechanism, and photocatalytic properties. Advanced Functional Materials. 2007;17(1):59-64.

[14]. Verma S, Joy P, Khollam Y, Potdar H, Deshpande S. Synthesis of nanosized MgFe2O4 powders by microwave hydrothermal method. Materials Letters. 2004;58(6):1092-5.

[15]. Li Z, Hou B, Xu Y, Wu D, Sun Y, Hu W, et al. Comparative study of sol–gel-hydrothermal and sol–gel synthesis of titania–silica composite nanoparticles. Journal of Solid State Chemistry. 2005;178(5):1395-405.

[16]. Wang H, Ma Y, Yi G, Chen D. Synthesis of Mn-doped Zn 2 SiO 4 rodlike nanoparticles through hydrothermal method. Materials chemistry and physics. 2003;82(2):414-8

[17]. Li B, Wang Y. Facile synthesis and photocatalytic activity of ZnO–CuO nanocomposite. Superlattices and Microstructures. 2010;47(5):615-23.

[18]. Guglielmi M, Kickelbick G, Martucci A. Sol-Gel Nanocomposites: Springer New York; 2014.

[19]. Mittal V. Polymer Nanotube Nanocomposites: Synthesis, Properties, and Applications: Wiley; 2010

[20]. Zhu C-L, Chou S-W, He S-F, Liao W-N, Chen C-C. Synthesis of core/shell metal oxide/polyaniline nanocomposites and hollow polyaniline capsules. Nanotechnology. 2007;18(27):275604.

[21]. Reddy ALM, Ramaprabhu S. Nanocrystalline metal oxides dispersed multiwalled carbon nanotubes as supercapacitor electrodes. The Journal of Physical Chemistry C. 2007;111(21):7727-34.

[22]. Wang D, Kou R, Choi D, Yang Z, Nie Z, Li J, et al. Ternary self-assembly of ordered metal oxide– graphene nanocomposites for electrochemical energy storage. ACS nano. 2010;4(3):1587-95.

[23]. Nazir R, Mazhar M, Akhtar MJ, Shah MR, Khan NA, Nadeem M, et al. Superparamagnetic bimetallic iron–palladium nanoalloy: synthesis and characterization. Nanotechnology. 2008;19(18):185608.

[24]. Clapsaddle BJ, Gash AE, Satcher JH, Simpson RL. Silicon oxide in an iron (III) oxide matrix: the sol–gel synthesis and characterization of Fe–Si mixed oxide nanocomposites that contain iron oxide as the major phase. Journal of non-crystalline solids. 2003;331(1):190-201.

[25]. Chronakis IS. Novel nanocomposites and nanoceramics based on polymer nanofibers using electrospinning process—a review. Journal of Materials Processing Technology. 2005;167(2):283-93.

[26]. Zhang J, Xiong Z, Zhao X. Graphene–metal–oxide composites for the degradation of dyes under visible light irradiation. Journal of Materials Chemistry. 2011;21(11):3634-40.

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Pesticide Content Investigations of Alphonso Mangos

Suhas G. Patil[1], Ravindra Y. Thakur[2],Umesh K. Samant[3]
[1]Department of Chemistry, S. R. M. Mahavidyalaya, Kudal, Sindhudurg, Maharashtra, India
[2]Department of Botany, S. R. M. Mahavidyalaya, Kudal, Sindhudurg, Maharashtra, India
[3]Finolex Academy of Management and Technology, Ratnagiri, Maharashtra, India

ABSTRACT

In the present investigation an attempt has been made to determine the pesticide residues in ripened Alphonso mango fruits samples from Devgad and Vengurle region of the Sindhudurg district, Maharashtra, India. The samples were tested for ninety-eight different pesticides from twenty four chemical groups such as Organochlorines, Organophosphorous, Synthetic Pyrethroids, Triazines, Pyrimidines, Triazoles, Imidazole, Oxazole, Pthalimide, Benzimidazole, Nicotinoids, Aliphatic nitrogen fungicides, Morpholine, Natural product derivatives, Substituted Thiourea, Benzoylphenyl Urea, Strobilurin, Phenyl Pyrazole, Pyrazole, Nitrophenyl Ether, Dithiocarbamates and others. The result shows that almost for all the pesticides, their residue level in the pulp of Alphonso mango is below limit of quantification except Carbendazim which is 0.13 mg/kg but still below MRL i.e. 0.5mg/kg. This shows that pesticides residues in ripened Alphonso mangos from Devgad and Vengurle region are in very traces and are below MRL, therefore the fruits are safe for consumption.

Keywords : MRL, Organochlorines, Organophosphorous, Synthetic Pyrethroids, Triazines, Pyrimidines, Triazoles, Imidazole, Oxazole, Pthalimide, Benzimidazole, Nicotinoids, Aliphatic nitrogen fungicides, Morpholine, Natural product derivatives, Substituted Thiourea, Benzoylphenyl Urea, Strobilurin, Phenyl Pyrazole, Pyrazole, Nitrophenyl Ether, Dithiocarbamates

I. INTRODUCTION

In Maharashtra, Konkan area is very much popular for growing mango, where Alphonso variety is grown prominently. The mango, which has wide varietal differences, grows in longer range of ecogeographical regions. There are different varieties in Konkan with wide range of popularity in common peoples. These varieties are Alphonso, Pairi, Ratna, Mankur, Batalihapus, Narali, Totapuri, Raiwal etc. Out of these mango varieties, Alphonso is very much popular, in the national as well as in the international market because of its aroma and taste.

Economically and nutritionally Alphonso mango is very important. In Sindhudurg district, the area under Alphonso mango cultivation is approximately 27000 hectors

producing 3000 kg mangoes per hector. It plays major role in the economy of Sindhudurg district.

Use of pesticides by cultivators also becomes obligatory to face diseases and pests. To minimize the economic loss caused by the noxious insects, fungi and weeds, farmers rely on pesticides such as, atrazine, cartap, chlorfenvinphos, malathion, methamidophos, monocrotophos, phosphamidon, etc. (M. Bujagendra Raju et. al. 2011). When applied improperly, residues of some of these pesticides can remain as such and can pose a significant hazard to human health. In India 54 pesticides are regularly monitored in exportable mangoes

The mango fruit is perishable in nature and there are many occasions for it to get spoiled till the fruit reaches to consumer's table. It is estimated that the total loss due to spoilage may be ranging from 30 to 40 per cent. Therefore, the fungicidal dip treatment to the mango fruits is a widely applied practice to increase shelf life of the mango fruits.

Very few mango growers, who export their mangoes, follow good agricultural practices (GAP) to maintain maximum residual limit (MRL). Only exporting mangoes are checked for MRL. Today's market demands not only the quality of agricultural produce but also safety and environment-friendly production practices. Thus, it becomes necessary to check mangoes in local market for MRL of pesticides to find out their safety for consumption.

A number of chemicals are in use today in the production of agricultural commodities. They are essential to modern agriculture. Prevention of health risks, including toxicological risks, due to food intake is central in food safety policy

For most of us the primary source of pesticide exposure is what we eat and drink. Maximum Residue Levels (MRLs) and Acceptable Daily Intake (ADIs) are measures set by government to assure us that the human exposure to pesticides is limited.

But there is no full proof way to ensure a safe universal ADI because of the diversity of food we eat and because some people are more vulnerable than others-especially young children and the malnourished. MRLs and ADIs also do not take into account the effects of combinations of pesticides or pesticide breakdown products.

Despite very low pesticide consumption, Indian food products, mainly fruits and agriculture crops have far more pesticide residue because other countries use degradable pesticides while in India there is more use of persistent pesticides hence their residues remain in food products.

Pesticides are chemical substances used to kill animal, insect, plant and fungal pests in agricultural, domestic and institutional settings. Interest on pesticide toxicity has particularly increased over the past years owing to increasing evidence of carcinogenic, mutagenic and teratogenic effects in experimental animals and exposed humans. They constitute a very important group of chemical compounds that have to be controlled due to their very high toxicity and their widespread use in agricultural practice for field and post-harvest protection. The general population is mainly exposed to pesticides through the ingestion of contaminated foods (such as cereals, vegetables and fruits), which are directly treated with these pesticides or are grown in contaminated fields. Diet is one potentially significant source of pesticide exposure considered in aggregate and cumulative risk models. The organophosphate, organochlorine and related pesticides act by binding to the enzyme acetyl cholinesterase, disrupting nerve function, resulting in paralysis and may cause death. They may produce acute and chronic toxicity. The acute effects manifesting as miosis, urination, diarrhoea, diaphoresis, lacrimation, excitation of CNS and salivation. The chronic exposure involves neurotoxic and behavioural effects. Specific effects of pesticides can include cancer, allergies and hypersensitivities, damage to the central and peripheral nervous systems, reproductive disorders and disruption of the immune system. Recent studies have shown that exposures to contaminants in food may pose a public health risk.

Children may be more susceptible to the effects of these exposures, as they have higher rates of metabolism, less mature immune systems and different patterns of activity and behaviour than adults. Pesticides can also interfere with drug metabolizing enzymes especially Cytochrome P450 leading to drug interactions. .

According to the World Health Organization (WHO, 2003), food consumption consists on averaged for 30% (Based on mass) of fruits and vegetables, and fruits and vegetables are the most frequently consumed food group (WHO, 2003). Fruits and vegetables are essential to a nutritious and healthy diet; however, the health benefits are compromised by consistent contamination with pesticide residues.

At the international level, the Codex Alimentarius Commission of the United Nation's Food and Agriculture Organization and the World Health Organization has established maximum residue limit (MRL) for pesticides in a variety of foods.

II. METHODOLOGY

Pesticide residue analysis was carried out by using GC-MS and LC-Tandem MS techniques.

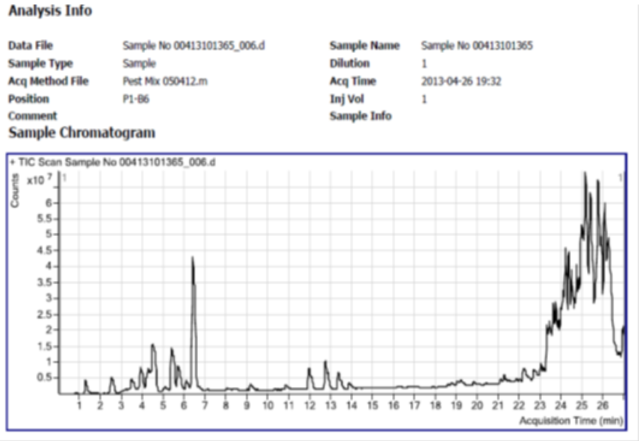
III. EXPERIMENTAL

Ripened Alphonso mango fruits samples were purchased from the local market from Devgad and Vengurle region of the Sindhudurg district. The analysis was carried out from a commercial laboratory 'TUV India Private Limited', Pune. The samples were tested for ninety-eight different pesticides from twenty four chemical groups such as Organochlorines, Organophosphorus, Synthetic Pyrethroids, Triazines, Pyrimidines, Triazoles, Imidazole, Oxazole, Pthalimide, Benzimidazole, Nicotinoids, Aliphatic Nitrogen Fungicides, Morpholine, Natural Product Derivatives, Substituted Thiouria, Benzoylphenyl Urea, Strobilurin, Phenyl Pyrazole, Pyrazole, Nitrophenyl Ether, Dithiocarbamates and others.

IV. RESULTS AND DISCUSSION

Quantitative analysis of Pesticides:

Chromatogram and its Interpretation no. I



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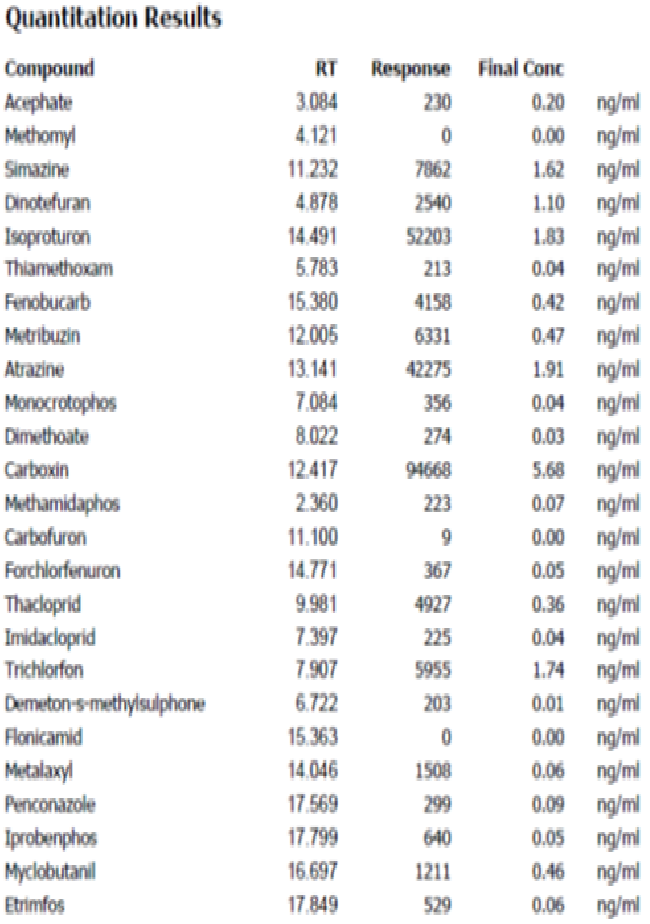
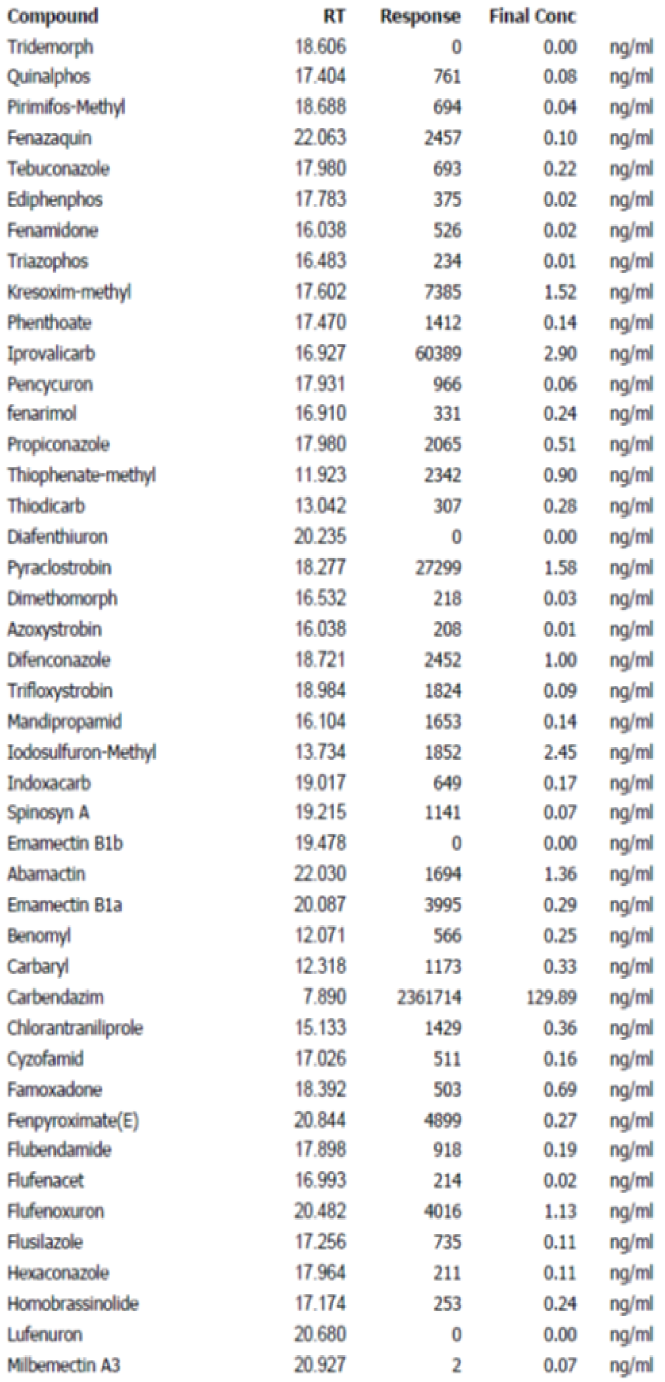
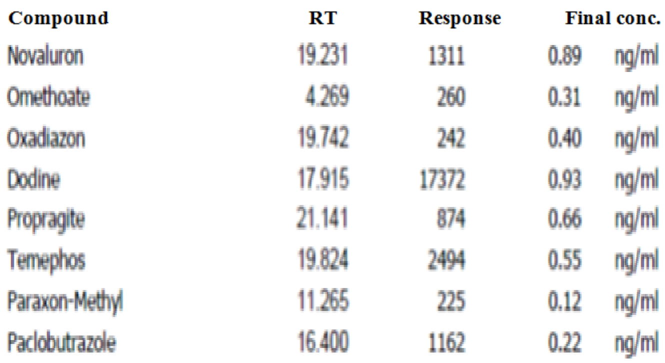


Quantitation Results

Compound	RT	Response	Final Conc	
Acephate	3.084	230	0.20	ng/ml
Methomyl	4.121	0	0.00	ng/ml
Simazine	11.232	7862	1.62	ng/ml
Dinotefuran	4.878	2540	1.10	ng/ml
Isoproturon	14.491	52203	1.83	ng/ml
Thiamethoxam	5.783	213	0.04	ng/ml
Fenobucarb	15.380	4158	0.42	ng/ml
Metribuzin	12.005	6331	0.47	ng/ml
Atrazine	13.141	42275	1.91	ng/ml
Monocrotophos	7.084	356	0.04	ng/ml
Dimethoate	8.022	274	0.03	ng/ml
Carboxin	12.417	94668	5.68	ng/ml
Methamidaphos	2.360	223	0.07	ng/ml
Carbofuron	11.100	9	0.00	ng/ml
Forchlorfenuron	14.771	367	0.05	ng/ml
Thacloprid	9.981	4927	0.36	ng/ml
Imidacloprid	7.397	225	0.04	ng/ml
Trichlorfon	7.907	5955	1.74	ng/ml
Demeton-s-methylsulphone	6.722	203	0.01	ng/ml
Flonicamid	15.363	0	0.00	ng/ml
Metalaxyl	14.046	1508	0.06	ng/ml
Penconazole	17.569	299	0.09	ng/ml
Iprobenphos	17.799	640	0.05	ng/ml
Myclobutanil	16.697	1211	0.46	ng/ml
Etrimfos	17.849	529	0.06	ng/ml

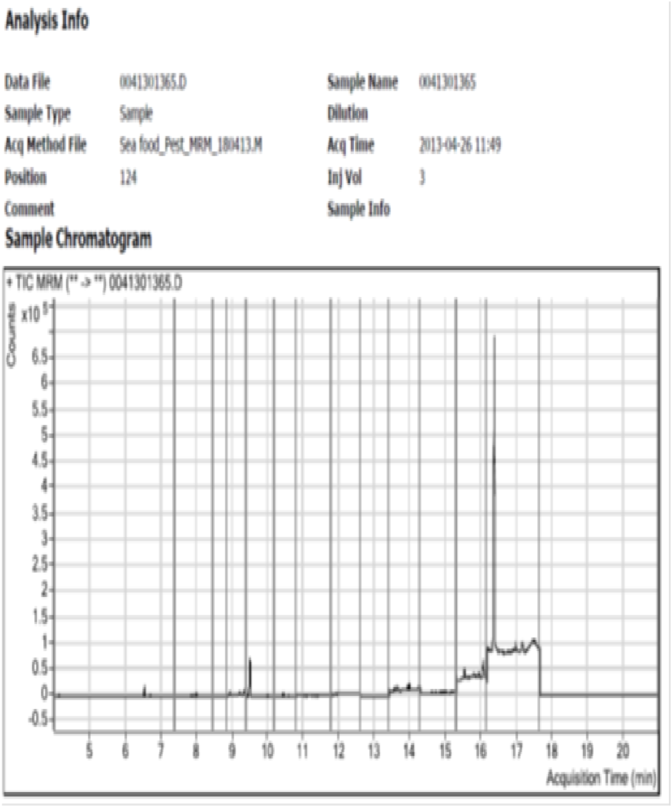


Compound	RT	Response	Final Conc	
Tridemorph	18.606	0	0.00	ng/ml
Quinalphos	17.404	761	0.08	ng/ml
Pirimifos-Methyl	18.688	694	0.04	ng/ml
Fenazaquin	22.063	2457	0.10	ng/ml
Tebuconazole	17.980	693	0.22	ng/ml
Ediphenphos	17.783	375	0.02	ng/ml
Fenamidone	16.038	526	0.02	ng/ml
Triazophos	16.483	234	0.01	ng/ml
Kresoxim-methyl	17.602	7385	1.52	ng/ml
Phenthoate	17.470	1412	0.14	ng/ml
Iprovalicarb	16.927	60389	2.90	ng/ml
Pencycuron	17.931	966	0.06	ng/ml
fenarimol	16.910	331	0.24	ng/ml
Propiconazole	17.980	2065	0.51	ng/ml
Thiophenate-methyl	11.923	2342	0.90	ng/ml
Thiodicarb	13.042	307	0.28	ng/ml
Diafenthiuron	20.235	0	0.00	ng/ml
Pyraclostrobin	18.277	27299	1.58	ng/ml
Dimethomorph	16.532	218	0.03	ng/ml
Azoxystrobin	16.038	208	0.01	ng/ml
Difenconazole	18.721	2452	1.00	ng/ml
Trifloxystrobin	18.984	1824	0.09	ng/ml
Mandipropamid	16.104	1653	0.14	ng/ml
Iodosulfuron-Methyl	13.734	1852	2.45	ng/ml
Indoxacarb	19.017	649	0.17	ng/ml
Spinosyn A	19.215	1141	0.07	ng/ml
Emamectin B1b	19.478	0	0.00	ng/ml
Abamactin	22.030	1694	1.36	ng/ml
Emamectin B1a	20.087	3995	0.29	ng/ml
Benomyl	12.071	566	0.25	ng/ml
Carbaryl	12.318	1173	0.33	ng/ml
Carbendazim	7.890	2361714	129.89	ng/ml
Chlorantraniliprole	15.133	1429	0.36	ng/ml
Cyzofamid	17.026	511	0.16	ng/ml
Famoxadone	18.392	503	0.69	ng/ml
Fenpyroximate(E)	20.844	4899	0.27	ng/ml
Flubendamide	17.898	918	0.19	ng/ml
Flufenacet	16.993	214	0.02	ng/ml
Flufenoxuron	20.482	4016	1.13	ng/ml
Flusilazole	17.256	735	0.11	ng/ml
Hexaconazole	17.964	211	0.11	ng/ml
Homobrassinolide	17.174	253	0.24	ng/ml
Lufenuron	20.680	0	0.00	ng/ml
Milbemectin A3	20.927	2	0.07	ng/ml



Compound	RT	Response	Final conc.	
Novaluron	19.231	1311	0.89	ng/ml
Omethoate	4.269	260	0.31	ng/ml
Oxadiazon	19.742	242	0.40	ng/ml
Dodine	17.915	17372	0.93	ng/ml
Propragite	21.141	874	0.66	ng/ml
Temephos	19.824	2494	0.55	ng/ml
Paraxon-Methyl	11.265	225	0.12	ng/ml
Paclobutrazole	16.400	1162	0.22	ng/ml

Chromatogram and its Interpretation no. II



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Sample Chromatogram

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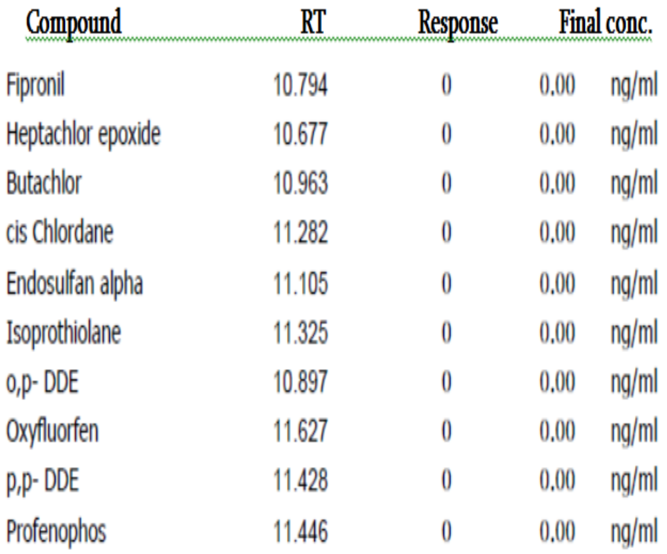
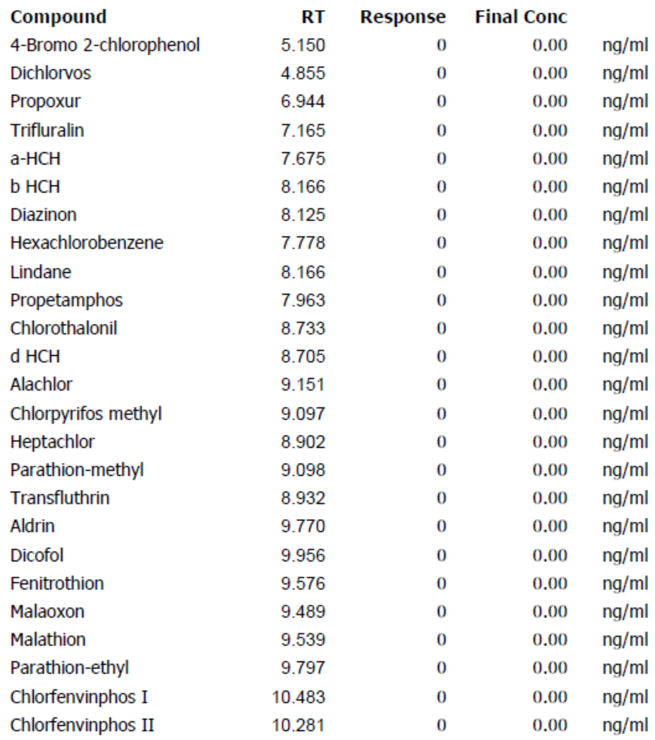
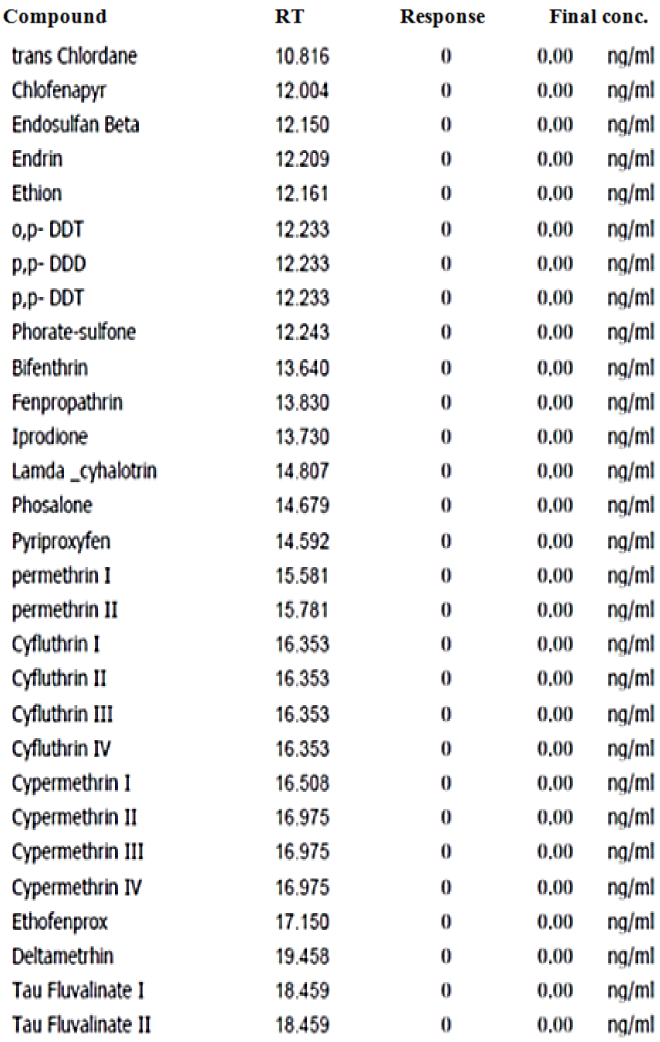


Compound	RT	Response	Final conc.	
Fipronil	10.794	0	0.00	ng/ml
Heptachlor epoxide	10.677	0	0.00	ng/ml
Butachlor	10.963	0	0.00	ng/ml
cis Chlordane	11.282	0	0.00	ng/ml
Endosulfan alpha	11.105	0	0.00	ng/ml
Isoprothiolane	11.325	0	0.00	ng/ml
o,p- DDE	10.897	0	0.00	ng/ml
Oxyfluorfen	11.627	0	0.00	ng/ml
p,p- DDE	11.428	0	0.00	ng/ml
Profenophos	11.446	0	0.00	ng/ml

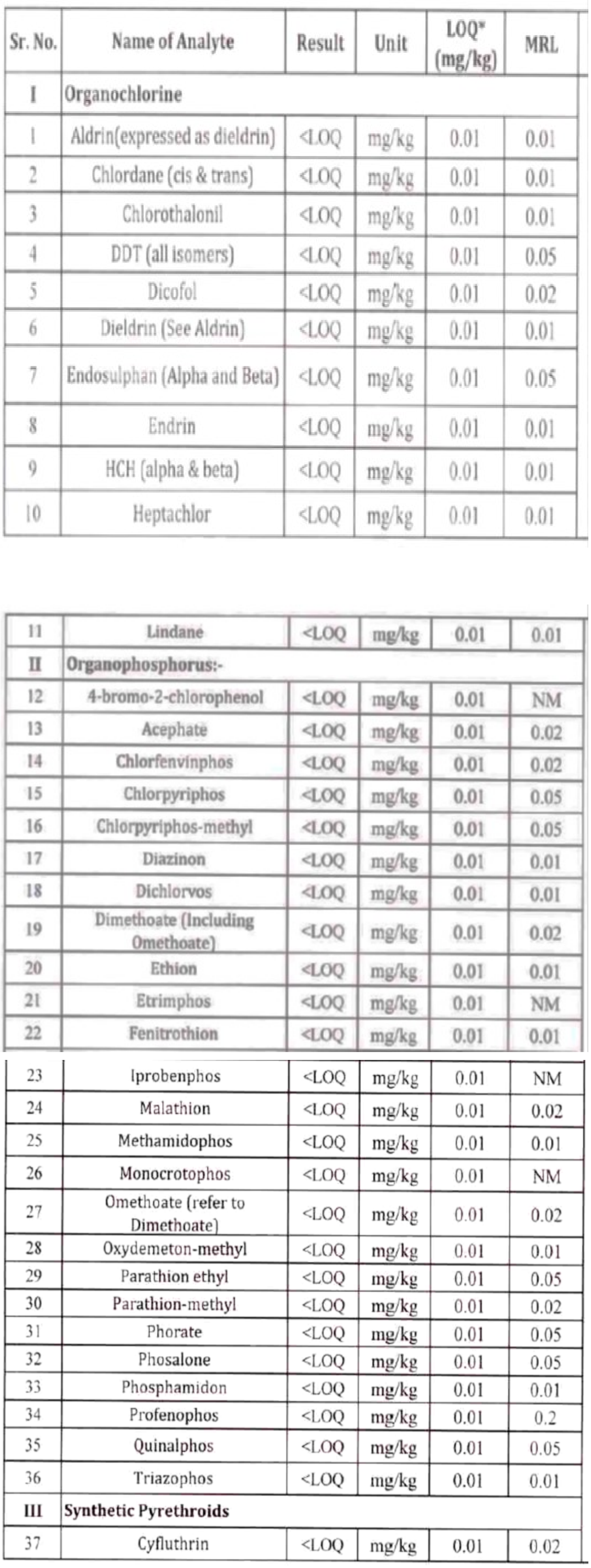


Compound	RT	Response	Final Conc	
4-Bromo 2-chlorophenol	5.150	0	0.00	ng/ml
Dichlorvos	4.855	0	0.00	ng/ml
Propoxur	6.944	0	0.00	ng/ml
Trifluralin	7.165	0	0.00	ng/ml
a-HCH	7.675	0	0.00	ng/ml
b HCH	8.166	0	0.00	ng/ml
Diazinon	8.125	0	0.00	ng/ml
Hexachlorobenzene	7.778	0	0.00	ng/ml
Lindane	8.166	0	0.00	ng/ml
Propetamphos	7.963	0	0.00	ng/ml
Chlorothalonil	8.733	0	0.00	ng/ml
d HCH	8.705	0	0.00	ng/ml
Alachlor	9.151	0	0.00	ng/ml
Chlorpyrifos methyl	9.097	0	0.00	ng/ml
Heptachlor	8.902	0	0.00	ng/ml
Parathion-methyl	9.098	0	0.00	ng/ml
Transfluthrin	8.932	0	0.00	ng/ml
Aldrin	9.770	0	0.00	ng/ml
Dicofol	9.956	0	0.00	ng/ml
Fenitrothion	9.576	0	0.00	ng/ml
Malaoxon	9.489	0	0.00	ng/ml
Malathion	9.539	0	0.00	ng/ml
Parathion-ethyl	9.797	0	0.00	ng/ml
Chlorfenvinphos I	10.483	0	0.00	ng/ml
Chlorfenvinphos II	10.281	0	0.00	ng/ml



Compound	RT	Response	Final conc.	
trans Chlordane	10.816	0	0.00	ng/ml
Chlofenapyr	12.004	0	0.00	ng/ml
Endosulfan Beta	12.150	0	0.00	ng/ml
Endrin	12.209	0	0.00	ng/ml
Ethion	12.161	0	0.00	ng/ml
o,p- DDT	12.233	0	0.00	ng/ml
p,p- DDD	12.233	0	0.00	ng/ml
p,p- DDT	12.233	0	0.00	ng/ml
Phorate-sulfone	12.243	0	0.00	ng/ml
Bifenthrin	13.640	0	0.00	ng/ml
Fenpropathrin	13.830	0	0.00	ng/ml
Iprodione	13.730	0	0.00	ng/ml
Lamda _cyhalotrin	14.807	0	0.00	ng/ml
Phosalone	14.679	0	0.00	ng/ml
Pyriproxyfen	14.592	0	0.00	ng/ml
permethrin I	15.581	0	0.00	ng/ml
permethrin II	15.781	0	0.00	ng/ml
Cyfluthrin I	16.353	0	0.00	ng/ml
Cyfluthrin II	16.353	0	0.00	ng/ml
Cyfluthrin III	16.353	0	0.00	ng/ml
Cyfluthrin IV	16.353	0	0.00	ng/ml
Cypermethrin I	16.508	0	0.00	ng/ml
Cypermethrin II	16.975	0	0.00	ng/ml
Cypermethrin III	16.975	0	0.00	ng/ml
Cypermethrin IV	16.975	0	0.00	ng/ml
Ethofenprox	17.150	0	0.00	ng/ml
Deltametrhin	19.458	0	0.00	ng/ml
Tau Fluvalinate I	18.459	0	0.00	ng/ml
Tau Fluvalinate II	18.459	0	0.00	ng/ml

Result Table: (Appendix – I)



Sr. No.	Name of Analyte	Result	Unit	LOQ* (mg/kg)	MRL
I	Organochlorine				
1	Aldrin(expressed as dieldrin)	<LOQ	mg/kg	0.01	0.01
2	Chlordane (cis & trans)	<LOQ	mg/kg	0.01	0.01
3	Chlorothalonil	<LOQ	mg/kg	0.01	0.01
4	DDT (all isomers)	<LOQ	mg/kg	0.01	0.05
5	Dicofol	<LOQ	mg/kg	0.01	0.02
6	Dieldrin (See Aldrin)	<LOQ	mg/kg	0.01	0.01
7	Endosulphan (Alpha and Beta)	<LOQ	mg/kg	0.01	0.05
8	Endrin	<LOQ	mg/kg	0.01	0.01
9	HCH (alpha & beta)	<LOQ	mg/kg	0.01	0.01
10	Heptachlor	<LOQ	mg/kg	0.01	0.01
11	Lindane	<LOQ	mg/kg	0.01	0.01
II	Organophosphorus:-				
12	4-bromo-2-chlorophenol	<LOQ	mg/kg	0.01	NM
13	Acephate	<LOQ	mg/kg	0.01	0.02
14	Chlorfenvinphos	<LOQ	mg/kg	0.01	0.02
15	Chlorpyriphos	<LOQ	mg/kg	0.01	0.05
16	Chlorpyriphos-methyl	<LOQ	mg/kg	0.01	0.05
17	Diazinon	<LOQ	mg/kg	0.01	0.01
18	Dichlorvos	<LOQ	mg/kg	0.01	0.01
19	Dimethoate (Including Omethoate)	<LOQ	mg/kg	0.01	0.02
20	Ethion	<LOQ	mg/kg	0.01	0.01
21	Etrimphos	<LOQ	mg/kg	0.01	NM
22	Fenitrothion	<LOQ	mg/kg	0.01	0.01
23	Iprobenphos	<LOQ	mg/kg	0.01	NM
24	Malathion	<LOQ	mg/kg	0.01	0.02
25	Methamidophos	<LOQ	mg/kg	0.01	0.01
26	Monocrotophos	<LOQ	mg/kg	0.01	NM
27	Omethoate (refer to Dimethoate)	<LOQ	mg/kg	0.01	0.02
28	Oxydemeton-methyl	<LOQ	mg/kg	0.01	0.01
29	Parathion ethyl	<LOQ	mg/kg	0.01	0.05
30	Parathion-methyl	<LOQ	mg/kg	0.01	0.02
31	Phorate	<LOQ	mg/kg	0.01	0.05
32	Phosalone	<LOQ	mg/kg	0.01	0.05
33	Phosphamidon	<LOQ	mg/kg	0.01	0.01
34	Profenophos	<LOQ	mg/kg	0.01	0.2
35	Quinalphos	<LOQ	mg/kg	0.01	0.05
36	Triazophos	<LOQ	mg/kg	0.01	0.01
III	Synthetic Pyrethroids				
37	Cyfluthrin	<LOQ	mg/kg	0.01	0.02

38	Cypermethrin	<LOQ	mg/kg	0.01	0.7
39	Deltamethrin	<LOQ	mg/kg	0.01	0.05
40	Ethofenprox (Etofenprox)	<LOQ	mg/kg	0.01	0.01
41	Fenvalerate & Esfenvalerate (sum of RR & SS isomers)	<LOQ	mg/kg	0.01	0.02
42	Fenvalerate & Esfenvalerate (sum of RS & SR isomers)	<LOQ	mg/kg	0.01	0.02
43	Lambda-cyhalothrin	<LOQ	mg/kg	0.01	0.2
44	Permethrin	<LOQ	mg/kg	0.01	0.05
IV	**Triazines**				
45	Atrazine	<LOQ	mg/kg	0.01	0.05
46	Simazine	<LOQ	mg/kg	0.01	0.01
V	**Acylamino acid fungicides**				
47	Metalaxyl & Metalaxyl-M	<LOQ	mg/kg	0.01	0.05
VI	**Carbamates**				
48	Carbaryl	<LOQ	mg/kg	0.01	0.05
49	Carbofuran	<LOQ	mg/kg	0.01	0.02
50	Carbosulfan	<LOQ	mg/kg	0.01	0.05
51	Indoxacarb	<LOQ	mg/kg	0.01	0.02
52	Iprovalicarb	<LOQ	mg/kg	0.01	0.05
53	Methomyl	<LOQ	mg/kg	0.01	0.02
54	Thiodicarb (See Methomyl)	<LOQ	mg/kg	0.01	0.02
VII	**Pyrimidines**				
55	Fenarimol	<LOQ	mg/kg	0.01	0.02
VIII	**Triazoles**				
56	Bitertanol	<LOQ	mg/kg	0.01	0.05
57	Flusilazole	<LOQ	mg/kg	0.01	0.02
58	Hexaconazole	<LOQ	mg/kg	0.01	0.02
59	Myclobutanil	<LOQ	mg/kg	0.01	0.02
60	Penconazole	<LOQ	mg/kg	0.01	0.05
61	Propiconazole	<LOQ	mg/kg	0.01	0.05
62	Tebuconazole	<LOQ	mg/kg	0.01	0.1
63	Triadimefon	<LOQ	mg/kg	0.01	0.1
64	Triadimenol	<LOQ	mg/kg	0.01	
65	Difenoconazole	<LOQ	mg/kg	0.01	0.1
IX	**Imidazole**				
66	Iprodione	<LOQ	mg/kg	0.01	0.02
67	Fenamidone	<LOQ	mg/kg	0.01	0.02
X	**Oxazole**				
68	Famoxadone	<LOQ	mg/kg	0.01	0.02
XI	**Phthalimide**				
69	Captafol	<LOQ	mg/kg	0.01	0.02
70	Captan	<LOQ	mg/kg	0.01	2
XII	**Benzimidazole**				
71	Carbendazim (Including Benomyl)	0.13	mg/kg	0.01	0.5
72	Thiophanate-methyl	<LOQ	mg/kg	0.01	1
XIII	**Nicotinoids**				
73	Acetamiprid	<LOQ	mg/kg	0.01	0.01
74	Clothianidin	<LOQ	mg/kg	0.01	0.02
75	Imidacloprid	<LOQ	mg/kg	0.01	0.2
76	Thiacloprid	<LOQ	mg/kg	0.01	0.02
77	Thiamethoxam	<LOQ	mg/kg	0.01	0.5
XIV	**Aliphatic Nitrogen fungicides**				
78	Cymoxanil	<LOQ	mg/kg	0.01	0.05
XV	**Morpholine**				
79	Dimethomorph	<LOQ	mg/kg	0.01	0.05
80	Tridemorph	<LOQ	mg/kg	0.01	0.05
XVI	**Natural Product Derivative**				
81	Buprofezin	<LOQ	mg/kg	0.01	0.1
82	Cartap hydrochloride	<LOQ	mg/kg	0.01	NM
83	Emamectin Benzoate	<LOQ	mg/kg	0.01	0.01
84	Spinosad (Sum of Spinosyn A+D)	<LOQ	mg/kg	0.01	0.02
85	Abamectin	<LOQ	mg/kg	0.01	0.01
XVII	**Substituted Thiourea**				
86	Difenthiuron	<LOQ	mg/kg	0.01	NM
XVIII	**Benzoylphenyl urea**				
87	Flufenoxuron	<LOQ	mg/kg	0.01	0.05
XIX	**Strobilurin**				
88	Azoxystrobin	<LOQ	mg/kg	0.01	0.7
89	Kresoxim methyl	<LOQ	mg/kg	0.01	0.05
90	Pyraclostrobin	<LOQ	mg/kg	0.01	0.05
91	Trifloxystrobin	<LOQ	mg/kg	0.01	0.5
XX	**Phenyl pyrazole**				
92	Fipronil	<LOQ	mg/kg	0.005	0.005
XXI	**Pyrazole**				
93	Fenpyroximate	<LOQ	mg/kg	0.01	0.05
XXII	**Nitrophenyl ether**				
94	Oxyfluorfen	<LOQ	mg/kg	0.01	0.05
XXIII	**Others**				
95	Propargite	<LOQ	mg/kg	0.01	0.01
96	Diflubenzuron	<LOQ	mg/kg	0.01	0.05
97	Dinocap	<LOQ	mg/kg	0.01	0.05
XIV	**Dithiocarbamates**				
98	Dithiocarbamates (Mancozeb, Maneb, Propineb, Metiram, Thiram, Zineb and Ziram collectively estimated as CS_2)	<LOQ	mg/kg	0.05	2

The result (Appendix – I) shows that almost for all the pesticides, their residue level in the pulp of Alphonso mango is below limit of quantification except Carbendazim which is 0.13 mg/Kg but still below MRL i.e. 0.5 mg/Kg. This shows that pesticide residues in ripened Alphonso mango pulp from Devgad and Vengurle region are in very traces and are below MRL, therefore the fruits are safe for consumption.

Similar kind of results are noted by different workers. Hussain et.al., (2002) studied different varieties of mango fruits for pesticide residue and found all the samples contaminated but within permissible limits being set by FAO/WHO with reference to public health.

Waskar et.al.,(2004) studied the residue levels of carbendazim and captan in peel and pulp of Kesar mango and found it below detectable limit.

Shah et.al.,(2007) assessed three different varieties of mango for the residues of commonly used pesticides viz Cypermethrin, Methamedophos, Monocrotophos, Cyfluthrin, Dialdrin and Methyl Parathian, and found all the samples to be contaminated with a degree of variation of pesticides residue studied. However, all the samples were within permissible limits, set by FAO/WHO with reference to public health.

Tahir et.al., (2009) analysed some fruits and vegetables for the levels of nine pesticide residues and found that most of the samples did not contain any residues and only two samples had detectable residue but below MRL.

Kumar et.al.,(2010) estimated organochlorine pesticide residues in mango fruits and found below MRL.

Bempah et.al.,(2011) assessed the concentration of pesticide residue in 350 locally produced fruits and vegetables and showed that 37.5% of the fruit and vegetable samples analyzed contained no detectable level of the monitored pesticides, 19.0% of the samples gave results with levels of insecticides residues above the MRL, while 43.5% of the samples showed results below the MRL.

Based on these observations it may be assumed that the Alphonso mango fruits are within the permissible range of MRLs proposed by FAO/WHO and may not pose a serious threat to public health.

But, the various studies disclose that even a low level exposure to pesticide residues puts consumers, especially children on risk in a cumulative manner. So an analysis showing the residues in undetectable or safe range does not essentially mean that it is absolutely safe and free of any untoward effects. More over as mentioned earlier, MRLs and ADIs do not take into account the effects of combinations of pesticides or pesticide Break down products. Besides direct threat to human health, pesticides cause major loss to biodiversity affecting ecosystems. Because most of the pesticides contaminate ecosystems by accumulating in soil and waterbodies. Sindhudurg district is situated on west coast of Maharashtra having great slope from the Sayhyadri range (Western Ghat) to the Arabian see. As a result most of the rain water get mixed to the Arabian see as surface run off. Therefore a large quantity of pesticides sprayed must have get mixed with potable water bodies and see water contaminating marine ecosystem every year, affecting marine life. And most of the population in Sindhudurg is dependent on marine food.

It is studied that, Organochlorine insecticides like DDT accumulate in the food chain because they build up in the fatty tissue of organisms that are then eaten in quantity by higher organisms, thus moving up the food chain and threatening fish, birds and higher animals like humans. Through such an ecological multiplier effect, far away in Antarctica, penguins, have been found to have enough accumulated pesticides residue to cause their egg shells to be soft and break. There are many examples of even wild life dying or suffering disrupted reproduction because of pesticides used to kill other organisms.

Honey bees, which are vital for successful cropping, are often accidental victims of sprays aimed at harmful insects like grubs and beetles on food crops.

This shows that though there may not be any direct harm to the human being from pesticide residues in fruits and other crops, their indirect effects are also of major concern.

V. REFERENCES

[1]. A.O.A.C. 1975 Official Methods of Analysis. Association of Official Analytical Chemists. 12th Edition, Washington, D. C. 20044.

[2]. A.O.A.C. 18th Edition, 2007.01.

[3]. A.O.A.C. International, vol.91, No.6, 2008.

[4]. Ahmed 2001 Ahmed FE. ‘Analyses of Pesticides and Their Metabolites in Foods and Drinks'. Trends in analytical chemistry 2001; 20: 49.

[5]. Bai et.al. 2006 Bai Y, Zhou L, Wang J. ‘Organophosphorous Pesticide Residues in Market Foods in Shaanxi Area, China'. Food Chemistry 2006; 98: 240-2.

[6]. Bempah et.al. 2011 Crentsil Kofi Bempah, Archibold Buah-Kwofie, Dzifa Denutsui, Jacob Asomaning and Anita Osei Tutu, ‘Monitoring of Pesticide Residues in Fruits and Vegetables and Related Health Risk Assessment in Kumasi Metropolis', Ghana Research Journal of Environmental and Earth Sciences 3(6): 761-771, 2011

[7]. Chauhan et. al. 1987 Chauhan, K.S., Kumar, J.; Sharma, R. K. and Singh, R. (1987). Harayan J. Hort. Sci., 16: 218-222.

[8]. Claeys et al. 2011 Claeys, W.L., S. Jean-Francois, C. Bragard, G. Maghuin-Rogister, P. Luc and B. Schiffers, 2011. ‘Exposure of Several Belgian Consumer Groups to Pesticide Residues through Fresh Fruit and Vegetable Consumption'. Food Cont., 22: 508-516.

[9]. Fenske et.al. 2002 Fenske RA, Kedan G, Lu C, Fisker-Andersen JA and Curl CL. ‘Assessment of Organophosphorous Pesticide Exposures In The Diets Of Preschool Children In Washington State'. Journal of Exposure Analysis and Environmental Epidemiology 2002; 12: 21-8.

[10]. Hodgson and Patrica 1996 Hodgson E and Patrica E. ‘Pesticides: An Important but Underused Model for the Environmental Health Sciences' 1996; 104: 97-106.

[11]. Hussain et.al. 2002 Saqib Hussain, Tariq Masud and Karam Ahad .Determination of Pesticides Residues in Selected varieties of Mango', Pakistan Journal of Nutrition 1 (1): 41-42, 2002 Asian Network for Scientific Information 2002

[12]. Mahindru 2009 S. N. Mahindru, 'Food Safety and Pesticides', A P H Publishing Corporation, New Delhi-110002

[13]. Morasso 2001 Morasso G et al. ‘Pesticides as Food Contaminants: A Pilot Project for Correct Public Information'. Trends in Food Science and Technology 2001; 11: 379-82.

[14]. Ortelli et.al. 2004 Ortelli D, Edder P, Corvi C. ‘Multi Residue Analysis of 74 Pesticides in Fruits and Vegetables by Liquid Chromatography Electrospray-Tandem Mass Spectrometry'. Analytica Chimica Acta 2004; 520: 33-4.

[15]. Rene and Zoonen 1999 Rene vanderhoff G and Zoonen PV. ‘Trace Analysis of Pesticides by Gas Chromatography'. J. Chromatogr. A 1999; 843: 301-22.

[16]. Sanborn et.al. 2002 Sanborn MD, Cole D, Abelsohn A, Weir E. ‘Identifying and managing adverse environmental health effects:4 Pesticides.' CMAJ 2002; 166: 1431-6.

[17]. Tahir et.al. 2009 M. Usman Tahir, Salma Iqbal Naik, Salma Rehman And M. Shahzad ,'A Quantitative Analysis For The Toxic Pesticide Residues In Marketed Fruits And Vegetables In Lahore, Pakistan', D:/Biomedica Vol.25, Jul.-Dec. 2009/Bio-23.Doc P. 171-174.

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Growth of Star Shaped Copper Iodate Crystals in Gel and Effect of Various Parameters on Crystal Growth.

K. P. Joshi[1], B. S. Nadekar[1], Barun k Mehata[2]
[1]Nano Material Application Lab., Department of Physics, Institute of Science, Madam Kama Road, Fort, Mumbai, Maharashtra, India
[2]Department of Chemistry, National Defence Academy, Pune, Maharashtra, India

ABSTRACT

The present manuscript reports several aspects regarding the growth procedure of copper iodate $Cu(IO_3)_2\ H_2O$ crystal, optimum growth conditions and the kinetics i.e. influence of different growth parameters to obtain optimization conditions for the growth of these crystals. It is also predicts the results obtained from the different techniques used for the characterization of gel grown crystals of copper iodate.gel technique ,Aging effect density,Nucleation,growth parameters at ambient temperature are discussed.

Keywords: Copper iodate, Crystal growth, Single diffusion method,Gel technique,starshaped crystal.

I. INTRODUCTION

Growth of copper iodate crystals by gel method is a promising technique for growing crystals of many substances. Now a day, most of the solid state investigations are made by using well developed crystals. An effective efficient process is one, which produces adequately perfect crystals for their use at minimum cost. The aim of the present work is to put the gel method with standard performance and potentiality so that more perfect larger crystals should obtain at ambient temperature.

Copper iodate crystals cannot be crystallized by high temperature methods, as the material starts decomposing before melting. Therefore conventional high temperature methods for its growth are not applicable. Gel method is only the alternative technique to grow the crystal of appreciable size and good quality as reported in the present work at ambient temperature, moreover, this method is simple and inexpensive. Hence the crystals of copper iodate were grown by gel method.

The present manuscript reports several aspects regarding the growth procedure of copper iodate $Cu(IO_3)_2\ H_2O$ crystal, optimum growth conditions and the kinetics i.e. influence of different growth parameters to obtain optimization conditions for the growth of these crystals. This article also predicts the results obtained from the different techniques used for the characterization of gel grown crystals of copper iodate.

II. EXPERIMENTAL PROCEDURE

Preparation of gel:

Initially, different concentration of solutions of sodium Meta silicate taken for e.g. 10gm, 21gm, and 21.5gm 22gm in distilled water to get 250cc solution. The solution is constantly stirred and then filtered by Dr Watts's filter paper. It is then kept in to an airtight bottle free from dust and contamination. Density of the solution was measured using Specific gravity bottle. A solution of different molarities prepared by adding proper amount of chemicals to the double distilled water. The chemicals used are copper nitrate, copper chloride, potassium iodate, acetic acid and sodium meta silicate.

When the solution of sodium Meta silicate is mixed with any of mineral or organic acid, gel formation takes place due to the polymerization in the resultant solution. In the present work, various concentrations of acetic acid, copper chloride, potassium iodate used with sodium Meta silicate tried for optimum condition to obtain good quality crystals of copper iodate.

Single diffusion method:

This method used to obtain good quality crystal of copper iodate in gel medium. In actual procedure, 5cc of 2N acetic acid was taken in a small beaker, to which sodium meta silicate solution of density 1.04 gm/cc was added drop by drop with constant stirring by using magnetic stirrer, till pH of the solution reaches a value 4.4 .A digital pocket sized pH meter of HANNA instrument is used for this purpose. A 5cc of copper chloride or copper nitrate solution was added with constant stirring in mixture of acetic acid and sodium Meta silicate solution. Continuous stirring process avoids excessive ion concentration which otherwise causes premature local gelling and makes the final medium inhomogeneous and turbid .The pH of the mixture was maintained at 4.4.

This mixture was then transferred to the test tube, a mouth of test tube closed using cotton plug used to avoid contamination of the exposed surface with atmospheric impurities and to keep the gel at atmospheric conditions. The setting time was 10-13days. The completely set gel was left for aging for 96 hours to 120 hours. Potassium iodate was used as supernatant having different molarities like 0.1M, 0.4M, 0.5M. 1M. were added over the copper chloride set gel. As the concentrations of supernatant increases, the numbers of nucleation centers were also found to be increased. Alternation method of supernatant and reactant also used to obtain good quality crystal of copper iodate.

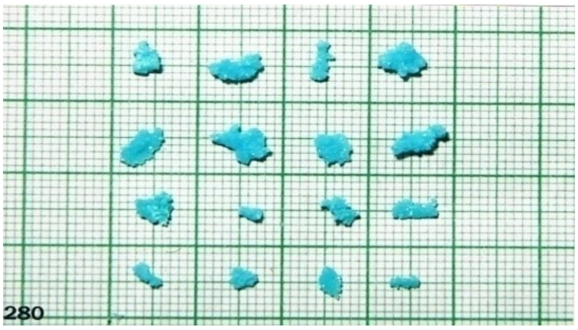

Figure 1. Shinning Star shaped crystals of copper iodate grown using copper chloride gel4FVNM

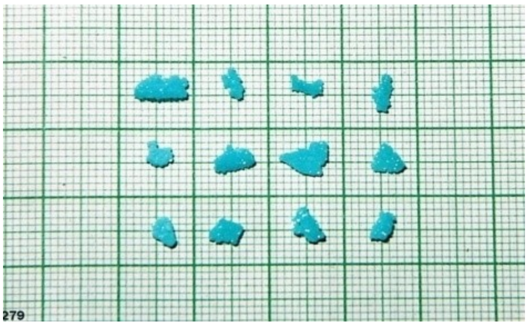

Figure 2. Shinning crystals of copper iodate grown using copper nitrate gel

III. RESULTS AND DISCUSSION

The optimum growth conditions for the growth of copper iodate crystals are represented in Table 1. Copper nitrate and copper chloride solutions are used to compared thickness transparency and quality of the crystal. The thickness of crystals grown by using copper nitrate as reactant is quiet effective in comparison when copper chloride is used as reactant. At a same time, crystals grown with reactant copper chloride are more transparent when same grown with copper nitrate. Crystals of copper iodate grown with help of copper chloride are shown in figure 2.1 and 2.4. A shape of copper iodate crystals in gel containing copper nitrate turns from spherical to star shaped are crowded shown in figure 2.2 and 2.3. The size of copper iodate crystal in nitrate gel is small but are also transparent as shown in figure 2.

Figure 2.1

Figure 2.2

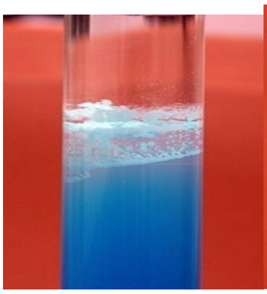

Figure 2.3

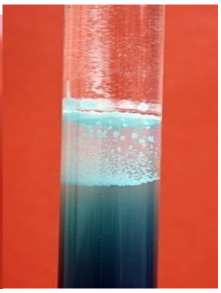

Figure 2.4

Table 1. Optimum condition for growth of $Cu(IO_3)_2$ crystals.

Condition Lattice parameter	**Copper iodate concentrations**
Density of sodium Meta silicate	1.04kg/m^3
pH of mixture	4.4
Amount of 2N acetic acid	5ml
Temperature	Room temperature
Gel setting time	13 days
Gel aging time	5 days
Concentration of KIO_3	0.4M
Concentration of $CuCl_2$	1M
Concentration of $Cu(NO_3)_2$	1M
Period of growth	4 weeks

IV. OBSERVATIONS

Figures shows different forms of grown copper iodate crystals inside the test tubes for the different concentrations of $CuCl_2$ solution in the gel. The range of the $CuCl_2$ Solution used was from 0.1 M to 0.5 M .The whisker growth with greater length originating from the interface of the gel was observed in the test tube containing $CuCl_2$ solution of 0.1M. However the dendritic crystal growth was not observed in the test tube containing $CuCl_2$ solution of 0.1 M concentration. As the concentration of $CuCl_2$ solution was increased up to 0.4M, it leads to dendritic growth along with the whisker growth .However there was no growth of shaped crystals. It was observed that in a test tube containing $CuCl_2$ solution of 0.5 M concentration, growth of copper iodate occurs in three phases which are whisker, cubical and star shaped. In present work, potassium iodate used as supernatant, in the test tube of Figure 3.1. Star Shaped one beautiful (2mm) shinning crystal is observed. In the test tube of Figure 3.5. Circular Shaped Crowded Crystals are seen. Large numbers of circular shaped small tiny crystals are seen at the wall of test tube. But at interface large, very crowded crystals are seen. The layer of crystals is very thick. The region of interface and region of crystal has turned transparent instead of blue i.e. the region in which copper nitrate has been completely utilized for crystallization. Figure 3.6. Figure 1.1 and 1.2 shows optimized star shaped transparent crystals of copper iodate on a graph paper with their scaling.

Effect of various parameters on crystal growth of copper iodate :

A. Effect of gel density:

The gels of different densities were obtained by mixing sodium Meta silicate solution of specific gravity 1.03 to 1.06 with 2N acetic acid. It is observed that the nucleation density decreases as the gel density increases. Table 3.2– shows the effect of gel densities on the quality of copper iodate crystals. Fig 3.9 shows the variation of time of gelation with gel density.

Table 3.5 indicates effect of gel density on number of nucleation centers.

pH=4.4 , Feed solution 0.4 M KIO_3

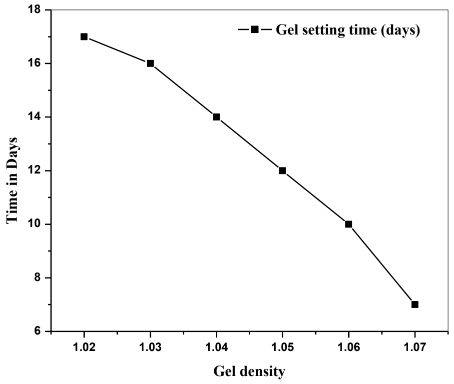

Figure 3.1. Plot of Effect of gel density on setting time

pH =4.4 feed solution 1M $CuCl_2$ and 0.4 M KIO_3:

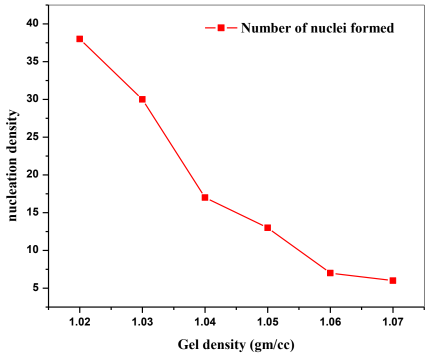

Figure 3.2. Plot of Effect of gel density on nucleation density

B. Effect of pH on gel:

The pH value of gel was varied from 2.5 to 7.0. The effect of the different pH values on gel setting time and the quality of grown crystal is as shown in Table 3.11. The optimum value of gel pH to get ideal gel is found to be 4.4 .At pH values less than 4.4 the time for gelation increased, and the resultant gel was unstable, for pH values greater than 4.4, the gelation occurred very soon and the resultant gel was not transparent. Figure 3.11 shows the graph of pH values against the setting time in hours. In the present work, pH value of 4.4 is the optimum condition for the good quality crystal of copper iodate.

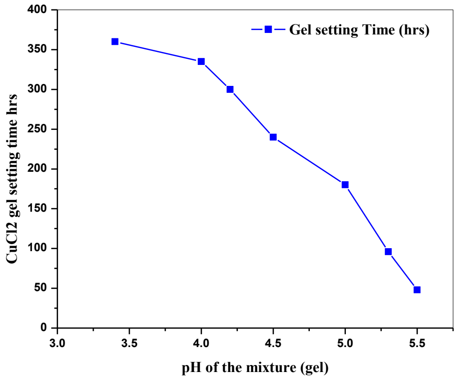

Figure 3.3. Plot of pH against gel setting Time

C. Effect of gel aging:

A feed solution of constant molarity was then added over a set gel. It is found that the number of copper iodate crystals decreases as the aging of gel increases. Aging of gel decreases the diffusion and nucleation density. More aging causes more amount of water evaporation out of the gel. Before the gel is set, the evaporation of water causes an increase in gel density which in turn decreases the diffusivity of reactive ions in the gel, thereby decreasing the number of nucleation sites. After the gel containing copper chloride is set, the evaporation of water causes not only the lack of ionic carriers in the channel of gel frame work, but also discontinuities in the channel due to the shrinkage of gel. Both these effects would adversely affect the diffusion of reactants ions hence the decrease in the number of nucleation sites. Table-3.5 shows the effect of aging time on number and the quality of crystal .Fig3.12 shows graph of aging in hours verses in number of crystal .In the present work aging of 124 hours was found most suitable at ambient temperature.

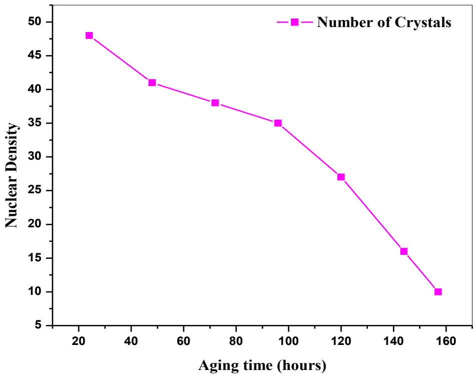

Figure 3.4. A gel aging time on number of nucleation

D. Effect of concentration of reactants:

Feed solution of either KIO_3, $CuCl_2$ and Cu $(No_3)_2$ were tried. Potassium iodate solutions of concentrations 0.1M to 0.4M molarity were prepared. As the concentration of the reactant in the gel increases, the nucleation density also increases. For the growth of good quality crystal of copper iodate, suitable concentration of reactant incorporated in gel is found to be 0.5M . It is to mention that the reactant [0.5M of $CuCl_2$ and $Cu(No_3)_2$,0.4M for KIO_3] were taken to grow good quality crystal of copper iodate using copper nitrate and copper chloride .. However, the use of KIO_3 and $CuCl_2$ yields the better and transparent quality of crystal, in terms of size and shape. All experiment were carried out by incorporating 5cc,1M $CuCl_2$ solution in gel and 15cc,0.4M of KIO_3 solution as supernatant was put over the set gel acidified with 2N acetic acid as a feed solution .Table 3.6 summarizes effect of concentration of reactant on quality,habit, and size of crystal.

E. Colour:

It is observed that an acidified gel containing copper nitrate leads to growth of blue colour crystal of copper iodate,while gel containing $CuCl_2$ leads to blue shinning and starshaped required crystal.

V. CONCLUSION:

1. Star shaped copper iodate crystal can be grown by simple gel technique.
2. The effect of pH, concentration of reactants, gel aging and setting, gel density and room temperature is important to grown crystals.
3. It is observed that the colour of copper nitrate is dark blue as compare to copper chloride, copper chloride crystals are shining and transparent but both are star shaped.
4. Single diffusion gel growth technique is suitable to grow copper iodate crystals.
5. Different habits of copper iodate crystals can be obtained by changing parameter like gel density,itspH,gel aging and gel concentration of reactants etc.

VI. REFERENCES

[1]. Qiuliang, Luo, Copper dissolution behavior in acidic iodate solutions, Langmuir 11, 2000, 5154-5158.

[2]. Li Guanghua, Shi Zhan, Liu Xiaomin, Dai Zhimin, Gao Lu, Feng Shouhua, Inorganic Chemistry 26, 2004, 8224-8226.

[3]. H. Wang, G. Wang, P. Bao et al, Controllable synthesis of submillimeter single-crystal monolayer graphene domains on copper foils by suppressing nucleation, Journal of the American Chemical Society 8, 2012, 3627-3630.

[4]. M. Anik, Selection of an oxidant for copper chemical mechanical polishing: Copper-iodate system, Journal of Applied Electrochemistry 1, 2005, 1-7.

[5]. D. Cooke, On the effect of copper (II) and chloride ions on the iodate-hydrogen peroxide reaction in the presence and absence of manganese (II), International Journal of Chemical Kinetics 10, 1980, 671- 681.

[6]. A. Rogbertson, J. Warner, Hexagonal single crystal domains of few-layer graphene on copper foils, Nano Letters 3, 2011, 1182-1189.

[7]. Pourmortazavi S. M., Hajimirsadeghi S. S., Optimization of parameters for the synthesis of silver iodate submicron belts by Taguchi robust design method, Chemical Engineering Communications 10, 2011, 1182-1188.

[8]. D. Mott, J. Galkowski, L. Wang et al, Synthesis of size-controlled and shaped copper nanoparticles, Langmuir10, 2007, 5740-5745.

[9]. H. Ghorbani, Chemical synthesis of copper nanoparticles, Oriental Journal of Chemistry 2, 2014, 803-806.

[10]. J. Barton, A. Vertegel, E. Bohhanan et al, Epitaxial electrodeposition of copper(I) oxide on single-crystal copper, Chemistry of Materials 3, 2001, 952-959.

[11]. S. Chemler, Copper catalysis in organic synthesis, Beilstein Journal of Organic Chemistry 11, 2015, 2252-2253.

[12]. B. Park, S. Jeong, D. Kim et al, Synthesis and size control of monodisperse copper nanoparticles by polyol method, Journal of Colloid and Interface Science 2, 2007, 417-424.

[13]. F. Outten, D, Huffman, J. Hale et al, The Independent cue and cus Systems Confer Copper Tolerance during Aerobic and Anaerobic Growth in Escherichia coli, Journal of Biological Chemistry 276, 30670-30677.

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Thermodynamics Laws of Physics in light of Quran (Zeroth and First)

Tanwin M. S. Ashrafi[1*], Momin Aayesha Mohammad Arif[2], Rangari Rubina Alauddin[3]

[1*]Assistant Professor, Department of Physics, G.M. Momin Women's College, Bhiwandi, Maharashtra, India

[2]Student , Department of Physics, G.M. Momin Women's College, Bhiwandi, Maharashtra, India

[3]Student , Department of Physics, G.M. Momin Women's College, Bhiwandi, Maharashtra, India

ABSTRACT

The Scientific principals and laws are the knowledge of the things. The human mind makes the decision on biases of four arguments: Natural Argument, Philosophical Argument, Spiritual Argument and Scientific Argument. Each of this argument gave a ground to human thought to develop in search of the truth[6]. Quran gave lots of answer if one can understand. Quran also give chance and challenge to the seeker "A quest for hidden truth or knowledge". In this paper, scientific aspect has been given explanation through the Quran. Thermodynamics Laws are based on fundamental physical quantities like temperature, energy and entropy. These Laws are explaining the behaviour of these quantities under various circumstances. It also gives the explanation to conservation Law of energy. A simple try has been done to explain Zeroth and First Thermodynamics laws under the view of Quran.

Keywords : Zeroth thermodynamics Law, First Thermodynamics laws, Quran

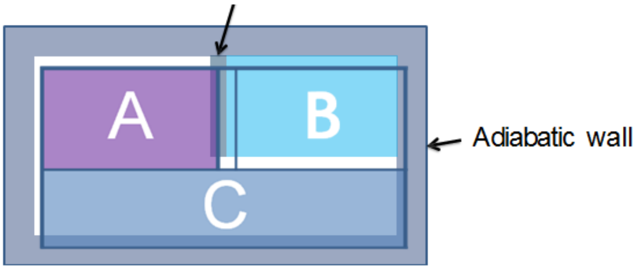
I. INTRODUCTION

In the view of Dr. Bertrand Russell, there are two kinds of knowledge: knowledge of things and knowledge of truths. So far as "things" are concerned it is possible to apply direct argument to them. But inferential arguments alone can be applied to prove "truths", as relating to the laws of nature. Inferential arguments are held to be valid in science.

Whole world is combination of various matter and non-matter. Matter is physical substance that which occupies space and possesses rest mass, especially as distinct from energy. Functional entities (like; energy, mass, 'force', attributes, qualities, etc.), created by rational beings, are non-matter. They fulfil functions assigned to them by rational beings. Matters or non-matters are nothing but the form of energy. Energy is the entity that shows the property (ability) of the substance to do the work. Scientifically, 'matter' is divided into three categories solid, liquid, and gaseous. Thermodynamics laws explain behaviour of the substance under various conditions of temperature, pressure, volume and entropy.

A. Zeroth Law of thermodynamic:

Statement: It state that if two bodies A and B are each separately in thermal equilibrium with third body C , then A and B are also in thermal equilibrium with each other.[1]



a. **Scientific Explanation:** we consider two system A and B insulated from each other but in good thermal contact with a common system C. then, system A and B will attain thermal equilibrium with third system C.

b. **Quranic View:** In Quran, in verses [21:30]

أَوَلَمْ يَرَ ٱلَّذِينَ كَفَرُوٓا۟ أَنَّ ٱلسَّمَـٰوَٰتِ وَٱلْأَرْضَ كَانَتَا رَتْقًا فَفَتَقْنَـٰهُمَا ۖ وَجَعَلْنَا مِنَ ٱلْمَآءِ كُلَّ شَىْءٍ حَىٍّ ۖ أَفَلَا يُؤْمِنُونَ ٣٠

it is stated that

"Have those who disbelieved not considered that the heavens and the earth were a joined entity, and We separated them and made from water every living thing? Then will they not believe?"

Here, there is a talk of three bodied heavens means skies, earth, water. Let sky be body A, earth be B then water be C. Verses say have they not see th sky and earth become a joined entity where we are well known of their isolation by scientific proof. Further, verses say "we separated them " and again it explain that they made water to be a mediator to attended thermal equilibrium between them. This verse mix segment of cosmology and biology of the universe. It alluding to the initial stage of the skies and earth, when they all are single entity. With the reference to Edwin Hubble`s observation of the expanding universe that proved Russian mathematician Alexander Friedmann`s prediction in his solution to Einstein`s general theory of relativity, the universe is a homogeneous and isotropic universe that means single entity[3].

In Quran [41:11],

ثُمَّ ٱسْتَوَىٰٓ إِلَى ٱلسَّمَآءِ وَهِىَ دُخَانٌ فَقَالَ لَهَا وَلِلْأَرْضِ ٱئْتِيَا طَوْعًا أَوْ كَرْهًا قَالَتَآ أَتَيْنَا طَآئِعِينَ ١١

it is said that in early stage of formation of Earth, Sky and earth is not more than smoke and Creator (***Allah***) made them to come in harmony and function for a purpose.

A team of astronomers leaded by Michele Fumagail in Nov 2011 detect two clouds of gas that formed in the first few minutes after the big bang that created the universe. These two primordial clouds of gas contain no elements heavier than hydrogen and deuterium. These clouds condense to form the first stars. The new observation appear to match the theoretical prediction about the chemical makeup of the early universe. The discovery of the pristine gas clouds offers the scientific proof of the Quranic revelation of the primordial Smoke[3].

In Quran, in verses [21:31]

وَجَعَلْنَا فِى ٱلْأَرْضِ رَوَٰسِىَ أَن تَمِيدَ بِهِمْ وَجَعَلْنَا فِيهَا فِجَاجًا سُبُلًا لَّعَلَّهُمْ يَهْتَدُونَ ٣١

it is stated that

" and we made earth stabilize so that it would not tumble with you"

This shows Allah made earth thermally stable with human body that means two systems earth (system A) & Human body (system B) isolated with each other (works independently in view of mechanism) but made thermally be in equilibrium with each other on words of *Allah.*

The formation of Ocean made a the environmental conditions under which life first arose. With the help of verses 21:31 it is explain that how the earth made suitable environment for the human. Function of earth is to make environment and the purpose was for the human race. With the help of oxygen and carbon dioxide the photosynthesis process can able to complete which give a greatest support to human race.

B. First Law of thermodynamic:

Statement: when a certain amount of heat Q is supplied to a system, which does external work done W in passing from state 1 to state 2 , the amount of heat is equals to the sum of the increase in internal energy(U_2-U_1) of the system and the external work done by the system.[1]

$$Q= (U_2-U_1) +W$$

a. Scientific Explanation: Although the First law of Thermodynamic is based on the principle of conservation of energy of a system, which say "energy neither be created nor destroyed, only change from one form to another" and applicable to every process in nature between equilibrium states, it does not specify the condition under which a system can use energy to produce a supply of mechanical work.

b. Quranic View:

Quran say in verses [39:62]

وَجَعَلْنَا فِى ٱلْأَرْضِ رَوَٰسِىَ أَن تَمِيدَ بِهِمْ وَجَعَلْنَا فِيهَا فِجَاجًا سُبُلًا لَّعَلَّهُمْ يَهْتَدُونَ ﴿٣١﴾

"*Allah* is the Creator of all things, and He is, over all things, Disposer of affairs."

Allah created everything in the universe. The process of creation has been long since prescribe as "creation from nothing". "Nothing" that is intangible (gayab) to us, that means we the human have no knowledge about it. This knowledge is with *Allah*. What and how, he is best to know about it.

Quran say in verses [20:98]

إِنَّمَآ إِلَٰهُكُمُ ٱللَّهُ ٱلَّذِى لَآ إِلَٰهَ إِلَّا هُوَ ۚ وَسِعَ كُلَّ شَىْءٍ عِلْمًا ﴿٩٨﴾

"Your god is only Allah, except for whom there is no deity. He has encompassed all things in knowledge."

Quran say in verses [42:12]

لَهُۥ مَقَالِيدُ ٱلسَّمَٰوَٰتِ وَٱلْأَرْضِ ۖ يَبْسُطُ ٱلرِّزْقَ لِمَن يَشَآءُ وَيَقْدِرُ ۚ إِنَّهُۥ بِكُلِّ شَىْءٍ عَلِيمٌ ﴿١٢﴾

"With Him are the keys of the sky and earth. He enhance or restricts the sustenance to whom He pleases. Verily He has full knowledge of everything"

The first law of the thermodynamic concentrated on the conservation of energy not on creation and source of it origin. The aspect of existence of energy leads to the question as to how it originated in first place.

One of the most interesting, inspiring and contemporary problems in Astronomy, is Dark Matter, which was introduced by Zwicky (1933). In simple word this issue can be explain as follows: if we try to study the universe, we will see that the total visible mass present in it, is not enough to create require gravity to keep stable the stellar system it is made of, like galaxy and clusters. Since, the block of universe are not damage means there should be special type of matter, which produce the missing required gravity for this stability. Astronomer assigned the name "Dark Matter" to this particular matter.

Dark Matter is present not only in galaxy clusters but also in individual galaxies even in the solar system. The presence of invisible matter in elliptical galaxies was confirmed by studying the hot gas and the existence of x-ray emission (Johnson *et al.* 2009; Das *et al.* 2010). The actual density of the luminous matter in the universe is just a few percent of critical density ρ_c (which is density of matter require to expand the universe.), that shows 90% of universe has non luminous matter[4]. The existence of the invisible matter with such huge amount shows intangible entity, whose knowledge is not with us but proven to kept the stability in the energies and work done of universe and hold the First law of Thermodynamic.

Every component was exists from the beginning of universe inform of intangible entity to which Allah said "Be" it turn into the required formed.

In Quran, verses [2:117]

بَدِيعُ ٱلسَّمَٰوَٰتِ وَٱلۡأَرۡضِۖ وَإِذَا قَضَىٰٓ أَمۡرٗا فَإِنَّمَا يَقُولُ لَهُۥ كُن فَيَكُونُ ﴿١١٧﴾

“Originator of the heavens and the earth. When He decrees a matter, He only says to it, "Be," and it is.”

II. CONCLUSION

It is with the help of cognition of the ideas and finding, the man justifies its hypothesis. The Quran is viewed as religious text by the world and its area of observation is around the Islam. This thought limited the scope of Quran. In view of Quran, this paper is one of infinitesimal effort to prove the relation between Laws of nature and Quranic perspectives. Science has divided the world of knowledge in to two parts- knowledge of the things and knowledge of the truths. According to this division, science has confined its study only to a part of the world. This means that science being confined in its scope to the physical aspect of the world. Science try to find how the objective world function not why its functions. There are several verses of scientific significance in the Quran. These verses give very useful hints about certain aspect of the physical world such as its origin, structural components and organization. This shows that Quran objective is not confined to just on functionality but also give the knowledge of the origin and purposes of its function. If we add these two different fields of study, we can study the quest to find the absolute truth.

III. REFERENCES

[1]. Brij lal, N. Subrahmanyam, Heat Thermodynamics and Statistical Physics, S Chand, 3th eidition,p.g.109.

[2]. Arthur Beiser, Shobhit Mahajan, S Rai Choudhury, Modern Physics, McGraw Hill Education (India) Private Limited, 6th Edition(2009), ISBN: 9780070151550,p.g. 563

[3]. Prof. P.A.Wahid, The Quran Scientific Exegesis, Adam Publishers (2015), ISBN-10: 8174357440.

[4]. Fumagalli, John M. O'Meara, J. Xavier Prochaska . Detection of pristine gas two billion years after the big bang. Science(2011) DOI:10.1126/science.1213581.

[5]. Quran

[6]. Wahiduddin Khan, Faith and Reason. (2012). In Islam rediscovered(pp. 24-31). New delhi: Goodword.

Sr.No.	Name	Class	ID	Category	Level	Title
1.	Miss. Momin Aayesha Mohammad Arif	S.y.Bsc	3189	C1 &C3	U.G.	**Thermodynamics Laws of Physics in light of Quran**
2.	Miss. Rangari Rubina Alauddin	S.y.Bsc	3195	C1 &C3		

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