Proceedings of the Two Day National Seminar on

# Impact of Scientific Advances On Society (ISAS-2015)

on 18th & 19th August 2015

Editor-in-Chief
Dr. Mala Das Sharma

Sponsored by

Indian Institute of Geomagnetism
Mumbai

Organized by
Department of Physical & Life Sciences
ST.PIOUS X DEGREE & P.G.COLLEGE FOR WOMEN
(Accredited by NAAC with "A" Grade)
Snehapuri Colony, Nacharam, Hyderabad-500 076

**International E – Publication**

www.isca.me ,www.isca.co.in

# PROCEEDINGS OF THE NATIONAL SEMINAR ON IMPACT OF SCIENTIFIC ADVANCES ON SOCIETY, ISAS-2015

**St. Pious X Degree & PG College for Women, Nacharam, Hyderabad-500076, INDIA**

**Editor-in-Chief: Dr. Mala Das Sharma**

**2015**

**International E - Publication**

**www.isca.me ,www.isca.co.in**

# International E - Publication

427, Palhar Nagar, RAPTC, VIP-Road, Indore-452005 (MP) INDIA
Phone: +91-731-2616100, Mobile: +91-80570-83382
E-mail: **contact@isca.co.in**, Website:**www.isca.me** , **www.isca.co.in**





**ISBN: 978-93-84648-95-4**

# Organizing Committee

## Chief Patron

Dr.Sr.U.Nirmala, Director

## Patron

Sr.G.Manikyam, Principal

## Convener

Dr.Mala Das Sharma HOD, Chemistry

## Co-coordinators

Dr.Komala HOD, Physics

Ms.C.Vanisree, HOD,Biochemistry

## Members of organizing committee

Dr.Sudha swaraga

Dr.Sangeetha lakshmi

Dr. Sangeetha

Mrs.Apama

Mrs.Hymavathi

Ms.K.Srilakshmi

Mrs.Sasi balaji

Ms.V.Rani Padmini

Ms.Z.Anjana

Mrs.Soniya manthri

Ms.Paleena

Ms. K. Nagamani

# Foreword

During the last two decades the world has seen tremendous advancement in the research areas of science, in general, with special emphasis on certain areas that include space, communication, medical, pharmaceutical, biological and material sciences. We, the Indians, are also involved in this mission in a big way. As an educational institute of repute within the twin cities of Hyderabad and Secunderabad, it has always been our endeavour to educate ourselves and our students with the recent advancements in the field of science and technology. A look back into our earlier organized seminar/workshop since 2005 onwards clearly brings out as to how the college is striving to make an effort towards familiarizing the students about the thrust areas of research in different fields. The present national seminar on "Impact of Scientific Advances on Society" is also organized with the same broad objective. Further, such platform provides us (both teachers and students) an excellent opportunity to interact, exchange ideas and information, and possibly work together on the topic of mutual interest.

This time we are delighted to release the proceedings of the seminar with an ISBN generated by the International E-Publication (Registered publisher under MHRD, Government of India). The proceeding volume comprise of four abstracts of the invited talk and twenty-seven full length papers contributed by the faculty and research scholars of different institutes. We received blessings in the form of messages from several renowned personalities.

We offer our sincere thanks to Dr. Ch. Mohan Rao, Director, CCMB, Hyderabad for accepting invitation to inaugurate this national seminar as the Chief Guest and agreeing to deliver the keynote address. We express our gratitude to Prof. D. S. Ramesh, Director, IIG, Mumbai for making our dream into reality by sponsoring this national seminar. We are also thankful to all the invited speakers and other researchers, who have contributed their research findings for the proceeding volume. We have provided the e-mail Ids of the authors to facilitate communication between readers and authors.

We sincerely hope that the seminar would inspire many young student participants for preferring a career in research and excel in their respective areas to fulfil the very purpose of organizing this seminar.

Mala Das Sharma, R. Komala and C. Vanisree

Editorial Team

भारतीय भूचुम्बकत्व संस्थान
(विज्ञान एवं प्रौद्योगिकी विभाग, भारत सरकार के अंतर्गत एक स्वायत्त निकाय)
कलम्बोली हायवे, न्यू पनवेल, नवी मुंबई - 410 218

INDIAN INSTITUTE OF GEOMAGNETISM
(AN AUTONOMOUS BODY UNDER THE DEPT. OF SCIENCE & TECHNOLOGY, GOVT. OF INDIA)
KALAMBOLI HIGHWAY, NEW PANVEL, NAVI MUMBAI - 410 218

**Dr. D. S. Ramesh**
**Director**

## MESSAGE

The theme of your seminar is truly relevant today. It vividly reflects the pains and gains our ancient society is undergoing now, under the constant glare of science, leading to its rapid transformation like never before. I congratulate you all for conceiving such a contemporaneous topic for deliberations during your two-day seminar as it touches all our lives in more than one way. Invention of "zero" by the Indians stimulated a paradigm shift in our world view of everything, both tangible and transcendental. Such ancient spirit of inquiry by the Indians paved way later to the development of science in the western world, which dominates and perhaps affects all our lives deeply today. Discoveries and inventions associated with modern science and times, however serendipitous they could be, have been harnessed by mankind in the recent past. Whether this is for the betterment of humans or otherwise is certainly the focal point of debate in academia and various public fora. This debate is essentially spurred by noticing rapid changes in the external/physical environment around us and by way of experiencing incomprehensible inward changes within us in a very short time-span. The moot question is "are these induced by Science and how they impact our lives". It is important to ponder and learn how to live in tandem with both the inside and outside worlds under the sustained impact of modern science. After all, the modern dictum is 'survival of the fittest'.

I wish the seminar every success and hope the participants would enrich their lives through this unique experience.

D. S. Ramesh
**DS Ramesh**

27 July 2015

Post Box No. 105 | फैक्स FAX 022-27480762 | ई-मेल E-MAIL postmast@iigs.iigm.res.in | टेलीफोन PHONE 27484000

*Dr. R. Sayanna*
**Professor & Head**

**Department of Physics**
**University College of Science**
**Osmania University**
**Hyderabad - 500 007**
**Tel Off : 91-040-27682242 Ext :-134**
**Email ID: rsayanna@gmail.com**

**Dt : 30-07-2015**

## MESSAGE

I am very happy to know that Departments of Physical and Life Sciences, St.Pious X Degree and PG College For Women is organizing a two day National Seminar On "Impact of Scientific Advances On Society" (SAS-2015) 18th and 19th August, 2015.

The seminar is for introducing the budding scientists to the advancement of science and technology in the fields of communication systems, astronomy, semiconductor devices, automobiles, electronic devices of daily usage, bio electronic devices or medical sciences. I am given to understand that the seminar aims at familiarizing the young students about the recent significant discoveries and the thrust area of research in different fields of physical and life sciences and sensitizing the students about the fast pace of development in the emerging research frontiers from the experts of various fields.

I am sure this initiative of the St.Pious X Degree and PG College For Women will lead to the future road map of young brains paving a way for their future academic achievements. I extend my best wishes and greetings to organizers and participants and wish the seminar good luck and great success

**Prof. R. Sayanna**

*Prof. L. Nalanda Sharada*
M.Sc., Ph.D. (Osm.)
Head
Department of Chemistry

Date : 3·8·2015

# Message

I am extremely happy to note that the physical and life science department of St.Pious X Degree & PG College for Women is organizing a two day national Seminar titled **"Impact of Scientific Advances on Society"** –ISAS2015 on 18th and 19th August 2015.

These type of conferences will not only improve the understanding but also help the Academic faculty ,govt . officials, Research scholars and industry leaders in getting exposure to lattest improvements in the field of science and technology.

I am sure this National Conference provide a common platform for chemists & Biologists to have discussion on the advancements in the research of chemical and life sciences and teaching as well. The conference will facilitate the interaction between researchers and academicians for research collaborations and also encourage students and young scientists for the pursuit of professional careers in physical and life sciences.

I wish the Organiziing committee and participants of this conference all success and congratulate the orgsnizers on this occasion.

L Nalanda

( Prof.L.Nalanda Sharada)

# DEPARTMENT OF BIOCHEMISTRY

University College of Science, Osmania University, Hyderabad – 500 007.
Tele (O): +91-040-27097044 / 040-27682245, e-mail: **headbiochemistry@osmania.ac.in**
hodbiochemistryou@gmail.com, Website: www.osmania.ac.in

**Prof. Ch. Venkata Ramana Devi**
Head & Convenor, Department of Biochemistry,
UCS, OU, Hyderabad – 500007


Dt: 05-08-2015.

## Message for the National Seminar

It gives me immense pleasure to know that the departments of Physics, Chemistry and Biochemistry nof St.Pious X Degree and PG College for women are jointly organizing a two day national seminar on the topic " ***Impact of Scientific Advances on Society***" on 18th and 19th August,2015.

Scientific research should always aim at making the society more conducive and a better place to live in by applying the novel scientific methods and advanced technology.

Today's youth are tomorrow's responsible citizens of our nation. Hence the prime responsibility of the teaching fraternity is to inculcate the spirit of scientific aptitude in their minds and create a platform for them to interact with the stalwarts of the scientific community.

I appreciate and congratulate the efforts of the management , the heads of the departments and the staff of St.Pious X Degree and PG College for organizing the two day national seminar and helping the young minds to become aware of the scientific advancements.

My best wishes to the organizers for a successful seminar.

Ch. Venkata Ramana Devi
Head - Dept
OU.

# ST. PIOUS X DEGREE & PG COLLEGE FOR WOMEN

**Accredited with 'A' Grade by NAAC**
Affiliated to Osmania University

Snehapuri Colony, Nacharam, Hyderabad - 76
Tel : 040-27175786, 27175600 Fax : 040-27178233

Email : stpiouscollege@yahoo.co.in
Visit Us : www.stpiouscollege.org


Date : 12th August,2015

## Principal's Message

Science has historically been solving mankind's problems ! with the evolution of scientific observation and with the aid of technology, the scientists discovered the effective means to address out present and future challenges.

Imparting scientific knowledge among the young population making them aware of the significant research carried out and the invention, innovation and scientific knowledge will surely lead to an increased participation in improving their scientific aptitude,

A program that provides an exceptional leading opportunity for young minds seeking to further their knowledge and depth of scientific Advancement & its impact on Society would help develop interest & greater thrust about Science and technology and their application to daily life.

One of the objectives of the college is to empower women through knowledge and information and to foster scientific aptitude and to promote professional and technological expertise. This two day National Seminar on **" Impact of Scientific Advances on Society"** on **18th & 19th August,2015** is a positive step towards this. I congratulate the department of Physics , Chemistry & Biochemistry for their perseverant and meticulous efforts that they have put in organizing the seminar.

I hope the deliberations expressed by the professional experts during the seminar would help promote aptitude for further studies in Science and help them cope with challenges of the modern society.

Sr.G.Manikyam
Principal

# Title of articles with list of authors

## List of Invited Talks



## List of Contributed Papers

Proceedings of the National Seminar on
"Impact of Scientific Advances on Society", August 18-19, 2015, p.1-1
St. Pious X Degree & PG College for Women, Hyderabad-500076.

# Ionosphere Seismology - Anatomy of the 25 April 2015 Gorkha Earthquake

**Durbha Sai Ramesh***
*Indian Institute of Geomagnetism*
*Navi Mumbai-410218, India*
*dsramesh@iigs.iigm.res.in*

Earth and its near space environment consisting of the atmosphere and Ionosphere are coupled systems and therefore processes that operate in either domain largely influence the other. This can be both an opportunity and an obstacle based on the experiment designed to understand this coupling. The ionosphere is perhaps one of the most dynamic elements of such a vibrant system. The Ionosphere is affected by a variety of disturbances - e.g. severe magnetic storms, weather, volcanic eruptions, earthquakes etc. Therefore the forcing on the ionosphere can be of varied origin - from above (solar) and below (lithosphere). For example, disturbances that nucleate from below, follow the mechanical or chemical pathways to propagate into the ionosphere to interact with the ionised gas and alter the electron density there. Exponential decrease of atmospheric density with altitude results in anomalous amplification of these upward propagating waves (disturbances) by a factor $10^5$ - $10^6$ following the requirement of energy conservation. Thus even mm - cm scale disturbances in the neutral atmosphere and ground level become observable at ionospheric altitudes. This characteristic property is exploited to monitor earthquakes from Space using tools such as Global Positioning System (GPS) and Synthetic Aperture Radar Interferometry (InSAR).

Earthquake related vertical and horizontal surface displacements induce infrasonic pressure waves in the vicinity of neutral atmosphere and travel as acoustic gravity waves to perturb total electron content (TEC) in the ionosphere. Similarly, horizontally propagating surface waves (e.g. Rayleigh wave) also effect the TEC. The ionospheric disturbances triggered by earthquakes are called coseismic ionospheric disturbances (CIDs). Deploying dense networks of GPS, variations in TEC induced by CIDs are recorded. The TEC can therefore act as proxies to ionospheric disturbances excited by earthquakes. From these observations several characteristics of the earthquakes can be distilled in a refined manner compared to ground based instrumentation such as the seismometers. This in essence is the emerging field of “Ionosphere Seismology”. Further, Space based observation tools add a new dimension to earthquake precursory research that is hitherto unexplored by seismologists to realise its potential. In this context, some fresh insights related to the recent Gorkha (Nepal) earthquake are presented here.

However, the challenge is to unambiguously recognise and associate variations in measured TEC values to earthquakes occurrence rather than other competing candidate forcings from above and below.



Sponsored by the Indian Institute of Geomagnetism, Navi Mumbai-410218 (DST, Govt. of India)

Proceedings of the National Seminar on
"Impact of Scientific Advances on Society", August 18-19, 2015, p.2-2
St. Pious X Degree & PG College for Women, Hyderabad-500076.

# Seismological images and xenolith P-T modelling for diamond exploration: a combined tool for demarcation of target areas

**Subrata Das Sharma***
*National Geophysical Research Institute*
*(Council of Scientific & Industrial Research)*
*Uppal Road, Hyderabad-500007, India*
**sdassharma@ngri.res.in*

Geophysical signatures per se are of extreme value. However, their interpretation needs to be supported by relevant geological, geochemical and geochronological results in order to reduce the ambiguity associated with the evolution of a region. Understanding the tectonic make up of an area through study of surface geological features together with depth information on the nature of the underlying lithosphere forms the key to diamond exploration strategy. Although diamonds have been reported from the Indian craton for many centuries, search for their carrier rocks dates back only to the beginning of 20th century. This study focuses on a wide area in southeast India, parts of which are bestowed with both diamondiferous and non-diamondiferous source rocks like the kimberlites and lamproites.

Using special processing techniques for analyzing earthquake data, called the Ps (SV and SH) and Sp receiver function techniques, we recover depth images of the lithospheric mantle beneath southeast India encompassing a wide region. These images reveal presence of two significant velocity anomalies of contrasting nature at different depths beneath the study region. High velocity features are observed between 160 and 220 km depth (popularly known amongst the geophysicists as the Lehmann discontinuity or L-boundary) while a complex low velocity contrast layer (LVZ) is delineated at ~ 80-100 km depth. Analyses of results from several other studies that include regional geology, geophysics, geochemistry, and geochronology allow us to infer that the positive velocity contrasts at L-boundary represent preserved oceanic remnants of a ~1.6 Ga old paleosubduction event in southeast India. Computations of pressure-temperature data on suitable rocks (called mantle xenoliths) in conjunction with multiple evidences presented in this study argue that the craton beneath southeast India is underlain by a thick lithospheric root/keel in excess of 200 km. This suggests an environment conducive for diamond stability. Our transverse component receiver functions (SH) bear remarkable similarity in shallow mantle stratification with that of the kimberlite bearing Slave craton in Canada, which has confirmed presence of diamonds accompanied by a thick lithospheric keel.

The results obtained from this study together with several other lines of evidences collectively reaffirm that the shield areas/cratons beneath southeast India have deep keels associated with low geothermal gradient which are indeed the potential regions where the diamond crystals remain stable. Such a P-T environment is referred in the literature as the diamond 'storage area'. Wide regions covering the Godavari graben and adjoining areas, besides a few others, are identified as potential zones for diamond exploration endeavours. Initiation of concerted efforts in these regions might prove extremely rewarding. Search for new indicator minerals that are stable within the stability field of diamond and dominantly defined by subduction related process that possibly operated over an area in excess of $2 \times 10^5$ km$^2$ holds the key to realize the unrealized potential of the study region in terms of diamond exploration.



Sponsored by the Indian Institute of Geomagnetism, Navi Mumbai-410218 (DST, Govt. of India)

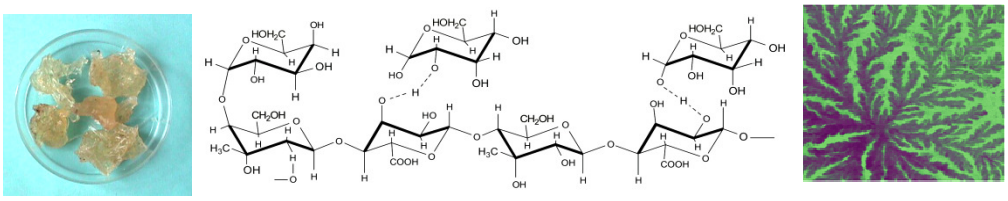
Proceedings of the National Seminar on
"Impact of Scientific Advances on Society", August 18-19, 2015, p.3-4
St. Pious X Degree & PG College for Women, Hyderabad-500076.

# Biopolymer based nanobiocomposite materials and its biological applications

**B. Sashidhar Rao***
*Department of Biochemistry, UCS*
*Osmania University, Hyderabad-500007, India*
**sashi_rao@yahoo.com*

Nanotechnology is a branch of science and technology that deals with materials having dimension less than 100 nm. The term *nano* originated from the Greek word ' *nanos'* which means 'dwarf'. The definition of a nanoparticle is an aggregate of atoms bonded together with a radius between 1 and 100 nm. Hence, nanoscience deals with very small (one billionth of a meter) objects that have a wide range of applications in various fields such as electronics, optical communications, agricultural, food and biological systems, especially as biosensors, antimicrobials, catalysts, drug delivery and other biomedical areas. Their physical properties, huge surface area and small size offer numerous functionalities. It is pertinent to note that Richard P. Feynman (Nobel Laureate in Physics, 1965) is often credited for introducing the concept of nanotechnology about five decades ago.

Gum kondagogu (GK) is a naturally occurring biopolymer which is a non-toxic exudate gum obtained from the bark of *Cochlospermum gossypium*, a native tree of India. This native Indian gum is collected by the tribals from the forests of Andhra Pradesh state, which is one of the major gum producing centers in India and marketed through Girijan Co-operative Corporation Ltd., Visakhapatnam. It has a potential application as food additive and drug delivery matrix. Recently, it has been successfully employed in the green synthesis metal based nanobiocomposite material with variety of biological applications.

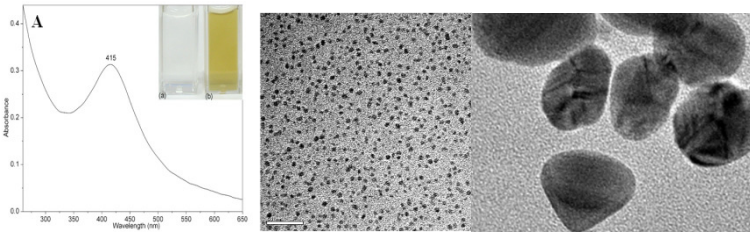


Gum specimen, its assigned structure and TEM image showing highly branched structure

This biopolymer has unique physiochemical properties as compared to other tree gums. Proximate analysis of the gum indicates that it has high volatile acidity and water-binding (hydrogel property) capacity. Gum kondagogu is an acidic gum with high content uronic acid and the major functional groups identified in the gum are hydroxyl, acetyl, carbonyl and carboxylic groups. The *zeta* potential of native gum was determined to be –23.4 mv, indicating that it contains negatively charged groups. The native gum shows the presence of -OH, $CH_3CO$-, -COO-, -C = O and $CH_3CO$-, functional groups. Based on the spectroscopic characterization, the probable structural feature assigned to gum kondagogu was (1 →2) β -D-Gal *p*, 1 → 3)β-D-Gal *p*, (1→6)- β -D-Gal *p*, (1 → 4) β-D-Glc *p* A, 4-0-Me- α -D-Glc *p* A, (1 → 2) α-L-Rha (*rhamnogalacturonan* type of gum).



Sponsored by the Indian Institute of Geomagnetism, Navi Mumbai-410218 (DST, Govt. of India)




Green synthesis (spectra of nanosilver) and silver nanoparticles (TEM images)

The elucidation of the structural aspects and its physico-chemical properties has paved the way for exploiting this biopolymer as a matrix for green synthesis of metal nano-composite materials with application s as (i) antimicrobial agents (ii) mercury biosensor (iii) nano-metal based catalysis (iv) nano-metal based enzyme mimic and (v) drug delivery matrix with relevance in nanomedicine.

In the present scenario, nanotechnology has profoundly impacted, both the economy and society, which is comparable to that of semiconductor technology, information technology, or cellular and molecular biology developed in the earlier times. The possible benefits that can be obtained from nanoscience and technology appear to be almost endless. Many of these dreams may be realized in the near future.



Sponsored by the Indian Institute of Geomagnetism, Navi Mumbai-410218 (DST, Govt. of India)

Proceedings of the National Seminar on
"Impact of Scientific Advances on Society", August 18-19, 2015, p.5-5
St. Pious X Degree & PG College for Women, Hyderabad-500076.

# Understanding Pharmaceutical Quality by Design

**Subramanian S. Iyer***
*Mylan Laboratories Ltd.*
*Hyderabad, India*
**iyer_subramanian@hotmail.com*

"Quality by design (QbD)," although a new concept to the pharmaceutical industry, has been in existence for quite a few years, extensively applied in the automotive, the semiconductor, and the petrochemical industry. QbD fundamentally means building Quality in. The implementation of QbD principles provides a cost-efficient approach to delivering high quality medicines for patients. It is a risk management and science-based approach promoted by the United States Food and Drug Administration to enhance pharmaceutical development throughout a product's life cycle. The endeavor of the presenter is to give an overview of the QbD elements and its likely benefits to Indian pharmaceutical industry.



Sponsored by the Indian Institute of Geomagnetism, Navi Mumbai-410218 (DST, Govt. of India)

Proceedings of the National Seminar on
"Impact of Scientific Advances on Society", August 18-19, 2015, p.6-10
St. Pious X Degree & PG College for Women, Hyderabad-500076.

# Impact of scientific advances on floristic diversity of Peddagattu–Sherepally area, a proposed site for uranium project, Nalgonda district, Telangana State, India

**A. Baleeshwar Reddy[1], V. Vasudeva Rao[2] and A. Vijaya Bhasker Reddy[1,*]**

*[1]Department of Botany, Osmania University, Hyderabad-500 007, Telangana State, India*
*[2]AINP on Vertebrate Pest Management, Prof. Jayashankar Telangana State Agricultural University, Rajendranagar, Hyderabad- 500030, Telangana State, India*
*[*]avijayabhaskerreddy@gmail.com*

## ABSTRACT

The study was carried out in order to explore the existing floristic composition in Pedagattu- Sherepally area, Nalgonda district, Telangana state, which is a proposed site for uranium project. The study area harbours 464 species under 324 genera and 86 families. Of the total 464 species, dicotyledons are represented by 373 species belonging to 258 genera under 70 families and 89 monocotyledon species belonging to 64 genera and 14 families. Habit-wise analysis showed that herbs are the most predominated species followed by shrubs, trees, aquatic forms and climbers. The family Poaceae is the dominated family followed by Fabaceae, Asteraceae, Caesalpiniaceae, Euphorbiaceae and Acanthaceae. The present study collected a total 21 endemic species belonging to 19 genera and 12 families and total of 83 medicinal plant species belonging to 43 families and 73 genera were recorded. The flora of the study area would be affected and altered in case the proposed site for uranium project comes to exist.

*Keywords*: Species richness, generic coefficient, uranium projects

## 1. INTRODUCTION

Power generation is an essential pre-requisite for establishment of a strong industrial base and infrastructural development. In this regard, availability of nuclear fuel, in the wake of over stress on other power resources, for continuous production of nuclear energy is a crucial and essential factor. Uranium Corporation of India Limited (UCIL) is undertaking mining and processing of Uranium ore on large scale and it is expanding its operation in Nalgonda District of Telangana state, which is endowed with huge uranium deposits. Jaduguda in Singhbhum Thrust Belt (in the state of Jharkhand) is the first uranium deposit to be discovered in the country in 1951 [1]. This discovery of uranium at Jaduguda in this belt paved the way for intensive exploration work and soon a few more deposits were brought to light in this area [1]. Some of these deposits like Bhatin, Narwapahar and Turamdih are well known uranium mines of the country. Apart from discoveries in the Singhbhum Thrust Belt, several uranium occurrences have also been found in Cuddapah basin of Andhra Pradesh and Telangana. These include Lambapur-Peddagattu, Chitrial, Kuppunuru, Tumallapalle, Rachakuntapalle which have significantly contributed towards the uranium reserve base of India.

Uranium processing plant has been planned in Sherepally area, Nalgonda district to treat the ore of Lambapur-Peddagattu mines. The plant site is about 54 km away from Lambapur area as there are some environmentally sensitive places around the mine site. The design philosophy of this plant is similar to the processing practices proposed at Turamidh plant. Latest equipment and degree of instrumentation similar to the ones proposed at Turamdih, will also be adopted in Sherepally plant [1]. However, the sizing of these equipment and provisions of flexibility to allow alternate Processing technology to accommodate unexpected ore characteristics will be the vital aspects for Sherepally plant [1].

Floristic study is need for sustainable development activities for any area. In floristic diversity, the concept of species richness is one of the oldest and most fundamental concepts [2] that was first coined by McIntosh [3]. Species richness can refer to the number of species present in a given area or in a given sample, without considering the number of individuals examined in each species [4]. Species richness can be numerical [5] or be related to species density in an area [6]. Species richness is the simplest way to describe community and regional diversity [7], and this variable i.e. number of species, forms the basis of many ecological models of community structure [8-10].

Biodiversty measures (species diversity and species richness ) have been widely used as indicators of ecosystem status, and play a critical role in studies dealing with the assessment of human impact on ecological systems [11]. However, since the biodiversity of any ecosystem is far too complex to be comprehensively quantified, suitable indicators [12] or surrogates [13] of biodiversity are needed. Conceptually, species richness appears as the most intuitive and straightforward parameter to measure biodiversity [14]. Nonetheless, for several reasons, to determine the true species richness of a community is not an easy task [15]. Hence, in the present study different non-parametric species richness estimators are used to



Sponsored by the Indian Institute of Geomagnetism, Navi Mumbai-410218 (DST, Govt. of India)

estimate the true number of species found in Peddagattu-Sherepally area, a proposed site for uranium projects.

## 2. MATERIALS AND METHOD

The study area is lying between 16°25' to 17° 00' N latitude and 78°40' to 79° 30' E longitude is having an area 4781.35 sq. km (Fig. 1). The annual rainfall varies between 56 and 62 cm with the annual mean temperature is $34^0$C. Physiographically Peddagattu consists of flat topped hills composed of Proterozoic sediments. The rocky exposures at the bottom of the hills generally are composed of granitic rocks.

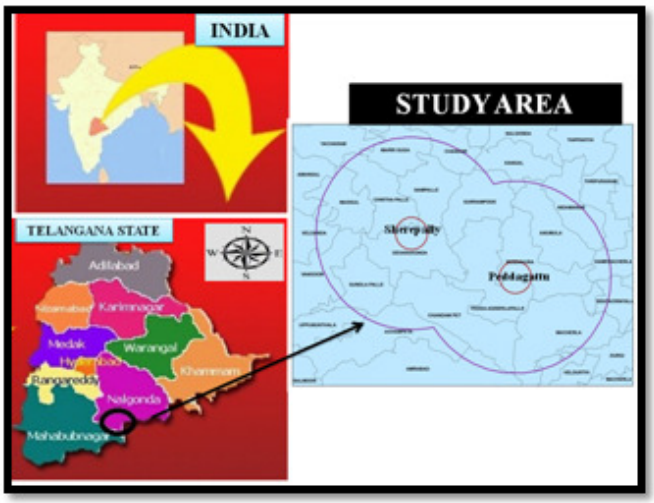



**Figure 1.** *Location map of the study area.*

The field work was carried out from April 2010 to December 2013. Floral exploration trips were regularly conducted on pre and post monsoon seasons. The specimens were identified from their key vegetative and reproductive features using the Flora of Nalgonda district [16], Flora of Guntur district [17] and Flora of the Presidency of Madras [18]. The plant species collected were processed and mounted on herbarium sheets. The collected specimens were pressed and deposited at Deccan regional center, Botanical Survey of India (BSI), Hyderabad.

## 3. RESULTS AND DISCUSSION

The investigation was carried out in ordered to explore the existing floristic composition in Pedagattu-Sherepally area, Nalgond district during 2010-2013 for period of 3 years. The vegetation was arid to semiarid and dry deciduous, thorny scrub type. Floristic analysis of Peddagattu - Sherepally, Nalgonda district reveals a total of 464 species belonging to 324 genera and 86 families. Of the total 464 species, dicotyledons are represented by 373 species belonging to 258 genera under 70 families and monocotyledons by 89 species belonging to 64 genera and 14 families. Family wise dicot/ monocot ratio was 5, genera wise dicot/ monocot ratio was 4.03 and species level it was found to be 4.19 (Table 1). The present study showed that the generic coefficient was 69.82, and revealed the study area was moderately to rich species diversity. Habit wise analysis shows that herbs predominated with represented by 239 species (51%) followed by shrubs 100 species (22%), trees 89 species (19%), aquatic forms 24 (5%) and climbers 12 species (3%) (Table 2 and Fig. 2).

**Table 1.** Species richness of dicotyledons, monocotyledons and pteriodophytes in the study area

| Group | Species | Genera | Families |
|---|---|---|---|
| Dicotyledons | 373 | 258 | 70 |
| Monocotyledons | 89 | 64 | 14 |
| Pteridophytes | 2 | 2 | 2 |
| Total | 464 | 324 | 86 |
| Dicot/Monocot ratio | 4.19 | 4.03 | 5 |

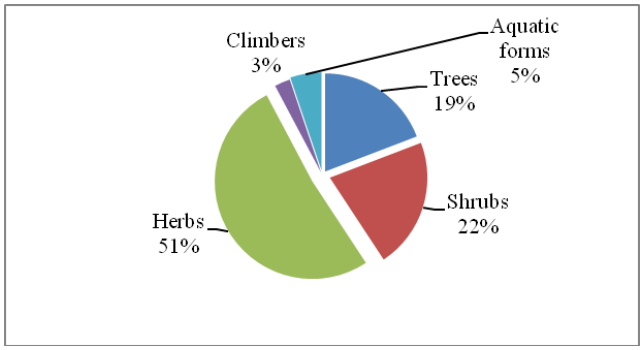



**Figure 2.** *Habit-wise distribution at Peddagattu-Sherepally area, Nalgonda district.*

**Table 2.** Floristic richness at Peddagattu–Sherepally area, Nalgonda district, Telangana State

| S. No | Family Name | T | S | H | C | A | No. of species | No. of genera |
|---|---|---|---|---|---|---|---|---|
| 1 | Acanthaceae | | 7 | 11 | | | 18 | 11 |
| 2 | Aizoaceae | | | 5 | | | 5 | 3 |
| 3 | Alangiaceae | 1 | | | | | 1 | 1 |
| 4 | Amarantha-ceae | | 1 | 10 | | | 11 | 10 |



Sponsored by the Indian Institute of Geomagnetism, Navi Mumbai-410218 (DST, Govt. of India)

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 5 | Amaryllida-ceae | | 1 | 1 | | | 2 | 2 |
| 6 | Anacardia-ceae | 2 | | | | | 2 | 2 |
| 7 | Annonaceae | 3 | | | | | 3 | 2 |
| 8 | Apocyna-ceae | 4 | 4 | 2 | 1 | | 11 | 9 |
| 9 | Aponogeto-naceae | | | 1 | | | 1 | 1 |
| 10 | Araceae | | | | | 1 | 1 | 1 |
| 11 | Arecaceae | 3 | | | | | 3 | 3 |
| 12 | Aristolo-chiaceae | | | | 1 | | 1 | 1 |
| 13 | Asclepiada-ceae | | 8 | 2 | 1 | | 11 | 10 |
| 14 | Asteraceae | | 1 | 20 | | | 21 | 20 |
| 15 | Bignonia-ceae | 4 | | | | | 4 | 4 |
| 16 | Boragina-ceae | 3 | | 5 | | | 8 | 4 |
| 17 | Cactaceae | | 3 | | | | 3 | 2 |
| 18 | Caesalpinia-ceae | 11 | 7 | 3 | | | 21 | 11 |
| 19 | Cannaceae | | | 1 | | | 1 | 1 |
| 20 | Capparaceae | 1 | 3 | 7 | | | 11 | 4 |
| 21 | Caricaceae | 1 | | | | | 1 | 1 |
| 22 | Caryophyl-laceae | | | 1 | | | 1 | 1 |
| 23 | Casuarina-ceae | 1 | | | | | 1 | 1 |
| 24 | Celastraceae | | 1 | | | | 1 | 1 |
| 25 | Combreta-ceae | 2 | | | | | 2 | 1 |
| 26 | Commelina-ceae | | | 3 | | | 3 | 2 |
| 27 | Convolvula-ceae | | 2 | 10 | 1 | 1 | 14 | 5 |
| 28 | Cucurbita-ceae | | 1 | 7 | | | 8 | 8 |
| 29 | Cyperaceae | | | | | 13 | 13 | 6 |
| 30 | Ebenaceae | 2 | | | | | 2 | 1 |
| 31 | Euphorbia-ceae | | 9 | 10 | | | 19 | 9 |
| 32 | Fabaceae | 4 | 11 | 15 | 2 | | 32 | 20 |
| 33 | Gentiana-ceae | | | 1 | | | 1 | 1 |
| 34 | Hernandia-ceae | 1 | | | | | 1 | 1 |
| 35 | Hydrochari-taceae | | | | | 1 | 1 | 1 |
| 36 | Hydrolea-ceae | | | 1 | | | 1 | 1 |
| 37 | Lamiaceae | | 1 | 8 | | | 9 | 6 |
| 38 | Lauraceae | | | | 1 | | 1 | 1 |
| 39 | Lecythida-ceae | 1 | | | | | 1 | 1 |
| 40 | Liliaceae | | 1 | 4 | 1 | | 6 | 6 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 41 | Loganiaceae | 1 | | | | | 1 | 1 |
| 42 | Lorantha-ceae | | | | 1 | | 1 | 1 |
| 43 | Lythraceae | 2 | | 2 | | | 4 | 4 |
| 44 | Malvaceae | 2 | 7 | 6 | | | 15 | 9 |
| 45 | Marsilea-ceae | | | | | 1 | 1 | 1 |
| 46 | Meliaceae | 1 | | | | | 1 | 1 |
| 47 | Menisper-maceae | | 2 | | 2 | | 4 | 4 |
| 48 | Mimosaceae | 10 | 3 | 1 | | 1 | 15 | 8 |
| 49 | Moraceae | 4 | 1 | | | | 5 | 2 |
| 50 | Moringaceae | 1 | | | | | 1 | 1 |
| 51 | Musaceae | | 1 | | | | 1 | 1 |
| 52 | Myrtaceae | 3 | | | | | 3 | 3 |
| 53 | Nyctagina-ceae | | 2 | 2 | | | 4 | 3 |
| 54 | Nymphaea-ceae | | | | | 3 | 3 | 2 |
| 55 | Oleaceae | | 2 | | | | 2 | 2 |
| 56 | Onagraceae | | | 1 | | 1 | 2 | 1 |
| 57 | Pandanaceae | | 1 | | | | 1 | 1 |
| 58 | Papavera-ceae | | | 1 | | | 1 | 1 |
| 59 | Passiflora-ceae | | | | 1 | | 1 | 1 |
| 60 | Pedaliaceae | | 1 | 2 | | | 3 | 3 |
| 61 | Plumbagina-ceae | | 1 | | | | 1 | 1 |
| 62 | Poaceae | | 1 | 53 | | | 54 | 37 |
| 63 | Polygala-ceae | | | 5 | | | 5 | 1 |
| 64 | Polygona-ceae | | | 4 | | | 4 | 3 |
| 65 | Pontederia-ceae | | | | | 1 | 1 | 1 |
| 66 | Portulaca-ceae | | | 2 | | | 2 | 1 |
| 67 | Pteridaceae | | | 1 | | | 1 | 1 |
| 68 | Punicaceae | 1 | | | | | 1 | 1 |
| 69 | Rhamnaceae | 1 | 1 | | | | 2 | 1 |
| 70 | Rubiaceae | 2 | 1 | 4 | | | 7 | 6 |
| 71 | Rutaceae | 3 | 2 | | | | 5 | 5 |
| 72 | Salvadora-ceae | 1 | 1 | | | | 2 | 2 |
| 73 | Santalaceae | 1 | | | | | 1 | 1 |
| 74 | Sapindaceae | 1 | 1 | 2 | | | 4 | 3 |
| 75 | Sapotaceae | 2 | | | | | 2 | 1 |
| 76 | Scrophula-riaceae | | | 7 | | | 7 | 5 |
| 77 | Simaruba-ceae | 2 | | | | | 2 | 2 |



Sponsored by the Indian Institute of Geomagnetism, Navi Mumbai-410218 (DST, Govt. of India)

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 78 | Solanaceae | | 2 | 6 | | | 8 | 4 |
| 79 | Sterculia-ceae | 3 | 1 | 3 | | | 7 | 6 |
| 80 | Tiliaceae | | 4 | 3 | | | 7 | 3 |
| 81 | Typhaceae | | | | | 1 | 1 | 1 |
| 82 | Ulmaceae | 1 | | | | | 1 | 1 |
| 83 | Verbenaceae | 3 | 4 | 2 | | | 9 | 8 |
| 84 | Violaceae | | | 1 | | | 1 | 1 |
| 85 | Vitaceae | | | 2 | | | 2 | 1 |
| 86 | Zygophylla-ceae | | | 1 | | | 1 | 1 |
| | Total | 89 | 100 | 239 | 12 | 24 | 464 | 324 |

D- Dicots; M- Monocots; Pt – Pteridophytes; T- Trees; S- Shrubs; H- Herbs; C- Climbers; A- Aquatic forms

Of the total 464 species belonging to 86 families were found, the first top ten dominant families constitute 222 species (47.84%). Of these, Poaceae is the dominant family comprising 54 species (37 genera), followed by Fabaceae 32 species (20 genera), Asteraceae 21 species (20 genera), Caesalpiniaceae 21 species (11 genera), Euphorbiaceae 19 species (9 genera), Acanthaceae 18 species (11 genera), Malvaceae 15 species (9 genera), Mimosaceae 15 species (8genera), Convolvulaceae 14 species (5 genera) and Cyperaceae 13 species (6 genera) (Fig. 3). Poaceae and Fabaceae take the first and second position in the present study, similar results were observed in Nallamalais [19]. Fabaceae take first position in flora of Nalgonda district [17] and Guntur district [16] and Nagarjuna konda valley [20], while in present study it takes second position.

The remaining families Amaranthaceae, Apocynaceae, Asclepiadaceae and Capparaceae are represented by 11 species each, followed by Lamiaceae (9), Verbenaceae (9), Boraginaceae (8), Cucurbitaceae (8), Solanaceae (8), Rubiaceae (7), Scrophulariaceae (7), Sterculiaceae (7), Tiliaceae (7), Liliaceae (6), Aizoaceae (5), Moraceae (5), Polygalaceae (5), Rutaceae (5). Six families are represented by 4 species each, they are Bignoniaceae, Lythraceae, Menispermaceae, Nyctaginaceae, Polygonaceae and Sapindaceae and seven families are represented by 3 species each, they are Annonaceae, Arecaceae, Cactaceae, Commelinaceae, Myrtaceae, Nymphaeaceae and Pedaliaceae. 12 families are represented by 2 species (Amaryllidaceae, Anacardiaceae, Combretaceae, Ebenaceae, Oleaceae, Onagraceae, Portulacaceae, Rhamnaceae, Salvadoraceae, Sapotaceae, Simarubaceae and Vitaceae) and 33 families are only represented by a single species (Alangiaceae, Aponogetonaceae, Araceae, Aristolochiaceae, Cannaceae, Caricaceae, Caryophyllaceae, Casuarinaceae, Celastraceae, Gentianaceae, Hernandiaceae, Hydrocharitaceae, Hydroleaceae, Lauraceae, Lecythidaceae, Loganiaceae, Loranthaceae, Marsileaceae, Meliaceae, Moringaceae, Musaceae, Pandanaceae, Papaveraceae, Passifloraceae, Plumbaginaceae, Pontederiaceae, Pteridaceae, Punicaceae, Santalaceae, Typhaceae, Ulmaceae, Violaceae and Zygophyllaceae) (Table 2).

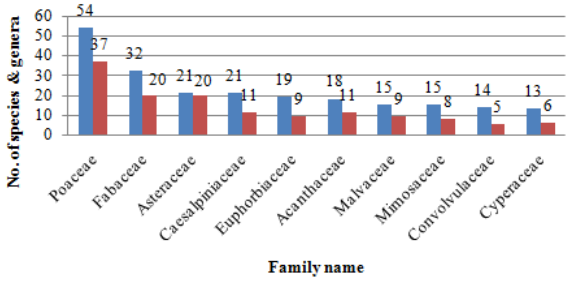



**Figure 3.** *Distribution of the top ten species richness families of Peddagattu-Sherepally area, Nalgonda district.*

The present study collected a total 21 endemic species belonging to 19 genera and 12 families. Among these Indian endemics, 21 taxa of flowering plants collected from the study area are endemic to Peninsular India, of which 3 species (*Alysicarpus mahabubnagarensis, Cleome viscosa* var. *nagarjunakondensis* and *Chrysopogon velutinus*) are restricted to Andhra Pradesh and Telangna state and among them, *Cleome viscosa* var. *nagarjunakondensis* is exclusive to the present study area collected at Nagarjunakonda. A total of 83 medicinal plant species belonging to 43 families and 73genera were recorded. Among the 83 reported species, Herbs (39 species), Shrubs (17 species), climbers (6 species) and trees (21 species) are used widely by local people to cure the disease.

## 4. CONCLUSION

The result in the present study shows that the flora is moderate to rich floristically, which may be attributed to its varied topography and variation in climatic conditions. The present study indicates that there are about 464 species belonging to 324 genera and 86 families. The study recorded a total of 21 different categories of endemic plants and 83 medicinal plants used by local people for curing different ailments. This area is under severe threat due various man-made reasons like using scientific advance technologies in general, and uranium mining in particular.



Sponsored by the Indian Institute of Geomagnetism, Navi Mumbai-410218 (DST, Govt. of India)

**REFERENCES CITED**

1. Gupta, R. and Sarangi, A.K., *IAEA symposium on Uranium production and raw materials for the nuclear fuel cycle-supply and demand, economics, the environment and energy security*, 2005, Vienna.
2. Peet, R.K. *Annual Review of Ecology and Systematics,* 1974, v. 5, p. 285-307.
3. McIntosh, R.P., *Ecology,* 1967, v. 48, p. 392–402.
4. Hamilton, A.J., *Journal of Environmental Management,* 2005, v. 75, p. 89–92.
5. Hurlbert, S.H., *Ecology,* 1971, v. 52, p.577–586.
6. Simpson, G.G., *Systematic Zoology*, 1964), v. 13, p. 57-73.
7. Magurran, A.E., *Ecological diversity and its measurement*, 1988, Chapman and Hall, London.
8. Mac Arthur, R.H. and Wilson, E.O., *The theory of island biogeography*, 1967, Princeton University Press, Princeton.
9. Connell, J. H., *Science,* 1978, v. 199, p. 1302-1303.
10. Stevens, G.C., *American Naturalist,* 1989, v. 133, p. 240-256.
11. Leitner, W. and Turner, W.R., *Ecyclopedia of biodiversity*, edited by Levin S.A., 2001, p. 123-144, Academic Press, Princeton.
12. Duelli, P. and Obrist, M.K., *Agriculture Ecosystem and Environment,* 2003, v. 98, p. 87-98.
13. Sarkar, S., *The Monist,* 2002, v. 85, p. 131-155.
14. Gotelli, N. and Colwell, R.K., *Ecology Letters*, 2001, v. 4, p.379–391.
15. Magurran, A.E., Measuring biological diversity, 2004, Blackwell Science Ltd.
16. Rao, P.N., Raghava Swamy., Pullaiah. T., *Flora of Nalgonda District, Andhra Pradesh*, 2001, Shipra Publication, Delhi.
17. Pullaiah, T., Ramakrishnaiah, V., Sadhya Rani, S. and Rao, P.N., *Flora of Guntur District, Andhra Pradesh, India*, 2000, Regency Publications.
18. Gamble, J.S. and Fischer, C.E.C., *Flora of the Presidency of Madras* (1915-1935).
19. Sudhakar Reddy. C, Thulsi Rao, Siva Rama Krishna, I. and Javed S.M.M., *Journal of Plant Science*, 2008, v. 3(1), p. 85-91.
20. Thothathri, K., *Ind. For.*, 1964, v, 90, p. 539-546.

**ACKNOWLEDGEMENTS**

The authors are grateful to Board of Research on Nuclear Science (BRNS), BARC, Government of India, for funding the project. We also extended our thanks to Osmania University and Prof. Jayashanker Telangana State Agricultural University for granting permission to conduct studies at Peddagattu and Shereplly area, Nalgonda district of Telangana State.

Proceedings of the National Seminar on
"Impact of Scientific Advances on Society", August 18-19, 2015, p.11-13
St. Pious X Degree & PG College for Women, Hyderabad-500076.

# Mini arc reactor – the future energy source

**A.R.S. Murthy[*] and R. Krishna Teja[#]**

*Krishnamurthy IIT Academy student, Hyderabad, Telangana, India*
[*]*murthy.ars123@gmail.com*
[#]*bittureebok23@gmail.com*

## ABSTRACT

Globally there is a growing demand for electricity that is cheap and reliable. At the same time, recent concerns over global warming have resulted in many governments pledging their nations to reduce the amount of Carbon Di Oxide they generate. Nuclear forces are the strongest force in the nature. The problem is that nuclear energy is the proverbial political hot potato - even in early days when the new energy source exploded onto the world scene. The tremendous amount of energy locked in the atom held the promise of a future like something out of a technological Arabian Nights. It would be a world where electricity will be cheap to meter, deserts would bloom, ships would circle the Earth on a lump of fuel the size of a baseball, planes would fly for months without landing, the sick would be healed and even cars would be atom powered. But though nuclear power did bring about incredible changes in our world, in its primary role, generating electricity for homes and industry, it ended up as less of a miracle and more of a very complicated way of boiling water. Mini nuclear reactor or an arc reactor is a miniature model of the nuclear reactor working on the same principles of a normal nuclear reactor. The only difference is that is the size. The mini arc reactor is basically in the size of a meter in diameter and would be as small as possible until invented promising to bring about many benefits to society.

*Keywords*: Mini arc reactor, nuclear force, source of energy

## 1. INTRODUCTION

A nuclear reactor, formerly known as atomic pile, is a device used to initiate and control a sustained nuclear chain reaction. Nuclear reactors are used at nuclear power plants for electricity generation and in propulsion of ships. Heat from nuclear fission is passed to a working fluid (water or gas), which runs through turbines. These either drive a ship's propellers or turn electrical generators. Nuclear generated steam in principle can be used for industrial process heat or for district heating. Some reactors are used to produce isotopes for medical and industrial use, or for production of weapons-grade plutonium. Some are run only for research. Today there are about 450 nuclear power reactors that are used to generate electricity in about 30 countries around the world.

When a large fissile atomic nucleus such as uranium-235 or plutonium-239 absorbs a neutron, it may undergo nuclear fission. The heavy nucleus splits into two or more lighter nuclei, (the fission products), releasing kinetic energy, gamma radiation, and free neutrons. A portion of these neutrons may later be absorbed by other fissile atoms and trigger further fission events, which release more neutrons, and so on. This is known as a nuclear chain reaction. To control such a nuclear chain reaction, neutron poisons and neutron moderators can change the portion of neutrons that will go on to cause more fission Nuclear reactors generally have automatic and manual systems to shut the fission reaction down if monitoring detects unsafe conditions. Commonly-used moderators include regular (light) water (in 74.8% of the world's reactors), solid graphite (20% of reactors) and heavy water (5% of reactors). Some experimental types of reactor have used beryllium, and hydrocarbons have been suggested as another possibility.

### *1.1 Heat generation*

The reactor core generates heat in a number of ways:

- The kinetic energy of fission products is converted to thermal energy when these nuclei collide with nearby atoms.
- The reactor absorbs some of the gamma rays produced during fission and converts their energy into heat.
- Heat is produced by the radioactive decay of fission products and materials that have been activated by neutron absorption. This decay heat-source will remain for some time even after the reactor is shut down.

A kilogram of uranium-235 (U-235) converted via nuclear processes releases approximately three million times more energy than a kilogram of coal burned conventionally ($7.2 \times 10^{13}$ joules per kilogram of uranium-235 versus $2.4 \times 10^{7}$ joules per kilogram of coal).

### *1.2 Electrical power generation*

The energy released in the fission process generates heat, some of which can be converted into usable energy. A common method of harnessing this thermal energy is to use it to boil water to produce pressurized steam



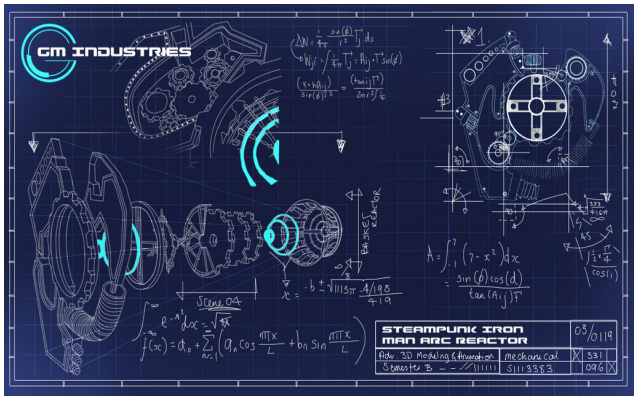
Sponsored by the Indian Institute of Geomagnetism, Navi Mumbai-410218 (DST, Govt. of India)

which will then drive a steam turbine that turns an alternator and generates electricity.

## 2. PRINCIPLE OF MINI ARC REACTOR

An improved plasma arc reactor is provided with variably positionable electrodes, including a cylindrical anode electrode having an inner, frustoconical cavity providing a reaction chamber and a spherical cathode ball electrode mounted therein. Between these electrodes an arc discharge is induced and sustained to heat and ionize an inert gas to produce an arc plasma for refining raw material introduced into the reaction chamber. A magnetic induction coil is mounted around the outer diameter of the anode electrode to thereby establish a magnetic field to rotate the arc discharge and plasma within the reaction chamber.

The mini reactor would run on palladium ($Pd^{103}$) or ($Pd^{105}$) as palladium has been regarded as a cold fusion reaction as it doesn't require any special plasma rods or containment triodes and would produce electrons by decaying. However only the blue prints have been made until present date. Scientists all around the world are trying to create one of its kinds.




## 3. COLD FUSION TECHNOLOGY

The cold fusion dream lives on: NASA is developing cheap, clean, low-energy nuclear reaction (LENR) technology that could eventually see cars, planes, and homes powered by small, safe nuclear reactors. LENR is absolutely nothing like either fission or fusion. Where fission and fusion are underpinned by strong nuclear force, LENR harnesses power from weak nuclear force — but capturing this energy is difficult. So far, NASA's best effort involves a nickel lattice and hydrogen ions. The hydrogen ions are sucked into the nickel lattice, and then the lattice is oscillated at a very high frequency (between 5 and 30 terahertz). This oscillation excites the nickel's electrons, which are forced into the hydrogen ions (protons), forming slow-moving neutrons. The nickel immediately absorbs these neutrons, making it unstable. To regain its stability, the nickel strips a neutron of its electron so that it becomes a proton — a reaction that turns the nickel into copper and creates a lot of energy in the process.

## 4. BENEFITS TO THE SOCIETY

- The mini arc reactor could easily power a whole block of houses for a period up to a year
- According to NASA, 1% of the world's nickel production could meet the world's energy needs, at a quarter of the cost of coal.
- The most logical first application of mini arc reactor is the home reactor, which would produce heat and electricity for the home while charging the family electric car. Another area is in transportation, with the light, portable reactors powering supersonic aircraft and flying cars without the danger or radiation. It could even be used to power a space plane capable of reaching orbit without stages or external fuel tanks.
- The main objective of mini arc reactor is to minimise the size and not occupying acres of land.
- The reactor produces comparably much more power than a simple generator and is more efficient.
- Less radioactive waste is a one more benefit of the reactor. Less radioactive waste is equal to less pollution and harmful gases.

## 5. CHALLENGES

- The electrons in the metal lattice are made to oscillate so that the energy applied to the electrons is concentrated into only a few of them. When they become energetic enough, the electrons are forced into the hydrogen protons to form slow neutrons. These are immediately drawn into the nickel atoms, making them unstable. This sets off a reaction in which one of the neutrons in the nickel atom splits into a proton, an electron and an antineutrino. This changes the nickel into copper, and releases energy without dangerous ionizing radiation.
- If it could be made to work, the practical applications would be as revolutionary as what fission has achieved and fusion has promised. Theoretically, the process could yield several million times more energy than chemical reactions. According to Dennis Bushnell, Chief



Sponsored by the Indian Institute of Geomagnetism, Navi Mumbai-410218 (DST, Govt. of India)

Scientist, NASA Langley Research Centre, one percent of the nickel mined per year could meet the world's energy needs for a quarter of the cost of coal. In past years, several labs have blown up while studying LENR and windows have melted – showing that if it really works, it can produce an impressive amount of energy.

- There are a lot of people who are trying to just build something without understanding anything. It worked for Edison and the light bulb, but it took him a long time and that was a simple system. This is very complex. And if they make something that just barely works, and accidentally one in a thousand works really, really well, it's going to take down a house with their trial-and-error method."
- Cooling is the biggest challenge of the reactor. Cooling high temperatures within a small amount of space quickly is a major challenge. If atoll the reactor is created it would be heated up to hundreds of degrees and would lead to a radioactive explosion. As long as the reactor's power coil is cooled down is would be redefining the power.
- One major problem is that the nuclear resources are a very powerful source of energy. They can be misused by using them as weapons.

## 6. SUGGESTIONS

Cooling a reactor: The approach to cooling is very simple: push water past the nuclear core and carry the heat somewhere else. The chain reaction that actually runs the reactor can be shut off in a matter of seconds. What's left over in the core, the radioactive material, will continue to give off heat for a long time. Unless there is a mechanism to remove that, the heat can build up and can eventually damage the radioactive fuel or the reactor.

Minimising the radioactive waste: - Even through the mini arc reactor produces very less amount of radioactive waste it may be harmful to the society. Proper disposal of this waste must be ensured. Waste disposal can be achieved by discovering or synthesizing new compounds or elements which can minimise radiations at the same time producing power.

## 7. CONCLUSION

Micro Reactor Technology (MRT) has a very promising future as it is sustainable, safe and green. It would be a technological dream to perceive mini arc reactors as alternative sources of energy in providing number of benefits to the society.

### REFERENCES

1. www.gizmag.com/small-modular-nuclear-reactors/20860/
2. https://en.wikipedia.org/wiki/Micro_nuclear_reactor
3. www.world-nuclear.org/.../Nuclear...Reactors/Small-Nuclear-Power-Reac..
4. www.gizmag.com/nasa-lenr-nuclear-reactor/26309/



Sponsored by the Indian Institute of Geomagnetism, Navi Mumbai-410218 (DST, Govt. of India)

Proceedings of the National Seminar on
"Impact of Scientific Advances on Society", August 18-19, 2015, p.14-16
St. Pious X Degree & PG College for Women, Hyderabad-500076.

# Study on antimicrobial activity of various plant derived polyphenol extracts on *Staphylococcus aureus*

**C. Vanisree***

*Department of Biochemistry, St. Pious X Degree & PG College for Women, Nacharam,, Hyderabad-500076, Telangana, India*
** vanisree3108@gmail.com*

## ABSTRACT

The polyphenols from five different plant sources, green tea, black tea, onion, grapes and lemon peel were extracted using ethyl acetate extraction for green tea and black tea, acetone and water extraction for onions and grapes and ethanol for lemon peel. The total polyphenol content was estimated using the Folin-Ciocalteu method with gallic acid as the reference standard (100 ug/ml). The highest amount of polyphenols was found in green tea (*camellia sinesis*) with gallic acid equivalent of 37.6±5.65 mg/ml and minimum in onion (*Allium cepa)* extract 17.6±1.414 mg/ml. The antimicrobial effect of polyphenol extracts of the five plant sources was studied on the isolate of *Staphylococcus aureus* by well diffusion method with 5mg/ml and 2.5 mg/ml concentration of the extracts. The *Staphylococcus aureus* was susceptible to the polyphenol extracts of the five plant sources. Though the concentration of polyphenols taken was same for all the extracts, the antimicrobial effect varied. The maximum zone of inhibition was seen with green tea (24.6±0.42 mm) and minimum with onion extract (7±0 mm).The lemon peel extract showed higher antimicrobial effect (15±0.28 mm) compared to grape extract (12.2±0.28 mm). The antimicrobial effect was comparable with that of tetracycline on *Staphylococcus aureus* with zone of inhibition of 30±0.14 mm and 22.5±0.28 mm with 5 mg/ml and 2.5 mg/ml concentration of the antibiotic respectively. The polyphenols from natural sources can be used as natural medicines instead of synthetic antibiotics.

*Keywords*: Polyphenol extract, antibacterial effect, disc diffusion

## 1. INTRODUCTION

Polyphenols (PPs) are reactive metabolites abundant in plant-derived foods, particularly fruits, seeds and leaves as secondary metabolites. Ranging from simple phenolic molecules to highly polymerized compounds with molecular weights of greater than 30,000 Da, the occurrence of this complex group of substances in plant foods is extremely variable and exhibit high antioxidant capacity (free radical scavenging and metal chelating activities) [1]. Their possible beneficial implications in human health, such as in the treatment and prevention of cancer, cardiovascular disease, and opportunistic infections caused by microbes like *Staphylococcus aureus* pseudomonas aeruginosa, E. coli etc. *Staphylococcus aureus* is a grampositive cocci often involved in respiratory infections, sinusitis, food poisoning and skin infections such as abscesses. The plant sources such as green tea (camellia sinesis), black tea, grapes, onion , lemon and apices are rich in antioxidants and are expected to show antimicrobial activity. Green tea polyphenols are catechins ,phytochemicals composed of several linked ring-like structures with chemical tags called phenol groups, and because there are many phenol groups, these catechins are called polyphenols [2, 3]. They protect cells and body chemicals against damage caused by free radicals, reactive atoms that contribute to tissue damage in the body**.** Grapes (*Vitis vinifera*), well known for their high levels of antioxidants and polyphenols, have also shown promise as novel antimicrobial agents [4-6]. Onion is one of the richest source of flavonoids and organosulphur compounds. They possess high level of antioxidant activity attribued to flavonoids quercetin and pigments such as anthocynins. Lemon is an important medicinal plant of the family Rutaceae. The peel of *Citrus* fruits is a rich source of flavonoid glycosides, coumarins, (- sitosterol, glycosides and volatile oils .

In the present study polyphenols were extracted from five different plant sources, green tea, black tea, lemon peel , onion and grapes and their antimicrobial effect was studied on gram positive bacteria *Staphylococcus aureus* by well diffusion method.

## 2. METHODOLOGY

### *2.1 Preparation of polyphenol extract*

Polyphenols were extracted from five different plant sources: green tea, black tea, grapes, lemon peel and onion as they possess high antioxidants.

### *2.2 Extraction from grapes, lemon and onion*

3 gm each of grapes, onion were homogenised using motor and pestle and extracted twice for 15 min with 10 ml acetone/water (80/20, v/v) containing HCl (0.1/10, v/v) to prevent oxidation of the polyphenols at room temperature and then stirred for 30 min on a magnetic agitator. After centrifugation (3000 rpm for 10 min), the supernatants from both extractions were combined and made up to a final volume of 25 ml with distilled $H_2O$. The extracts were filtered through Whatmann No.1 filter paper. Only pulp was used for extraction from onion [4,



Sponsored by the Indian Institute of Geomagnetism, Navi Mumbai-410218 (DST, Govt. of India)

7-9]. The polyphenols from lemon peel were extracted using ethanol extraction method [10].

*2.3 Extraction from green tea and black tea*

To the crudely crushed dried tea leaves (3 g) hot water (60˚C) was added in the ratio 1:20 (with periodical stirring to deactivate enzymes). The boiling mixture's filtrate was collected (three times). Water bath at 60˚C is used to concentrate the tea solution. The filtrate was decaffeinated using methylene chloride. To the filtrate ethyl acetate was added in 1:6 ratio and the upper yellow part containing polyphenols was collected for the estimation [3].

*2.4 Determination of total phenolic compounds*

Total phenolic compounds from lyophilized samples were quantified using Folin-Ciocalteu's method [11]. TPC of extracts was determined using the Folin-Ciocalteu method. Gallic acid of 100 µg/ml was used as standard. Samples (300 µl, in duplicate) were introduced into test tubes wrapped in aluminum foil followed by addition of 1.5 ml of FC reagent (10 times dilution) and 1.2 ml of sodium carbonate solution (7.5% w/v). The tubes were allowed to stand in the dark for 30 min before absorbance was measured at 765 nm. TPC was expressed as gallic acid equivalent (GAE) in µg/ml.

*2.5 Preparation of the bacterial culture*

Eleven bacterial isolates of *Staphylococcus aureus* was inoculated in Mueller Hinton broth (pH 7.4.) for 8 hours. The concentration of the suspensions was adjusted to 0.5 Mc Farland standard to reach an optical density of 0.08 – 0.10 at 625 nm by adding sterile distilled water. This gives a bacterial suspension containing 1.5 x $10^8$ CFU/ml. Isolates were seeded on Mueller Hinton agar plates by using sterilized cotton swabs.

*2.6 Susceptibility tests*

The susceptibility tests were performed by the Mueller Hinton agar well diffusion method [12]. The bacterial strains grown on nutrient agar at 37°C for 18 to 20 h were suspended in a saline solution (0.85%, w/v) to a turbidity of 0.5 Mac Farland standards (108 CFU/ml) [13]. The suspension was used to inoculate 90mm diameter Petri dishes with a sterile non-toxic cotton swab on a wooden applicator. Wells (6 mm diameter) were punched in the agar and filled with 50 µl of 5mg/ml extract and 2.5mg/ml extract. Plates were incubated in air at 37°C for 24 h. Antibacterial activity was evaluated by measuring inhibition zone diameters.

## 3. STATISTICAL ANALYSIS

The values of antimicrobial activity polyphenol extracts were expressed as mean ± standard deviation (n= 2) for each sample.

## 4. RESULTS AND DISCUSSION

As shown in Table 1 and Fig. 1, the amount of polyphenols was found to be maximum in the leaf extracts of green tea with concentration of 37.6±5.65 mg/ml followed by black tea 25.3±3.53mg/ml ,grape 21.3±2.12 mg/ml, lemon peel 19.1±1.414 mg/ml and minimum in onion extract 17.6±1.414 mg/ml. The inhibition zone of *Staphylococcus aureus* with 5mg/ml concentration of polyphenol extract was found to be maximum for green tea 24.6±0.42 mm followed by black tea with 20.5±0.14mm , lemon peel 15±0.28 mm, grapes with 12.2±0.28 mm and minimum for the onion extract with 7±0 mm. As seen in Fig. 2 the pattern of the graph of inhibition zone diameter of the five polyphenol extracts is similar for 5mg/ml and 2.5 mg/ml cconcentration of polyphenols. Though the concentration of polyphenols was found to be more in grapes than lemon peel but the antimicrobial effect of lemon peel was more than the grape extract based on the values of inhibition zones.

**Table 1.** Comparison of concentration of polyphenols in various plant sources and Inhibition zones (in mm) for *Staphylococcus aureus* with polyphenol extract of various plant sources

| S.No | Plant source | Standard gallic acid 100µg/ml | Zone diameters in millimetres | |
|---|---|---|---|---|
| | | Concentration of polyphenols mg/ml ± standard eviation | Polyphenol extract 5mg/ml | Polyphenol extract 2.5mg/ml |
| 1 | Grape | 21.3±2.12 | 12.2±0.28 | 10.15±0.07 |
| 2 | Onion | 17.6±1.414 | 7±0 | 6.25±0.07 |
| 3 | Lemon peel | 19.1±1.414 | 15±0.28 | 12.9±0.14 |
| 4 | Green tea | 37.6±5.65 | 24.6±0.42 | 18.3±0.21 |
| 5 | Black tea | 25.3±3.53 | 20.5±0.14 | 15.3±0.14 |
| 6 | Tetracycline | - | 30±0.14 | 22.5±0.28 |



Sponsored by the Indian Institute of Geomagnetism, Navi Mumbai-410218 (DST, Govt. of India)

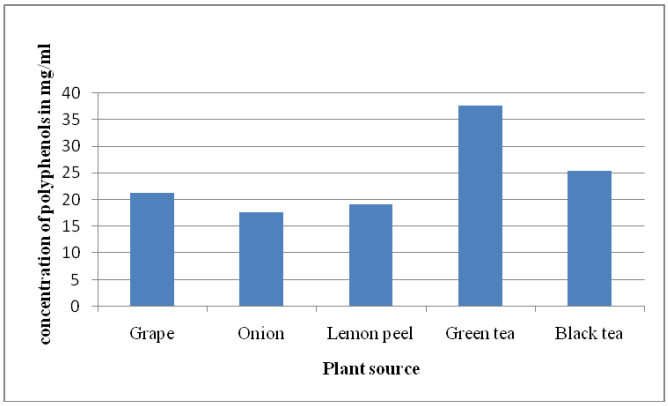



**Figure 1.** *Amount of polyphenols in various plant sources.*

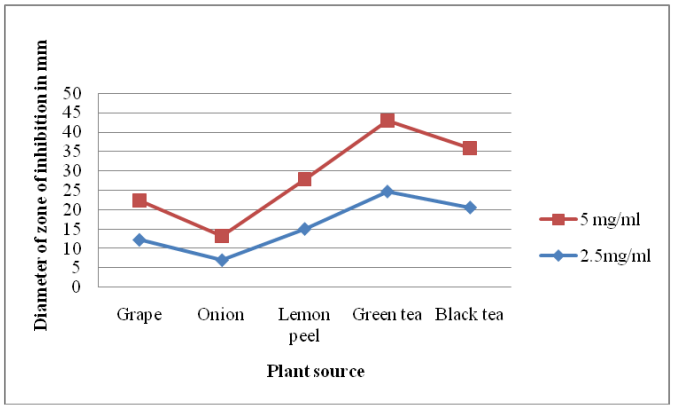



**Figure 2.** *The zone of inhibition of Staphylococcus aureus with various plant polyphenols.*

## 5. CONCLUSION

The five plant sources , green tea, balck tea, grapes, emon peel and onion contain high levels of polyphenols and exhibit antimicrobial effect against the gram positive bacteria *Staphylococcus aureus*. The antimicrobial effect of these polyphenols is comparable with the effect of tetracycline. Hence these plant sources can be used as natural medicines against the opportunistic pathogens.

## REFERENCES CITED

1. Quideau, S.P., Deffieux, D. Douat-Casassus, C.L., and Pouységu, L., *Angewandte Chemie International Edition,* 2011, v. 50(3), p. 586.
2. Maksum, R., Rafael, A.A., Berna, E., and Conny, R.T., *Asian Pac. J. Trop. Biomed*., 2013, v. 3(8), p. 663–667.
3. Bharadwaz, A., and Bhattacharje, C., *International Journal of Scientific & Engineering Research*, 2012, v. 3(5), ISSN 2229-5518.
4. Jensen, J., Blachez, B., Egebo, M., and Meyer, A., *American Journal of Enology and Viticulture*, 2007, v. 58(4), p. 451-460.
5. En-Qin Xia, Gui-Fang Deng, Ya-Jun Guo, and Hua-Bin Li, *Int. J. Mol. Sci*., 2010, v. 11(2), p. 622–646.
6. Taguri, T., Tanaka, T., and Kouno, I., *Biol. Pharm. Bull.*, 2004, v. 27(12), p.1965-1969.
7. Ghosh, J.S., *British Journal of Pharmacology and Toxicology,* 2011, v. 2(3), p. 119-122, ISSN: 2044-2467.
8. Cantos, E., Espin, J.C., and Tomas-Barberan, F.A., *J. Agric. Food Chem.* 2002, v. 50, p. 5691–5696.
9. Crozier, A., Lean, M.E.J., McDonald, M.S., and Black, C., *J. Agric. Food Chem.*, 1997, v. 45, p. 590-595.
10. Diankov, S., Karsheva, M., and Hinkov, I., *Journal of the University of Chemical Technology and Metallurgy*, 2011, v. 46(3), p. 315-319.
11. Singleton, V. L., Orthofer, R., and Lamuela-Raventós, R.M., 1999, v. 299, p. 152.
12. Cleidson, V., de Souza, S.M., Elza, F., A Smânia, A., and Smânia, A. Jr., *Brazilian Journal of Microbiology*, 2007, v. 38, p. 369-380, ISSN 1517-8382.
13. Lalitha, M.K., *Manual on Antimicrobial Susceptibility Testing* (Under the auspices of Indian Association of Medical Microbiologists), 2004, p. 1- 8.



Sponsored by the Indian Institute of Geomagnetism, Navi Mumbai-410218 (DST, Govt. of India)

Proceedings of the National Seminar on
"Impact of Scientific Advances on Society", August 18-19, 2015, p.17-18
St. Pious X Degree & PG College for Women, Hyderabad-500076.

# Rain water harvesting, conservation and management strategies

**Grace Beena Paul***

*Department of Zoology, St. Pious X Degree & PG College for Women, Nacharam, Hyderabad-500076,Telangana, India*
*gracebpaul@rediffmail.com

## ABSTRACT

As the water crisis continues to become severe, there is a dire need of reform in water management system and revival of traditional systems. Scientific and technological studies needs to be carried out to assess present status so as to suggest suitable mitigative measures for the revival to traditional system/wisdom. Revival process should necessarily be backed by people's initiative and active public participation. Water is considered an everlasting free source that can be acquired naturally. Demand for processed supply water is growing higher due to an increasing population. Sustainable use of water could maintain a balance between its demand and supply. Rainwater harvesting (RWH) is the most traditional and sustainable method, which could easily be used for potable and non potable purposes both in residential and commercial buildings. Rainwater harvesting (RWH) could be the most sustainable solution to be included in the urban water management system. It could mitigate the water crisis problem, reduce the burden on traditional water sources, alleviate nonpoint source pollutant loads, control water logging problems, prevent flooding, help in controlling climate change impacts, contribute to the storm water management, and so forth .Water scarcity and the limited capacity of conventional sources in urban areas promote RWH as an easily accessible source.

Rainwater harvesting system plays an important role in developing sustainable urban future. Availability of water of serviceable quality from conservative sources is becoming limited day by day due to huge demand. Rainwater provides sufficient quantity of water with small cost. Hence, the system can promote significant water saving in residential buildings Most of the researches on rainwater harvesting systems (RWHS) revealed that water conservation achieved through RWHS is quite significant especially in places where water is not easily available to consumers.

## 1. INTRODUCTION

Water is essential for all life and used in many different ways, It is also a part of the larger ecosystem in which the reproduction of the bio diversity depends. Fresh water scarcity is not limited to the arid climate regions, but in areas with good supply the access of safe water is becoming critical problem. Water harvesting like many techniques in use today is not new. It is practiced as early as 4500 B.C by the people of Ur and also latest by the Nabateans and other people of the Middle East. While the early water harvesting techniques used natural materials, 20th century technology has made it possible to bring awareness about conservation of rain water harvesting .The term water harvesting was used first by Geddes of the University of Sydney.

### *1.1 Water conservation*

This encompasses the policies, strategies and activities to manage fresh water as a sustainable resource. Population, household size and growth and affluence all affect how much water is used. Factors such as climate change will increase pressures on natural water resources especially in manufacturing and agricultural irrigation. World population tripled in the 1900s, resulting in six times the usage of water resources, reports World Water Council. With the council estimating a population increase of another 40 to 50 percent through 2050, water stress may increase. As the water crisis continues to become severe, there is a dire need of reform in water management system and revival of traditional systems. Scientific and technological studies need to be carried out to assess present status so as to suggest suitable mitigative measures for the revival to traditional system/wisdom. Revival process Living creatures of the universe are made of five basic elements, viz., Earth, Water, Fire, Air and Sky, Obviously, water is one of the most important elements and no creature can survive without it. Despite having a great regard for water, we seem to have failed to address this sector seriously. Human being could not save and conserve water and it sources, probably because of its availability in abundance. But this irresponsible attitude resulted in deterioration of water bodies with respect to quantity and quality both. Now, situation has arrived when even a single drop of water matters. However, “better late than never", we have not realized the seriousness of this issue and initiated efforts to overcome those problems.

### *1.2 Significance of harvesting rain water*

There are many reasons but following are some of the important ones.

- To arrest ground water decline and augment ground water table
- To beneficiate water quality in aquifers



Sponsored by the Indian Institute of Geomagnetism, Navi Mumbai-410218 (DST, Govt. of India)

- To conserve surface water runoff during monsoon
- To reduce soil erosion
- To inculcate a culture of water conservation

### *1.3 How to harvest rain water*

Broadly there are two ways of harvesting rainwater:

(i) Surface runoff harvesting

In urban area rainwater flows away as surface runoff. This runoff could be caught and used for recharging aquifers by adopting appropriate methods.

(ii) Roof top rainwater harvesting

It is a system of catching rainwater where it falls. In rooftop harvesting, the roof becomes the catchments, and the rainwater is collected from the roof of the house/building. It can either be stored in a tank or diverted to artificial recharge system. This method is less expensive and very effective and if implemented properly helps in augmenting the ground water level of the area.

## 2. METHODS OF ROOF TOP RAINWATER HARVESTING

### *2.1 Storage of direct use*

In this method rain water collected from the roof of the building is diverted to a storage tank. The storage tank has to be designed according to the water requirements, rainfall and catchment availability. Each drainpipe should have mesh filter at mouth and first flush device followed by filtration system before connecting to the storage tank. It is advisable that each tank should have excess water over flow system.

Excess water could be diverted to recharge system. Water from storage tank can be used for secondary purposes such as washing and gardening etc. This is the most cost effective way of rainwater harvesting. The main advantage of collecting and using the rainwater during rainy season is not only to save water from conventional sources, but also to save energy incurred on transportation and distribution of water at the doorstep. This alsoconserve groundwater, if it is being extracted to meet the demand when rains are on.

### *2.2 Recharging groundwater aquifers*

Ground water aquifers can be recharged by various kinds of structures to ensure percolation of rainwater in the ground instead of draining away from the surface. Commonly used recharging methods are:

a) Recharging of bore wells
b) Recharging of dug wells.
c) Recharge pits
d) Recharge Trenches
e) Soak ways or Recharge Shafts
f) Percolation Tanks

### *2.3 Recharging of bore wells*

Rainwater collected from rooftop of the building is diverted through drainpipes to settlement or filtration tank. After settlement filtered water is diverted to bore wells to recharge deep aquifers. Abandoned bore wells can also be used for recharge.

The department of Zoology with the help of Statistics department conducted a survey through questionnaire method (Fig. 1) to bring about the awareness to harvest rain water.

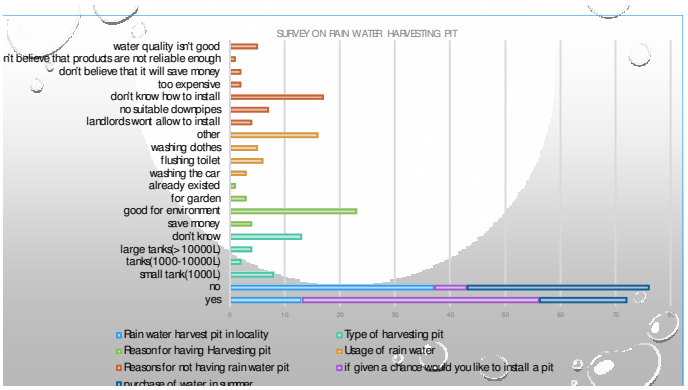



**Figure 1.** *Statistical analysis of the data–questionnaire method.*

## 3. CONCLUSION

St. Pious campus is charged with rain water harvesting pits, establishing the common flora and fauna, is instrumental in sending out conservational awareness as well as encouraging and appreciation of the biodiversity within the campus community. The Campus continues to support a rich diversity of plants and animals since the development of rain water harvesting pits.

### REFERENCES

1. Haigh, M.J., *Asian Journal of Water, Environment and Pollution*, 2004, v. 1(1), p. 17–28.
2. Behzadian, K., and Kapelan, Z., *Science of the Total Environment*, 2015, v. 527-528, p. 220–231.



Sponsored by the Indian Institute of Geomagnetism, Navi Mumbai-410218 (DST, Govt. of India)

Proceedings of the National Seminar on
"Impact of Scientific Advances on Society", August 18-19, 2015, p.19-20
St. Pious X Degree & PG College for Women, Hyderabad-500076.

# One pot rapid synthesis of novel 2-chloroquinolinyl-1,2,3-triazoles in water and their antibacterial activity

**Jyoti Mareddy[1,2], N. Sureshbabu[2], A. Jayasree[2], Soma Roy[3] and Sarbani Pal[1,*]**

[1]*Department of Chemistry, MNR Degree & PG College, Kukatpally, Hyderabad-500085, India.*
[2]*Centre for Chemical Sciences and Technology, Institute of Science & Technology, Jawaharlal Nehru Technological University Hyderabad, Kukatpally, Hyderabad-500085, India.*
[3]*Department of Biotechnology, Chaitanya Bharathi Institute of Technology, Gandipet, Hyderabad 500075, India.*
*sarbani277@yahoo.co.in

## ABSTRACT

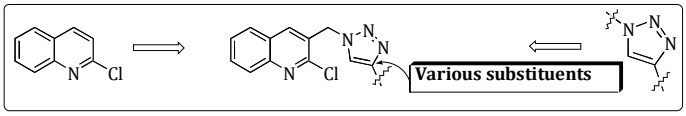
A series of 2-chloroquinolinyltriazoles possessing various substitutent on the triazolyl ring were designed as potential antibacterial agents. Synthesis of these compounds was carried out *via* a multi-step sequence consisting of copper-catalyzed azide-alkyne cycloaddition (CuAAC) of 3-(azidomethyl)-quinoline derivative with terminal alkynes as a key step using water as solvent. A number of compounds were synthesized by using this method some of which showed promising antibacterial activities when tested in vitro.

*Keywords*: 2-chloroquinoline, 1,2,3-triazole, cycloaddition, antibacterial activities

## 1. INTRODUCTION

The problem of increased prevalence of diseases worldwide caused by microorganisms has underlined the need for the identification and development of newer and potent antimicrobial agents. Thus, design, synthesis and pharmacological evaluation of new chemical entities are highly desirable to fight against bacterial pathogens. The design of drugs based on *molecular hybridization approach* involves linking of two pharmacophores possessing individual inherent activity into a single agent thus incorporating the dual activity or enhanced activity into a single hybrid molecule [1]. For example, a drug candidate Tazobactam showed enhanced antibacterial activity due to the synergistic effect of both 1,2,3-triazole and beta lactam nucleus [2].

Appropriately functionalized 1,2,3-triazole ring system has become one of the common fragments in the discovery of new chemical entities. The quinoline nucleus on the other hand has been found to be integral part of many synthetic and natural products with a wide range of pharmacological properties including antibacterial [3, 4] and antifungal [5] activities. Prompted by these observations we extended our search hoping to go one step ahead in the field of novel antimicrobial agents we undertook the design and the synthesis of a new class of quinoline coupled [1,2,3]-triazoles *via* the strategy based on linking the 1,2,3-triazole through the C-3 position of the quinoline ring was not explored earlier (Scheme 1). We anticipated that compounds synthesized would furnish promising antimicrobial properties.

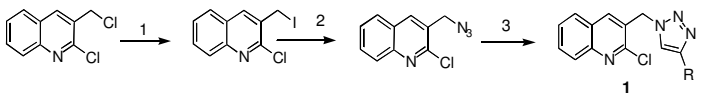



**Scheme 1**.*Design of hybrid molecules.*

## 2. PRESENT WORK

### *2.1 Chemistry*

The synthesis of our target compounds **1** was carried out by adopting multi-step sequence as outlined in Scheme 1. The copper-catalyzed azide-alkyne cycloaddition (CuAAC) [6, 7] the best paradigm of click chemistry was used as a key step in this sequence. This involves the construction of triazole ring *via* Cu(I)-catalyzed 1,3-cycloaddition of an azide to a terminal alkyne in the presence of a mixture of $CuSO_4$ and sodium ascorbate as a precatalyst system which generates the Cu(I) species *in situ* in the reaction mixture. The stating material, the corresponding dichloro derivative (1 mmol) was treated with KI (1.1 mmol) to afford the iodo derivative which on reaction with sodium azide (1.1 mmol) provided the corresponding 3-(azidomethyl)-2-chloroquinoline deri-vative. The azide (1 mmol) was then coupled with a variety of terminal alkynes (1 mmol) in the presence of $CuSO_4$ (0.25 mmol) and sodium ascorbate (0.25 mmol) smoothly under mild conditions in water to afford the desired compound **1** in one pot (Scheme 2). The progress of the reaction was checked by TLC and after completion of the reaction the reaction mixture was quenched in crushed ice and filtered to get the solid. The isolated solid was pure enough to preceed further.




**Scheme 2.** *Reagents and conditions: (1) KI, water, 3h, room temp, 91%; (2) $NaN_3$, water, 6h, room temp, 90%; (3) R-C≡CH, $CuSO_4$, Na-ascorbate, $H_2O$, 10 min-2h, room temp.*



Sponsored by the Indian Institute of Geomagnetism, Navi Mumbai-410218 (DST, Govt. of India)

| | | | | |
|---|---|---|---|---|
| **1a** | **1b** | **1c** | **1d** | **1e** |
| Ph (89) | $C_6H_4CH_3$-*p* (92) | $CH_2OPh$ (87) | $CH_2OC_6H_4CH_3$-*p* (96) | $CH_2OC_6H_4NO_2$-*p* (91) |
| **1f** | **1g** | **1h** | **1i** | |
| $CH_2OC_6H_4Cl$-*o* (83) | $CH_2OC_6H_4Cl$-*p* (88) | $CH_2OC_6H_3(CH_3$-*m*)Cl-*p* (79) | $CH_2OC_6H_4NHCOMe$-*p* (78) | |

*2.2 Biology*

Most of the compounds synthesized were assessed (Table 1) for their antibacterial properties against various strains of bacterial microorganism or species *in vitro*. The assay was carried out by adopting well diffusion method [8]. The *in vitro* antimicrobial activity was carried out against 24 h old culture of several bacterial cultures namely *Eschirichia coli* (or *E. Coli*; Gram negative rod shaped), *Klebsiella pnuemoniae* (or *K. pneumonia*; Gram negative rod shaped), *Pseudomonas aeruginosa* (*Ps. Aeruginosa*; Gram negative rod shaped), *Proteus vulgaris* (Gram negative rod shaped), *Sulmonella typhii* (Gram negative rod shaped) and urinary tract infection organisms (Gram positive). Amikacin an aminoglycoside antibiotic used to treat different types of bacterial infections was used as a standard drug in our assay.

**Table 1.** Antibacterial activities (Zone inhibition in mm) of some selected compounds (**1**)

| Compound | *E. coli* | *K. pneumonia* | *Ps. aeruginosa* | *P. vulgaries* | *S. typhi* | *UTI organism* |
|---|---|---|---|---|---|---|
| 1b | 10 | 12 | 12 | 11 | 11 | 7 |
| 1f | 11 | 12 | 12 | 10 | 9 | 8 |
| 1g | 10 | 20 | 19 | 11 | 20 | 8 |
| 1h | 12 | 10 | 11 | 11 | 12 | 9 |
| 1i | 13 | ND | ND | 12 | ND | 7 |
| Amikacin | 20 | 23 | 22 | 20 | 25 | ND |

## 3. CONCLUSIONS

In conclusion, a series of hybrid molecules possessing various substitutents such as phenyl, *p*-tolyl, aryloxymethyl etc on the triazolyl ring were synthesized in one pot using water as solvent. A multi-step sequence consisting of copper-catalyzed azide-alkyne cycloaddition (CuAAC) of 3-(azidomethyl)-quinoline derivative with terminal alkynes was used as a key step in synthesizing these compounds. Anti-bacterial activity were tested and few of them showed better activity against gram negative bacteria than gram negative.

### REFERENCES CITED

1. Muregi, F.W., and Ishih, A., *Drug Dev. Res.,* 2010, v. 71, p. 20-32.
2. Thomson, K.S., Weber, D.A., Sanders, C.C., and Sanders, W.E., *Antimicrob. Agents Chemother*., 1990, v. 34, p. 622-627.
3. Sheremet, E.A., Tomanov, R.I., Trukhin, E.V., and Berestovitskaya, V.M., *Russ. J. Org. Chem*., 2004**, v.** 40, p. 594–595.
4. Kaminsky, D., and Meltzer, R.I., *J. Med. Chem*., 1968, v. 11, p. 160-163.
5. Musiol, R., Jampilek, J., Buchta, V., Silva, L., Niedbala, H., Podeszwa, B., Palka, A., Majerz-Maniecka, K., Oleksyn, B., and Polanski, J., *J. Bioorg. Med. Chem*., 2006, v. 14, p. 3592-3598.
6. Rostovtsev, V.V., Green, L.G., Fokin, V.V., and Sharpless, K.B., *Angew. Chem. Int. Ed.,* 2002, v. 41, p. 2596-2599.
7. Tornoe, C.W., Christensen, C., and Meldal, M., *J. Org. Chem.,* 2002, v. 67, p. 3057-3064.
8. Kavanagh, F., *Analytical Microbiology* edited by F. Kavana, F., 1972, v. II, p. 11-23, Academic Press, New York and London.

### ACKNOWLEDGEMENTS

The authors (S. P. and K. K.) thank Mr. M. N. Raju, the chairman of M.N.R. Educational Trust for his constant encouragement and CFRD, OU, Tarnaka, for recording spectral data.



Sponsored by the Indian Institute of Geomagnetism, Navi Mumbai-410218 (DST, Govt. of India)

Proceedings of the National Seminar on
"Impact of Scientific Advances on Society", August 18-19, 2015, p.21-23
St. Pious X Degree & PG College for Women, Hyderabad-500076.

# Biosynthesis of silver nanoparticles by a soil isolate, *Aspergillus Species*

**J. Sridevi[1,*], Spandana Patnaik[1], Udaya Alekhya[1], and L. Venkateswar Rao[2]**

*[1]Department of Microbiology, Government Degree College for Women (Autonomous), Begumpet, Hyderabad. 500016, India.*
*[2]Department of Microbiology, University College of Science, Osmania University, Hyderabad-500006, India.*
*[*]manikonda.sridevi@gmail.com*

## ABSTRACT

In recent science Nanotechnology is a promising field for the researchers. Nanoparticle production by using biological systems like plants, microbes, is fast picking in the present scenario because of the immense applications of nanoparticles. There is an increasing interest in silver nanoparticles on account of the antimicrobial properties that they display and have been mentioned to be future generation antimicrobials. Other applications to mention a few include catalysis, biosensing, imaging, drug delivery, nanodevice fabrication and in medicine. The present study is focused on an eco-friendly, cost efficient, rapid and easy method for biosynthesis of silver nanoparticles (AgNPs) by using a fungus, Aspergillus sps. isolated from soil. The fungal culture was isolated in pure form and used for the biosynthesis of silver nanoparticles. The culture filtrate of *Aspergillus sps*. was added with 0.1 mM silver nitrate solution which resulted in the formation of silver nanoparticles after incubation. The silver nanoparticles were analyzed by Visual analysis, UV-Vis absorption spectroscopy. The culture filtrate showed a characteristic brown color after 24 hours of incubation at RT in dark conditions. The silver nanoparticle solution showed maximum absorbance at 440 nm in UV-Vis spectroscopy.

***Keywords*:** *Aspergillus sps.*, Silver nanoparticles, UV-Vis Spectroscopy

## 1. INTRODUCTION

Nanotechnology is an emerging and promising field in the area of interdisciplinary Biosciences [1]. Nanotechnology mostly deals with the synthesis of different types of nanoparticles by various physical and chemical processes. It is significant not only of the myriad of applications but also it is synthesized economically, in a green way [2]. Currently, there is a growing need to develop an eco-friendly process for nanoparticle synthesis and hence the focus turned towards 'green' chemistry and bioprocesses [3]. Nanotechnology applications are highly suitable for biological molecules, because of their exclusive properties. The biological molecules undergo highly controlled assembly for making them suitable for the metal nanoparticle synthesis which was found to be reliable and eco friendly. Biosynthesis of nanoparticles is gearing up for its huge potential applications [4-5]. Nano silver particles have been found tremendous applications in the fields of high sensitivity biomolecular detection, diagnostics, antimicrobials, therapeutics, catalysis and micro-electronics. However, there is still need for economic commercially viable as well as environmentally clean synthesis route to synthesize the silver nanoparticles. Silver is known for its inhibitory effect on many bacterial strains and microorganisms commonly present in medical and industrial processes. In medicines, silver nanoparticles are included in topical applications and creams to prevent infection of burns and open wounds. Medical devices and implants are also impregnated with silver components. In textile industry, silver-embedded fabrics are now used in sporting equipment. The need for environmental non-toxic synthetic protocols for nanoparticles synthesis leads to the developing interest in biological approaches which are free from the use of toxic chemicals as byproducts. Thus, there is an increasing demand for "Green nanotechnology". Many biological approaches for both extracellular and intracellular nanoparticles synthesis have been reported till date using microorganisms including bacteria, fungi. Biosynthesis of silvernanoparticles using fungi, including *Fusarium acuminatum* [6], *Fusarium oxysporum* [7], *Aspergillus niger* [8], *Aspergillus clavatus* [9], *Penicillium fellutanum* [10], *Fusarium solani* [11], *Alternaria alternata* [12] etc. have been successfully used for the synthesis of silver nanoparticles. The present study demonstrated the extracellular synthesis of stable silver nanoparticles using a soil isolate, *Aspergillus sps*.

## 2. MATERIALS AND METHOD

### *2.1 Isolation and identification of Aspergillus sps.*

Samples like soil, degrading wood, were collected from the college premises and transported to the laboratory and stored at 4°C. The samples were serially diluted by 10-fold and inoculated onto Potato Dextrose Agar medium plates for the isolation of fungi. After incubation at 28°C for 4 days, Morphologically different colonies were picked and subcultured onto PDA slants to obtain pure cultures. These slants were maintained at 4°C for subsequent identification. One of the fungal cultures was selected for the biosynthesis of silver nanoparticles. The



Sponsored by the Indian Institute of Geomagnetism, Navi Mumbai-410218 (DST, Govt. of India)

culture was identified by its microscopic and colony morphology.

*2.2 Production of fungal biomass*

The spores of the fungal culture identified to be Aspergillus sps.,were used for the production of fungal biomass. 100 mL of potato dextrose broth (Hi-Media) was inoculated with fungal spores at a rate of ~$10^5$ spores/mL in 100 mL Erlenmeyer flask. The flask was kept in a shaker incubator at 120 rpm, 28° C, for 3 days for the biomass to develop. After 3 days the fungal culture was filtered through Whatman No.1 filter paper to separate out the culture filtrate and biomass.

*2.3 Synthesis of silver nanoparticles (AgNPs) using culture filtrate of Aspergillus sps.*

The fungal biomass was washed thoroughly with sterile distilled water to remove residual medium components. Approximately 25 g of the biomass was aseptically transferred to a 250 mL flask having 100 mL of distilled water and incubated for 3 days in a shaker incubator at 120 rpm, 28° C. After incubation, the culture was filtered through Whatman No.1 filter paper to obtain clear fungal filtrate. 20 mL of the fungal filtrate was added with 20 mL of 0.1mM $AgNO_3$ solution in a 100 mL flask and incubated in dark in shaker incubator at 120 rpm, 28° C. During incubation the silver nanoparticles were produced by reduction of silver ions to metallic silver.

*2.4 Characterization of biosynthesized silver nanoparticles*

*(i) Visual Analysis*

After incubation for 24 hours, change in the color of the culture filtrate and $AgNO_3$ mixture was observed. This mixture was further subjected to various analyses.

*(ii) UV-Visible spectroscopic analysis*

The UV-Visible spectra of the mixture was recorded from 320 to 500, as function of wavelength using UV-Vis spectrophotometer. The surface Plasmon resonance of silver nanoparticles was determined by getting the peak value of wavelength.

## 3. RESULTS AND DISCUSSION

*3.1 Isolation and identification of Aspergillus sps.*

The fungal culture which was isolated in the pure form (Fig. 1) on PDA agar slant was identified to be Aspergillus sps., based on colony morphology and microscopic observation.

**Figure 1.** *Aspergillus sps* on PDA slant.

*3.2 Synthesis of silver nanoparticles (AgNPs) using culture filtrate of Aspergillus sps.*

Figure 2 shows Flask **A** of the fungal culture filtrate and before immersion in 0.1 mM AgN $O_3$ solution. The pale yellow color of the fungal cells can clearly be observed . The fungal cells after immersion in 0.1 mM $AgNO_3$ solution for 24 hours is shown in Flask **B**.

**Figure 2.** *Picture of flasks A and B containing Aspergillus sps. culture filtrate before and after exposure to Ag+ ions 24 hours.*

It can be observed that the previous pale yellow color of the reaction mixture is changed to the brownish color after 24 hours of incubation in dark. The appearance of brown color in solution containing the biomass is a clear indication of the formation of silver nanoparticles in the reaction mixture. The color of the solution is due to the excitation of surface plasmon vibrations in the silver nanoparticles.



Sponsored by the Indian Institute of Geomagnetism, Navi Mumbai-410218 (DST, Govt. of India)

*3.3 UV-Visible spectroscopic analysis*

The absorption spectra recorded at various wavelengths (λ) from the *Aspergillus sps*. reaction flask after 24 hours are reported in Table 1 and Figure 3. The strong surface plasmon resonance centered at 440 nm is characteristic of colloidal silver and found similar to result of [13] in which an intense peak was found at 410 nm. An earlier report indicated that the absorption spectrum of spherical silver nanoparticles is found maximum between 420 nm and 450 nm [14].

**Table 1.** Absorption spectra recorded at various wavelengths

| S. No. | Wave length (λ) | Absorbance (24 hrs) |
|---|---|---|
| 1 | 320 | 0.324 |
| 2 | 340 | 0.098 |
| 3 | 360 | 0.084 |
| 4 | 380 | 0.126 |
| 5 | 400 | 0.288 |
| 6 | 420 | 0.530 |
| **7** | 440 | 0.792 |
| 9 | 460 | 0.740 |
| 10 | 480 | 0.700 |
| 11 | 500 | 0.571 |

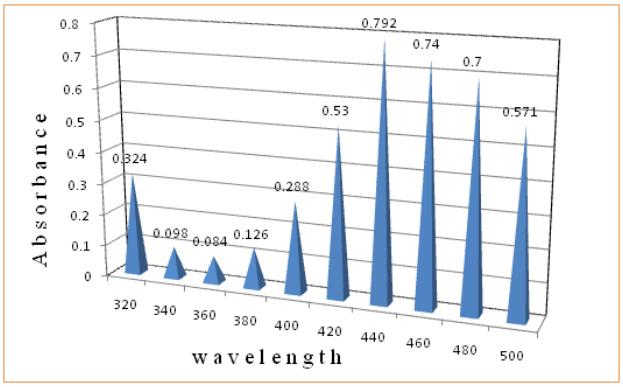



**Figure 3.** *Absorption spectra of Aspergillus sps. as a function of wave-length.*

## 4. CONCLUSION

In the present study a soil fungal isolate *Aspergillus sps.* had been used in the extracellular synthesis of silver nanoparticles. In the biosynthesis of metal nanoparticle by a fungus, enzymes are produced which reduce a salt to its metallic solid nanoparticles through the biocatalytic effect. *Aspergillus sps* which has a potential to synthesize various extracellular industrial enzymes, also has the potential to biocatalyze the reduction of silver salts to nano silver. The visual analysis and UV spectroscopic studies showing change of color of culture filtrate from pale yellow to brown and Surface Plasmon Resonance peak at 440 nm, respectively, clearly indicates the synthesis of silver nanoparticles. Thus the present study has reported the biological process for the synthesis of silver nanoparticles using a soil isolate *Aspergillus sps.* The silver nanoparticles can be further characterized and explored for their varied applications.

## REFERENCES CITED

1. Natarajan, K., Selvaraj, S., and Ramachandra, M.V., *Digest Journal of Nanomaterials and Biostructures*, 2010, v. 5, p. 135-140.
2. Gopinath, V., Mubarak Ali, D., Priyadarshini, S., Priyadharshini, N. M., Thajuddin, N., Velusamy, P. et al., *Colloids and Surfaces, B: Biointerfaces*, 2012, v. 96, p. 69-74.
3. Mohanpuria, P., Rana, N.K., and Yadav, S.K., *Journal of Nanoparticle Research*, 2008, v. 10, p. 507-517.
4. Narayanan, K., and Sakthivel, N., *Materials Letters*, 2008, v. 62, p. 4588.
5. Philip, D., *Physica E: Low-dimensional Systems and Nanostructures*, 2010, v. 42(5), p. 1417.
6. Ingle, A., Gade, A., Pierrat, S., Sonnichsen, C., and Rai, M., *Curr. Nanosci.*, 2008, v. 4, p. 141.
7. Ahmad, A., Mukherjee, P., Senapati, S., Mandal, D., Khan, M.I., Kumar, R. and Sastry, M., *Colloids and Surfaces B: Biointerfaces,* 2003, v. 28, p. 313-318.
8. Gade, A., Bonde, P., Ingle, A., Marcato, P., Duran, N., and Rai, M. J., *Biobased. Mater. Biener*, 2008, v. 2, p. 243.
9. Verma, V., Karwar, R., and Gange, A., *Nanomedicine (Lond)*, 2010, v. 5(1), p. 33.
10. Kathiresan, K., Manivannan, S., Nabeel, M.A., and Dhivya, B., *Colloid surface B*, 2009, v. 71, p. 13.
11. Ingle, I., Gade, A., Bawaskar, M., and Rai, M., *J. Nanopart. Res*., 2011, v. 11, p. 2079.
12. Gajbhiye, M., Kesharwani, J, Ingle, A., Gade, A., and Rai, M., *Nanomedicine: Nanotech. Bio. and Med*., 2009, v. 5, p. 383.
13. Mukherjee, P., Roy, M., Mandal, B., Dey, G., Mukherjee, P., Ghatak, J., Tyagi, A., and Kale, S., *IOP publishing Nanotechnology Journal*, 2008, v. 19, 075103 (7p.).
14. Maliszewska, J., Szewczyk, K., and Haszak, K., *Journal of Physics : Conference Series*, 2008, v. 146, 012025.



Sponsored by the Indian Institute of Geomagnetism, Navi Mumbai-410218 (DST, Govt. of India)

Proceedings of the National Seminar on
"Impact of Scientific Advances on Society", August 18-19, 2015, p.24-26
St. Pious X Degree & PG College for Women, Hyderabad-500076.

# Impact of cloud technology on society

**K. Kala Bharathi[*] and K.V.M. Udaya Lakshmi[#]**

*Department of Computer Science, St.Pious X Degree & PG College for Women, Nacharam, Hyderabad-500076, India.*
[*] *kudikalakalabharathi@gmail.com*
[#] *ULA_KKD@yahoo.com*

## ABSTRACT

Cloud computing is a new paradigm for hosting and delivering services over the internet and attracted business people, as it eliminates the requirement for users. Many factors are influenced such as elasticity, pay-as-you-go, cost savings and market barrier reduction etc. In our view, we want to reflect the systemic changes in society under cloud technology with some instance.

*Keywords*: cloud computing, communication, education, healthcare

## 1. INTRODUCTION

Cloud computing is typically defined as a type of computing that relies on sharing computing resources rather than having local servers or personal devices to handle applications. In cloud computing, the word cloud is used as a symbol for "the Internet," so the expression cloud computing means "a type of Internet-based computing," where different services such as servers, storage and applications are delivered to an organization's computers and devices through the Internet.

Why there is a need for cloud?

Means it is bigger, better, faster and cheaper.

- It is faster because it provides infrastructure on demand in terms of APIs.
- It is cheaper because reduced need for huge investment in purchasing hardware and software i.e. barrier to entry is much lower.
- It is better because no need to worry about infrastructure it is someone else's problem and we can focus on core business.

Before cloud computing traditional business applications have always been very complicated and expensive. The amount and variety of hardware and software required to run them are scary. We need a whole team of experts to install, configure, test, run, secure, and update them. With cloud computing, we can eliminate those headaches because we are not managing hardware and software-that's the responsibility of an experienced vendor. Present is the age of information technology. The aspect of work and personal life are moving towards the concept of availability of everything online. Understanding this trend, the big and massive web based companies like Google, Amazon, and Salesforce.com came with a model named "Cloud Computing" the sharing of web infrastructure to deal with the internet data storage, scalability and computation. The shared infrastructure means it works like a utility. We only pay for what we need. Upgrades are automatic and scaling up or down is easy.

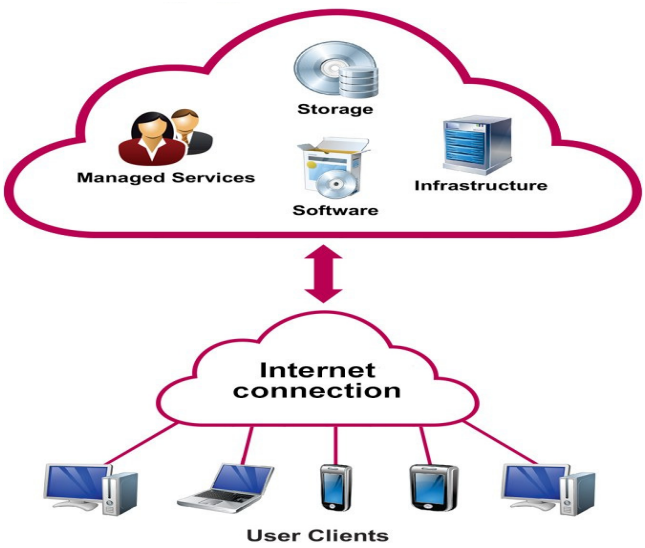



**Figure 1.** *Internet based cloud computing.*

Cloud-based apps can be up and running in days or weeks, and they cost less. With a cloud app, we just open a browser, log in, customize the app, and start using it. Anything from basic word processing to collaboration to e-mail to multimedia processing can be accomplished more efficiently using cloud computing than using one's personal computer. Cloud is classified into four types Public, Private, Community and Hybrid. These four are also called as four-pillars of cloud.

## 2. IMPACT ON SOCIETY

We would like to step to examine some of the ways that the cloud is making an impact on society.

### *2.1 Communication*

In the past, communications was one-to-many, whether for newspapers, radio, TV. It was the way companies give information about their products and governments communicated with the public. The cloud has turn over traditional communication models and the world is changing as a result. Today the model has been inverted



Sponsored by the Indian Institute of Geomagnetism, Navi Mumbai-410218 (DST, Govt. of India)

now we have many-to-one communication like Twitter and Facebook, where the page owner can issue a message, and hundreds, thousands or millions of people can respond. The result is a new transparency as people communicate with politicians, pop stars and anyone on the public stage in a very open way. It gave an example of how the cloud is changing the way we interact, with very real consequences.

*2.2 Closing the digital divide*

You may have heard of the One Laptop per Child (OLPC) was setup to direct the creation of affordable educational devices for use in the developing world. Its primary goal is the production of low-cost and low-power laptop computer to reach children. It was a noble idea, but unable to live up to expectations. It was a very hardware-focused view of the world, built with non-standard technology that was unfamiliar to people outside. A major inhibitor was the limited selection of software available, as well as how to distribute it, how to install it, how to maintain it, and what licensing was required. Building a land line infrastructure that's become out of date, countries are going directly to mobile because it's a much cheaper and easier way to provide coverage. The cloud provides a similar wholesale leap over the PC model on which OLPC was based. Rather than a specific laptop design with many technical constraints, now all you need is access to the web, and an endless variety of free software is at your fingertips. You still need an access and display device, but these devices (i.e., mobile phones) are everywhere, and they're constantly getting smarter, faster, cheaper, and more versatile.

*2.3 Education*

Another area where the cloud is making an impact is education, where innovative teaching tools and reference materials allow educators to stretch their precious budgets. Many institutions are adopting Cloud technology for several reasons, including:

- Ability for the students to access data anywhere, anytime, to enroll in online classes and to participate in group activities.
- The class enrollments and assignment tracking, thus reducing expenses significantly.
- Ability for the institutional body to leverage the storage cloud to store the daily 2.5 quintillion bytes of data securely and without the need to cater to a complicated infrastructure.
- The benefit of process billing and charging for education and non-education related activities.

Access is now instantly available and in many instances free thanks to the proliferation of websites dispensing educational material and cloud knowledge-sharing communities. A simple internet connection can go a long way.

*2.4 Science and Engineering*

The complexity of today's scientific and engineering problems is far beyond the capabilities of traditional tools. Innovations are based on modeling and simulation that require massive amounts of computing power. The cloud provides ready access to that power, on a highly efficient pay-as-you-go basis. This flexibility can be crucial for product development, as well as the fortunes of the company driving it. One example is the development of advance drugs, where every day can represent millions of Euros in sales and recovery of investment. If a pharmaceutical company needs to simulate how a promising new medication interacts with 16 million proteins, the analysis could run for weeks on their internal systems, tying up resources at enormous cost. The public cloud provides an alternative, giving scientists access to hundreds or thousands of servers, for a day, a week, or as long as they're needed. Cloud computing is advancing scientific progress in another way. Where previously only the largest companies could afford their own massive computer clusters, immense processing performance is now within reach for any small research team or individual with a brilliant design they want to bring into everyone life.

*2.5 Community*

In early days of Computing, where everyone had a "dumb terminal" connected to a mainframe for processing and storage. Then in the eighties, the PC brought processors and storage to our fingertips, providing the focus of innovation that lasted decades. Now the pendulum has shifted again, with data, applications, and computing power recentralized to make those resources available to everyone.

There's a community aspect to the cloud that's changing the way products are designed, projects are funded, and work gets done. This is the concept of crowd sourcing, enabling new forms of collaboration for people who share a common interest or passion, without geographic constraints. The approach is based on competition, where the customer describes what they're looking for and designers compete to come up with the best concept. The customer then hires the winner to create the final design. Customers get access to a global community of afforda-



Sponsored by the Indian Institute of Geomagnetism, Navi Mumbai-410218 (DST, Govt. of India)

ble design talent, while designers get work opportunities not previously available.

But unlike in the past, the cloud allows users–individual, companies, and global communities–almost unlimited creativity in how they take advantage of it. The result is an explosion of innovation with tremendous social, scientific, and business benefits.

*2.6 Health*

There are many reasons why using cloud technology in the healthcare industry is gaining speed. Some examples include managing patient data and sharing it among different parties such as medical professionals or patients checking their own status and treatment follow-ups and reducing operational costs such as data storage and accessing through devices such as mobile phones and going beyond the traditional intranet implementing a quick solution in a secure environment that is accommodating with the Health Insurance Portability and Accountability Act regulations.

While there may be challenges in integrating old or current tools with new technologies and the corresponding level of services, the benefits will outweigh the inhibition to move to the cloud.

## 3. CONCLUSION

Cloud Computing "The New Age lifesaver" is a relatively new concept that presents a good number of benefits for its users. We hope in future may increase their role in various sectors as hardware optional, medical treatments simplification, weather forecasting, education, online marketing and digital media etc.

**SUGGESTED REFERENCES**

1. Gandhi, V.C., .Prajapati, J.A. and Darji, P.A., *International Journal of Emerging Trends & Technology in Computer Science (IJETTCS)*, 2012, v. 1(3).
2. Singh, H., *International Journal of Electronics and Computer Science Engineering*, 2012.
3. Das , S.K., *Cloud Computing*, 2015, Dominant publisher and distributers.
4. http://www.thoughtsoncloud.com/2013/04/how-cloud-computing-is-impacting-everyday-life.

Proceedings of the National Seminar on
"Impact of Scientific Advances on Society", August 18-19, 2015, p.27-28
St. Pious X Degree & PG College for Women, Hyderabad-500076.

# Impact of environmental science on human welfare

**K. Sudha Rani***

*Department of Botany, Government Degree College for Women (Autonomous), Begumpet, Hyderabad. 500016, India.*
*sudhahoneyakshay@gmail.com*

## ABSTRACT

This paper presents the importance of environmental science on human development. Today environmental science plays a crucial role in the development of each individual. If not handled with care and wisdom, power plants, mining, chemical and other industries, which are so vital for the well being of modern man, are also potential of causing irretrievable damage to our greatest assets like forest, water, air and land. The threat to the human race due to environmental degradation is very great so we have to follow a middle path of "sustainable development" and growth of "Green Technology", that incorporates treatment of air emission, waste water reduction i. e. waste management development of non conventional renewable energy sources and recovery of resources recycle and reuse.

*Keywords*: Environment, natural resources, human welfare

## 1. INTRODUCTION

Impact of environmental science is very broad. There has been huge growth of interest in environmental science since 1960. The essence of environmental science is its multidisciplinary nature [1]. It has evolved from the integrated use of many disciplines and includes most important topics of modern civilization [2]. Environmental science is problem oriented i.e. it seeks new, valid, generalizable knowledge about the natural world and our impacts on it. It gives us ideas and information to deal successfully with the environmental problems [3].

## 2. NATURAL RESOURCES

Impact of recent scientific technology and their efforts on the natural or renewable resources are in the following broad areas of natural resources.

### *2.1 Mineral resources*

The mineral resources can have several broad categories such as elements for metal production and technology, building materials, minerals for metal production and minerals for the chemical production and technology for chemical industry.

Some of the suggested measures required to check the wasteful and injudicious use of minerals are: (i) recycling the minerals /metals, (ii) developing more efficient technologies, (iii) designing smaller equipment, and (iv) exploiting untapped deposits i. e. deep sea mining and finding new resources for glass, ceramics, plastics, synthetic fibres etc. and using them as substitutes for exhaustible minerals.

### *2.2 Water resources*

It is an important renewable resource. It is a biotic community literally the source of life on earth. It is the major constituent of the Hydrosphere.

The modern technology brings the advantage by constructing hydraulic dam structures across river valleys. The potential use could be for irrigation,hydroelectricity, water transport to deficit areas etc.

The efforts to improve the water resources by modern technology are: (i) hydroelectricity generation, (ii) ensuring a year- round water supply, (iii) transfer of water using canals from areas of excess to areas of deficit, (iv) flood control and soil protection, (v) irrigation during dry periods, and (vi) multipurpose river valley projects provide for inland water navigation can also used to develop fish hatcheries and nurseries.

### *2.3Food resources*

Food is the main resource for all living organisms**.** Man obtains food from cultivated plants and domesticated animals. The effects of agriculture on the environment broadly contain global, local changes through the entire the world.

Effect of artificial chemical fertilizers offer these advantages for improving the plant products: (i) fertilizers can be easier to store, handle and apply, (ii) there is a lower risk of pathogenic contamination, (iii) they allow intensive use of grazing land more rapidly after treatment.

### *2.4 Energy resources*

All living beings are operated by means of energy. Energy is not only the pre requisite for all life forms, but it is an important factor in the economic growth and technical change. Solar and bioenergy are very important in this field. So they are broadly used in (i) cooking, heating and lighting etc., (ii) transporting people and goods, (iii) production and convention of primary fuels.



Sponsored by the Indian Institute of Geomagnetism, Navi Mumbai-410218 (DST, Govt. of India)

*2.4.1 Solar energy*

The important energy resource in the nature is sun. The energy from the sun is solar energy .The modern technology brings so many merits for utilization of solar energy such as (i) solar cookers for cooking food and solar heaters, (ii) the solar electric system fulfilling requirement of electricity for decentralized applications, (iii) easy installation and maintenance, and (iv) no pollution and no charring.

*2.4.2 Bio energy*

It is considered as the living matter residues. It includes all the new plant growth residues of plants, waste herbage, agriculture and forest residues etc.

The static application of bio-energy as domestic heating and power generation. The biogas is produced from animal manure. Biogas is a cheap and convenient cooking fuel. It is also used for lighting and running small motors and providing power for cottage industries.

## 3. CONCLUSION

Thus from the above discussion it is clear that the impact of advantages of environmental science is enough to support future generations i.e. every desirable change in the physical, chemical and biological factors. There were natural resources that restored quality though the sustaining. The assimilative capacity of the environmental science is tremendous but not infinity. It also reveals the impact of humans upon the environment.

**REFERENCES CITED**

1. Pathak, A. K., *Environmental Studies*, 2006, Silver line Publications.
2. *Environmental Studies*, 2010, Neel Kamal Publications.
3. Sharma, P.D., *Ecology and Environment*, 2010 (10th revised edition), Rastogi Publications.

Proceedings of the National Seminar on
"Impact of Scientific Advances on Society", August 18-19, 2015, p.29-32
St. Pious X Degree & PG College for Women, Hyderabad-500076.

# Bacteriocin activity of an *Enterococcus sp.* isolated from dosa batter

**K. Vindyavasini Roy***

*Department of Microbiology, St. Pious X Degree & PG College for Women, Nacharam, Hyderabad-500076,Telangana, India*
*vasiniroy@gmail.com*

## ABSTRACT

Bacteriocins are antibacterial proteins or peptides produced by bacteria. Lactic acid bacteria(LAB) are capable of producing a variety of bacteriocins with activity against food borne pathogens and hence are of interest as they have potential role as food preservatives. Growing consumer awareness about the deleterious effects of chemical preservatives in food has led to their preference for natural or organic foods. In this scenario application of bacteriocins or bacteriocin producing cultures in food preservation is gaining importance. Use of either bacteriocin producing LAB strains, which are generally regarded as safe (GRAS), or their bacteriocins in food production and packaging could have a positive effect on food preservation and safety. Fifteen LAB were isolated from diary and fermented foods and were evaluated for their antibacterial activity. An isolate D1 from Dosa batter was found to exhibit good antibacterial activity. This isolate was identified as *Enterococcus* sps.

*Keywords*: Bacteriocin, lactic acid bacteria, antimicrobial activity

## 1. INTRODUCTION

Bacteriocins are extracellularly released peptides or proteins produced by bacteria, which exhibit antimicrobial action against other bacteria, especially closely related Species. They are not termed antibiotics as they differ from therapeutic antibiotics in being proteinaceous agents, which are rapidly digested by proteases in the human digestive tract. Bacteriocin production can be considered as an advantage for food and feed producers since, even in insufficient amounts; these peptides can kill or inhibit pathogenic bacteria that compete for the same ecological niche or nutrient pool. This role is supported by the fact that many bacteriocins have a narrow host range, and are likely to be most effective against related bacteria with similar nutritive demand [1]. Several types of bacteriocins from food-associated lactic acid bacteria have been identified and characterized, the important ones being Nisin, Bacteriocin, Diplococcin, Acidophilin, Bulgaricin, Helveticins, Lactacins and Plantaricins [2]. Apart from food associated lactic acid bacteria the nonfood lactic acid bacteria, such as enterococci and streptococci, have also been scrutinized for bacteriocin production, and many publications have shown that they are producers of such antimicrobial peptides [3-5]. Some enterococci are actually part of the main fermenting flora of dairy and meat products and among the dominant lactic acid bacteria in the intestinal flora of mammals and other animals.

Bacteriocins as biopreservatives have a great potential and can replace chemical preservatives in food products because they are non-toxic , easily degradable and stable in a wide range of pH and temperature [6].The purpose of the current study was to isolate and characterize bacteriocin producing lactic acid bacteria from dairy and fermented food products and evaluate their antibacterial activity.

## 2. MATERIALS AND METHODS

### *2.1 Sample collection*

The dairy products like milk, curd, yoghurt, buttermilk were collected from the local markets in Hyderabad. The fermented dosa and idli batters were obtained from different households in sterile containers. All the samples were stored in cold $4^0$C till processed.

### *2.2 Isolation and identification*

Samples like milk, curd, buttermilk, dosa and idli batters were diluted tenfold and 0.1ml of $10^{-2}$ , $10^{-3}$ , $10^{-4}$ samples was plated on de Man Rogosa agar (MRS agar HI Media laboratories Pvt ltd). Samples like cabbage and cucumber were chopped into small pieces and one gram of the samples were mixed in sterile saline and tenfold dilutions were prepared and plated on de Man Rogosa agar (MRS agar – HI Media laboratories Pvt ltd). The plates were incubated at 37°C for 24 hours in an anaerobic gas pak system (HI Media laboratories Pvt ltd). The isolates obtained were identified on the basis of growth, cell morphology, gram staining, catalase activity and carbohydrate fermentation tests.

### *2.3 Production of crude bacteriocin*

The isolated Lactic acid bacilli strains were grown in MRS broth (Hi Media Laboratory Pvt Ltd., India) (pH-6.0) using 5% inoculum of overnight culture and incubated anaerobically at 37°C for 48 h. After incubation, cells were removed from the growth medium by centrifugation 10,000×g for 15 min, 4°C.The cell-free superna-



Sponsored by the Indian Institute of Geomagnetism, Navi Mumbai-410218 (DST, Govt. of India)

tant thus obtained was adjusted to pH 6.0 using 1N NaOH and it was used as crude bacteriocin.

*2.4 Bacteriocin assay*

The antimicrobial activity of the crude bacteriocins was evaluated by the agar well diffusion method. Wells were made in Mueller-Hinton agar plates previously seeded with the indicator bacteria and different volumes of the crude bacteriocin were placed in the wells. The diameters of the zones of growth inhibition were measured after 12-18 h of incubation. The indicator organisms used were, *Bacillus subtilis, E.coli, Staphylococcus aureus, Klebsiella sps, Pseudomonas sps.* The Bacteriocin activity was calculated as AU/ml. which is defined as activity unit (AU); 1 AU is a unit area of inhibition zone per unit volume (mm2 /ml) 9. The bacteriocin activity was calculated using the formula:

Bacteriocin activity (mm2 /ml) $= Lz–Ls\ /V,$ where, Lz= clear zone area (mm2 ), Ls = well area (mm2 ), V = volume of sample (ml) [6].

*2.5 Optimization of culture condition*

The selected isolate D1 was subjected to different culture conditions to derive the optimum conditions for growth and bacteriocin production. Growth and bacteriocin production were estimated at various temperatures ($25^0$C, $37^0$C and $45^0$C) and pH (4.0, 5.0, 6.0).

## 3. RESULTS

Ten samples of Dairy and fermented foods were used for the isolation of Lactic acid bacteria on MRS medium. Twenty-one isolates were selected for further study. Eighteen of these isolates were Gram positive catalase negative bacteria and were presumed to be Lactic acid bacteria (Table 1). Cell free extract of these isolates were tested for bacteriocin activity. Only three isolates were found to show inhibitory activity against the test organisms and the results are given in Fig 1. Of these isolates only one designated as D1 isolate isolated from Dosa batter exhibited good antibacterial activity against all the test organisms (Fig . 2).It showed a broader range of activity against *Bacillus, Staphylococcus, Pseudomonas and Klebsiella* and hence it was used for further analysis. D1 isolate was characterized and identified as *Enterococcus* sps based on various charecteristics (Table 2). The identification of D1 isolate as *Enterococcus* sps was further confirmed by 16S rRNA sequence analysis(RAS life sciences). The Bacteriocin activity of 16485 Au/ml and 10362 Au/ml was exhibited against *Staphylococus* and *Pseudomonas* sps.

**Table 1.** Morphological and biochemical charecteristics of isolates

| S. No | Sample | Isolate Number | Morphology | Catalase Reaction | Acid from Glucose | $CO_2$ from Glucose |
|---|---|---|---|---|---|---|
| 1 | Milk | M1 | Gram + ve Rods | -ve | +ve | -ve |
| 2 | | M2 | Gram + ve Rods | -ve | +ve | -ve |
| 3 | | M3 | Gram + ve Rods | -ve | +ve | -ve |
| 4 | | M4 | Gram + ve Rods | +ve | +ve | +ve |
| 5 | Curd | C1 | Gram + ve Rods | -ve | +ve | -ve |
| 6 | | C2 | Gram + ve Rods | -ve | +ve | -ve |
| 7 | Yoghurt | Y1 | Gram + ve Cocci | -ve | +ve | -ve |
| 8 | | Y2 | Gram + ve Cocci | -ve | +ve | -ve |
| 9 | Butter milk | B1 | Gram + ve Rods | +ve | +ve | -ve |
| 10 | | B2 | Gram + ve Rods | -ve | +ve | -ve |
| 11 | Dosa batter | D1 | Gram + ve Cocci | -ve | +ve | -ve |
| 12 | | D2 | Gram + ve Rods | -ve | +ve | -ve |
| 13 | | D3 | Gram + ve Cocci | -ve | +ve | -ve |
| 12 | | D4 | Gram + ve Cocci | -ve | +ve | -ve |
| 14 | | D5 | Gram + ve Cocci | -ve | +ve | -ve |
| 15 | Idly batter | I1 | Gram + ve Rods | +ve | +ve | -ve |
| 16 | | I2 | Gram + ve Cocci | +ve | +ve | -ve |
| 17 | | I3 | Gram + ve Rods | - ve | +ve | -ve |
| 18 | | I4 | Gram + ve Bacilli | - ve | +ve | -ve |
| 19 | Cabbage | G1 | Gram + ve Cocci | -ve | +ve | -ve |
| 20 | | G2 | Gram + ve Cocci | -ve | +ve | -ve |
| 21 | | G3 | Gram + ve Cocci | -ve | +ve | -ve |



Sponsored by the Indian Institute of Geomagnetism, Navi Mumbai-410218 (DST, Govt. of India)

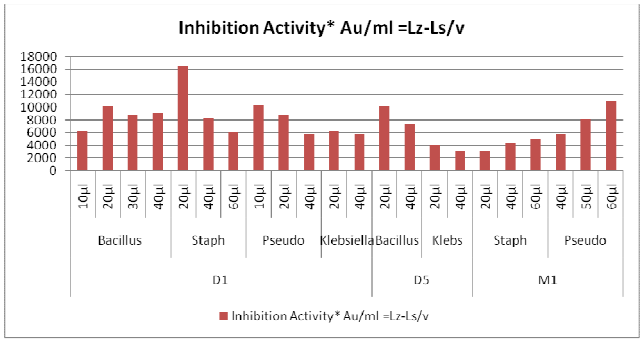



**Figure 1.** *Antibacterial activity of lactic acid bacteria isolates.*

**Table 2.** Characteristics of D1 isolate

| | |
|---|---|
| Gram Reaction | +ve |
| Catalase | -ve |
| Acid from glucose | +ve |
| $CO_2$ from glucose | - ve |
| Growth at $45^0$C | +ve |
| Growth in presence of 6.5% NaCl | +ve |

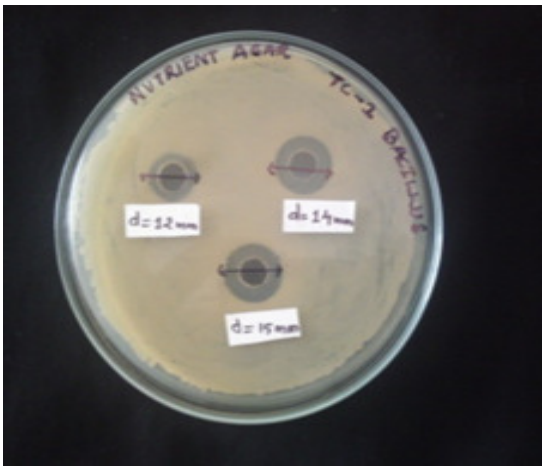



**Figure 2.** *Antibacterial activity of D1 isolate.*

The growth pattern of the *Enterococcus* isolate was studied by measuring the absorbance at 620nm. A lag period of 10 hours was observed, maximum growth was seen at 24 hours and then the growth plateaued (Fig. 3). The *Enterococcus* isolate showed maximum growth at $37^0$C and pH 6 (Fig. 4).

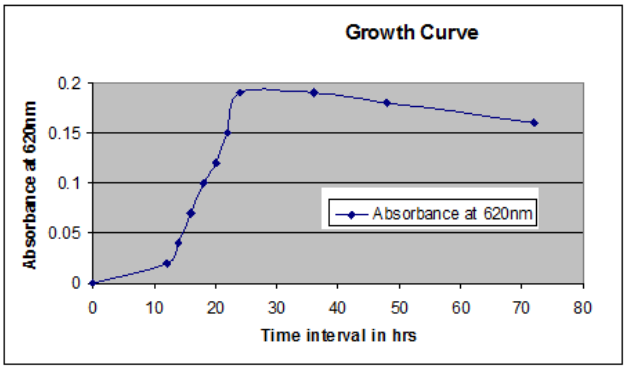



**Figure 3.** *Growth pattern of Enterococcus isolate.*

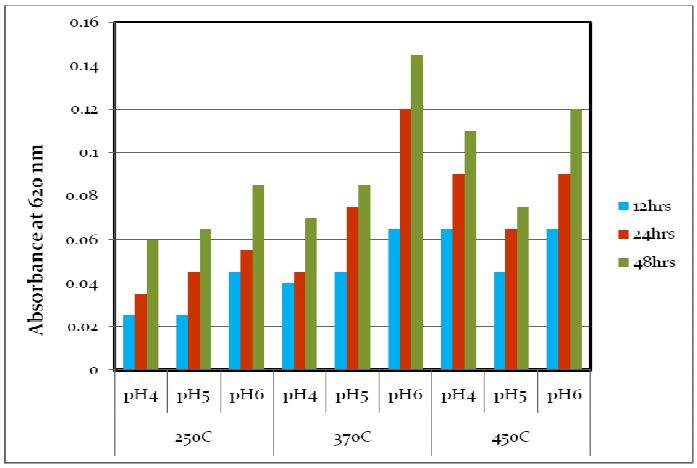



**Figure 4.** *Effect of Temperature and pH on growth of D1 isolate.*

## 4. DISCUSSION

Different authors have reported isolation of bacteriocin producing enterococci from foods [7] and from animals [8]. Strong anti-listerial activity of bacteriocins produced by enterococci has also been reported in several matrices e.g. cheese, fermented meat products, canine feed, horses and rabbits faeces [4, 9, 10].

This study also shows presence of bacteriocin producing enterococci in fermented foods having good antimicrobial activity against common bacteria. The isolate D1 exhibited good antibacterial activity against *Pseudomonas* sps which are usually resistant to various antimicrobial agents. However, this study is limited as the activity was not tested against food borne pathogens like Salmonella, Listeria etc. The emergence of multiple antibiotic-resistant enterococci among agents of nosocomial disease and the presence of virulence factors among food isolates requires a careful safety evaluation of isolates intended for potential biotechnical use. Further evaluation of this enterococcal bacteriocin may



Sponsored by the Indian Institute of Geomagnetism, Navi Mumbai-410218 (DST, Govt. of India)

provide information as to its potential application in food preservation.

**REFERENCES CITED**

1. Deegan, L.H., Cotter, P.D., Hill, C., and Ross, P., *Int. Dairy J.*, 2006, v. 16, p. 1058-1071.
2. Nettles, C.G., and Barefoot, S.F., *Journal of Food Protection*, 1993, v. 56, p. 338-356.
3. Henning, C., Gautam, D., and Muriana, P., *Microorganisms*, 2015, v. 3, p. 1-16.
4. Giraffa, G., *Food Microbiology*, 1995, v. 12, p. 291–299.
5. Franz, C.M., van Belkum, M.J., Holzapfel,W.H., Abriouel, H., and Gálvez, A., *FEMS Microbiol. Rev*., (2007, v. 31(3), p. 293-310.
6. Usmiati, S., and Marwati, T., *Indonesian Journal of Agriculture*, 2009, v. 2(2), p. 82.
7. Tulini, F.L., Gomes, B.C., and de Martinis, E.C.P., *Food Science and Technology*, 2011, v.31(1), p. 155-159.
8. Shin, M.S., Han, S.K., Ji, A.R., Kim, K.S., and Lee, W.K., *J. Appl. Microbiol*., 2008, v. 105(6), p. 2203-2212.
9. Ennahar, S., Aoude-Werner, D., Assobhei, O., and Hasselmann, C., *J. Appl. Microbiol*., 1998, v. 85(3), p.521-526.
10. Yenizey M. Alvarez-Cisneros, Francisco J. Fernández, Carmen Wacher-Rodarte, Manuel B. Aguilar, Teresita del Rosario Sáinz Espuñes, and Edith Ponce-Alquicira, *J. Sci. Food Agric*., 2010, v. 90(14), p. 2475-2481.



Sponsored by the Indian Institute of Geomagnetism, Navi Mumbai-410218 (DST, Govt. of India)

Proceedings of the National Seminar on
"Impact of Scientific Advances on Society", August 18-19, 2015, p.33-34
St. Pious X Degree & PG College for Women, Hyderabad-500076.

# Health risk assessment due to $Cr^{6+}$, Cd and Ni contamination in selected water bodies from Indian cities

**Mala Das Sharma***

*Department of Chemistry, St. Pious X Degree & PG College for Women, Nacharam,, Hyderabad-500076, Telangana, India*
*mdassharma@rediffmail.com*

## ABSTRACT

The contents of heavy metals in rivers, lakes and groundwater collected from different Indian cities are estimated. The results are found to be highly variable ($Cr^{6+}$=9.5–337 $\mu gL^{-1}$ , Cd=below detection limit to 34 $\mu gL^{-1}$ and Ni=below detection limit to 19 $\mu gL^{-1}$). With the exception of Ni, the contents of $Cr^{6+}$ and Cd, in most cases, are characterized by higher values than the permissible limits set by the World Health Organization. In view of low geochemical baseline values for chromium and cadmium, the origin of heavy metal pollution is inferred to be anthropogenic. The toxicological data on water bodies, when integrated with published health data, brings out a clear picture about their mutual linkage.

*Keywords*: River and lake water, groundwater, heavy metals, India, pollution

## 1. INTRODUCTION

In recent years many aquatic environments have reached critical stages due to heavy metal pollution. The sources of pollution, in majority of cases, are attributed to anthropogenic activities. There are studies which show that the use of heavy-metal-contaminated water for agriculture has caused uptake of heavy metals by leafy vegetables [1]. Likewise, it has been shown that dumping of solid wastes are the major sources of groundwater contamination by heavy metals [2]. In view of these studies, a number of water bodies of India, which include samples from river, lake and groundwater, were analyzed for three important heavy metals, viz. $Cr^{6+}$, Cd and Ni. The purpose of choosing these heavy metals are based on (i) the comprehensive reviews on the toxicological effects of hexavalent chromium and nickel on human health [3, 4] and (ii) toxicity of cadmium to living organisms and its leaching behaviour from industrial wastes [5]. The analyzed data are evaluated in terms of locating the origin of heavy metal pollution in water bodies. The toxicological data are then integrated with published health data for risk assessment and impending health hazard.

## 2. MATERIALS AND METHOD

A total of 13 water samples were collected from various sources. These include (i) two locations on the bank of river Ganges at Jajmau in Kanpur (Uttar Pradesh) and Dakshineswar in Kolkata (West Bengal), (ii) one location on the bank of river Godavari at Bhadrachalam (Telangana), (ii) five freshwater lakes in the city of Hyderabad (Telangana), (iii) four groundwater samples in the vicinity of these lakes (within 0.5 to 1.0 km) at Hyderabad, and (iv) one groundwater sample from Bithoor area of Kanpur. As a first step, a double beam spectrophotometer (Elico–164) was calibrated with known standard solutions of each target metal ($Cr^{6+}$, Cd and Ni). In order to get maximum sensitivity of spectrophoto-meter, the wavelength for maximum absorbance was chosen for the calibration of each element and subsequent sample analysis. Details about the calibration and experimental procedures are given in [6].

## 3. RESULTS AND DISCUSSION

The concentrations of $Cr^{6+}$, Cd and Ni in all samples analyzed in this study are presented in Fig. 1. The guideline values recommended by the World Health Organization [7] and the desirable limits suggested by the Bureau of Indian Standard [8] are displayed as horizontal lines. With the exception of Ni, the other two heavy metals ($Cr^{6+}$ and Cd) document contamination of water bodies to variable degrees (Fig. 1). River water samples from Ganges and Godavari (Sample Nos. 10 and 12 in Fig. 1) are within the desirable limits [8] and hence will not be discussed further. The Ganges water at Jajmau in Kanpur and groundwater samples collected near Bithoor area of Kanpur and Babanagar Lake in Hyderabad are very high (Fig. 1a). A large number of processing units (>450) for leather tanneries in and around the Jajmau area [9] and indiscriminate dumping of chromate salts are primarily responsible for high concentration of $Cr^{6+}$at Kanpur aquifer and surface water bodies. The high levels of $Cr^{6+}$ documented in the surface and groundwater bodies of Hyderabad city (Fig. 1a) may owe their origin from different industries in and around our study area [10].



Sponsored by the Indian Institute of Geomagnetism, Navi Mumbai-410218 (DST, Govt. of India)

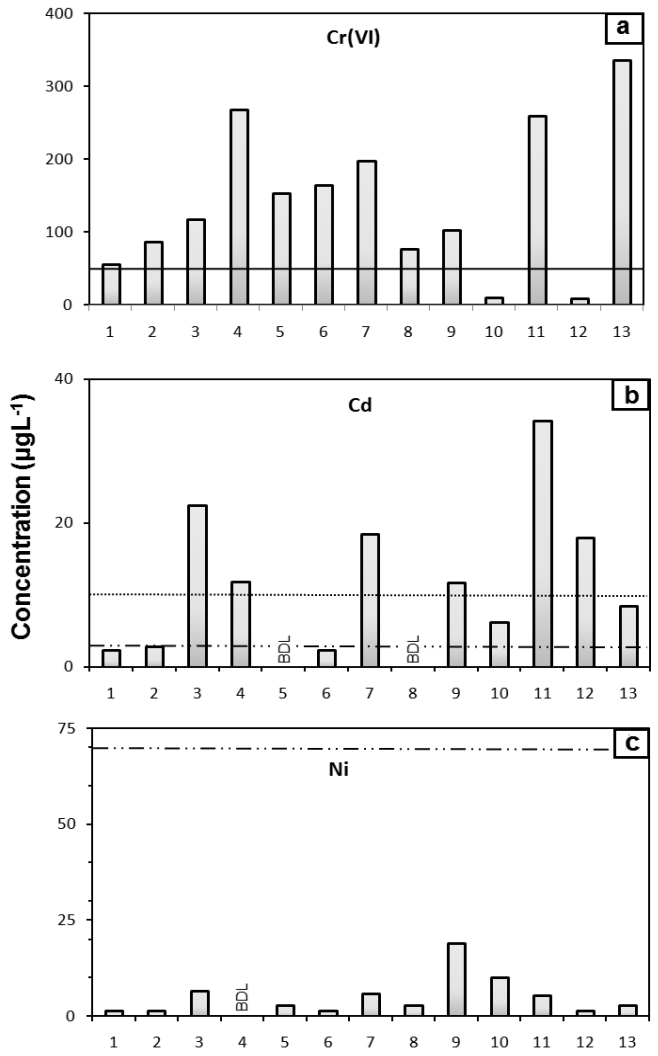



**Figure 1.** *Concentration of toxic heavy metals. (a) $Cr^{6+}$, (b) Cd and (c) Ni contents in different water bodies are shown. The sample numbers are as follows: 1: Nacharam Lake, 2: Groundwater near Nacharam Lake, 3: Babanagar Lake, 4: Groundwater near Babanagar Lake, 5: Safilguda Lake, 6: Groundwater near Safilguda Lake, 7: Kapra Lake, 8: Groundwater near Kapra Lake, 9: Hussainsagar Lake, 10: Ganges (Kolkata), 11: Ganges (Kanpur), 12: Godavari (Bhadrachalam), and 13: Groundwater from Bithoor (Kanpur). In the case of Cr, the guideline value of Cr(total) is shown as horizontal line [7, 8]. For Cd and Ni, the dash-dot lines represent guidelines values of [7] and dot-line is the desirable limit recommended by [8].*

The concentration of Cd in each water body is presented in Fig. 1b, which shows its highly variable nature. Eight samples are higher than the guideline value [7]. However, this number reduces to six following the desirable limit of BIS [8]. The observed variable range is a reflection of contamination originating from different point sources. A large number of anthropogenic sources of cadmium exist. In view of low geochemical baseline values for cadmium, its high content in water samples can be attributed to different kinds of anthropogenic activities that are prolific at specific locations [9,10].

The health hazards originating from ingestion of both $Cr^{6+}$ and Cd are of common nature [6], although their response times may be different. Increased incidences of reported skin diseases, diarrhea and acute renal impairment within the city populations of Kanpur [11] and Hyderabad [12] are inferred to be a result of Cr and/or Cd ingestion.

## 4. CONCLUSION

The present study shows the effect of certain heavy metal pollution on different water bodies of India. Some of the collected water samples give alarming picture and call for immediate mitigation measures. General public awareness is a must to tackle such a situation.

### REFERENCES CITED

1. Swapna Priya, E., Sunil, G., Shivaiah, K.,Gaddameedi, A., and Kumar, A., *J. Industrial Pollution Control,* 2014, v. 30(2), p. 289–293.
2. Laniyan, T.A., Kehinde Phillips, O.O., and Elesha, L., *Intl. J. Engineering & Technology*, 2011, v. 11(5), p. 53–60.
3. USEPA, *U.S. Environmental Protection Agency,* 1998, Washington, DC, CAS No. 18540-29-9.
4. Cempel, M., and Nikel, G., *Polish J. Environ. Stud.*, 2006, v. 15(3), p. 375–382.
5. Naja, G.M., and Volesky, B., (2009) *Heavy Metals in the Environment*, 2009, p. 13–61, Wang, L.K., Chen, J.P., Hung, Y-T. and Shammas, N.K. (eds.), CRC Press.
6. Das Sharma, M., Juyal, A., Karuna, M., and Das Sharma, S., *Current Science,* (under review).
7. WHO, *Guidelines for drinking water quality*, 2004, 3rd edition, ISBN 9241546387.
8. BIS, *Drinking water—Specification*, 1991, IS 10500, New Delhi.
9. Gowd, S.S., and Reddy, M.R., *20th Annual Goldschmidt Conference*, 2010, p. A986, Knoxville, Tennessee, USA.
10. Ministry of MSME, Government of India, 2014, (on-line); http://dcmsme.gov.in/dips/.
11. Sharma, P., Bihari, V., Agarwal, S.K., Verma, V., Kesavachandran, C.N. *et al., PLoS ONE*, 2012, v. 7, e47877.
12. IIHFW, *Environmental pollution and its effects on health*, 2009, (on-line) http://iihfw.org.



Sponsored by the Indian Institute of Geomagnetism, Navi Mumbai-410218 (DST, Govt. of India)

Proceedings of the National Seminar on
"Impact of Scientific Advances on Society", August 18-19, 2015, p.35-39
St. Pious X Degree & PG College for Women, Hyderabad-500076.

# Spectrophotometric determination of molybdenum (VI)

**M. Bala Raju* and R. Mohan Reddy**

*Department of Chemistry, PSC & KVSC Govt. College, Nandyal- 518502, Kurnool District, Andhra Pradesh, India*
*balarajuchem@gmail.com*

## ABSTRACT

Molybdenum (VI) forms yellow colored water soluble complex with 2,4-Dihydroxybenzaldehyde-p-hydroxybenzoylhydrazone(2,4-DHBPHBH) in the pH range of 1.0 to 7.0. The complex has an absorption maximum at 415 nm. The reagent has negligible absorbance at 415 nm. Hence, analytical studies are made at 415 nm. Absorbance is maximum and constant in the pH range of 2.0 to 3.5. Hence, pH 3.0 is selected for further studies. The linear plot between the absorbance and the amount of Mo(VI) indicates that Beer's law is obeyed in the range of 0.479–11.993 µg/ml of Mo(VI). The molar absorptivity and Sandell's selectivity are $0.864 \pm 0.002 \times 10^4$ l mol$^{-1}$ cm$^{-1}$and 0.0090 µg/cm$^2$ respectively. The standard deviation of the method for ten determinations of 4.797 µg/ml of Mo(VI) is 0.008. The correlation coefficient (γ) of the calibration equation of the experimental data is 0.9999. The effective range of concentration for accurate determination of Mo(VI) as ascertained from Ringbom plot is 0.500 to 10.990 µg/ml.

*Keywords*: Molybdenum(VI), 2,4-DHBPHBH, Sandell's selectivity Ringbom plot

## 1. INTRODUCTION

Molybdenum is an important transition metal in agriculture and metallurgy. Its chemistry is very complex in nature. The compounds containing molybdenum in 0,+2, +3, +5 and +6 oxidation states are known to exist. About 85 percent molybdenum that is being produced is used in manufacture of iron based alloys. Molybdenum is added to the cast iron to increase its strength which is widely used in the manufacture of automobile engines. Because of the properties such as strength, stiffness, electrical and thermal conductivity and corrosion resistance, the alloys of molybdenum find numerous industrial applications.

Molybdenum when added in the form of fertilizer, large increase in the crops yields, particularly leguminous, have been observed. It is added in trace amounts in vitamin supplements and specialized medicines. Recent studies have shown that molybdenum is an important element in promoting healthy teeth. Molybdenum is being used as catalyst in many petroleum and chemical processes. It is used as activator or promoter of other catalysts.

The number of chromogenic reagents available for molybdenum is relatively small. Of these the thiocyanate-tin (II) chloride method is the oldest and most widely used. However, even this method suffers from a number of limiting factors [1, 2] such as variations of absorbance with thiocyanate, tin (II) chloride and hydrogen ion concentrations, interference from various metal ions and problems of stability and reproducibility of measurements. Among the reagents employed dithiol [3-5] is popular because of its selectivity, sensitivity. However, the reaction between molybdenum and dithiol is more rapid at higher temperatures (75$^0$C) and heating is not possible in the presence of tungsten, which reacts with dithiol. Most of the methods are extraction methods [6,7]. Only a few methods are reported using benzoyl hydrazone derivatives.

Podcahinova [8] reported a paper in 1974 for spectrophotometric determination of molybdenum(VI) with 2-hydroxy-1-napthaldehyde isonicotinoylhydrazone which suffers from interference of Fe(III). Rao et al. [9] determined Mo(VI) with resacetophenone-isonicotinolyhydrazone spectrophotometrically, kavlentis in1986 presented a paper describing the spectrophotometric determination of molybdenum [10] with salicylaldehyde isonicotinoylhydrazone. Murthy et al. [11] in 1988 determined molybdenum spectrophotomertically with salicylaldioxime isonicotinoylhydrazone.

In view of greater importance of molybdenum(VI) in agriculture, industry and biological activity, the author has undertaken a detailed study of the colour reaction between Mo(VI) and 2,4-DHBPHBP to develop a new sensitive spectrophotometric method for the determination of Mo(VI) and the results are presented .

## 2. PRESENT INVESTIGATION

2,4-DHBPHBH forms yellow colored water soluble complex with molybdenum(VI) in the pH range of 1.0 to 7.0. The yellow solution is, therefore, investigated spectrophometrically for the possible determination of micro amounts of molybdenum(VI).

### *2.1 Absorption spectra of the reagent and the experimental solution*

The absorption spectra of the reagent solution against corresponding buffer blank and the experimental solution containing solutions of the reagent the buffer (pH



Sponsored by the Indian Institute of Geomagnetism, Navi Mumbai-410218 (DST, Govt. of India)

3.0) against the reagent blank are recorded in the wave-length range 365 nm to 600 nm. The typical spectra are presented in Fig. 1.

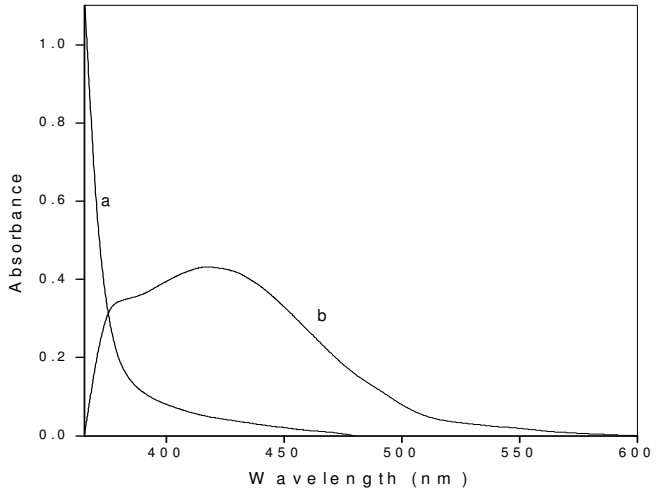



**Figure 1.** *Absorption spectra of (a) 2,4 – DHBPHBH Vs buffer blank***,** *(b) [Mo (VI)] - 2,4 – DHBPHBH Vs reagent blank.[Mo (VI)] = 5 x $10^{-5}$M ; [2,4 DHBPHBH] = 1.0 x $10^{-3}$M***,** *pH = 3.0.*

The spectra presented in Fig.1 shows that the complex has an absorption maximum at 415 nm. The reagent has negligible absorbance at 415 nm. Hence, analytical studies are made at 415 nm.

*2.2 Effect of pH on the absorbance of experimental solution*

The optimum pH required for the maximum colour development is established from the results obtained in the experiment carried out. The plot drawn between absorbance and pH (Fig. 2) indicates that the absorbance is maximum and constant in the pH range of 2.0 to 3.5. Hence, pH 3.0 is selected for further studies.

*2.3 Effect of 2,4- DHBPHBH concentration on the absorbance of the experimental solution*

The optimum concentration of 2,4-DHBPHBH required for achieving maximum absorbance is arrived at by following the procedure in 3.d and the results are presented in Table 1.

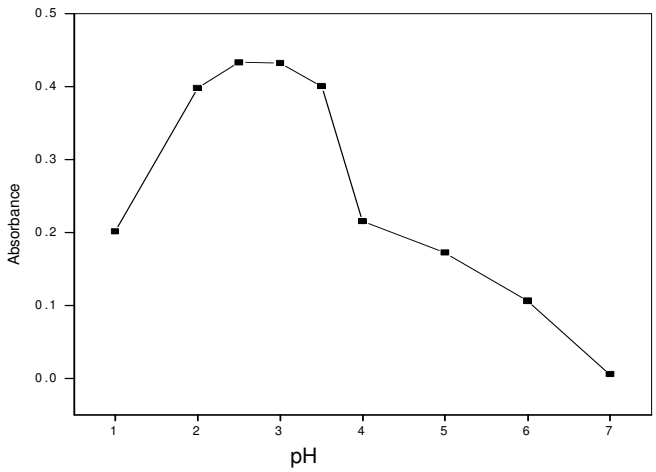



**Figure 2.** *Effect of pH on absorbance of [Mo (VI)] - 2,4 – DHBPHBH system.[Mo (VI)] = 5 x $10^{-5}$M; [2,4 – DHBPHBH]=1.0 x $10^{-3}$M, λ = 420 nm.*

**Table 1.** Effect of 2,4-DHBPHBH concentration on the absorbance of experimental solutions, [Mo(VI)] = 5.0 x $10^{-5}$M ; pH = 3.0 ; λ = 415 nm

| [2,4-DHBPHBH] : [MO(VI)] | Absorbance |
|---|---|
| 1: 2 | 0.179 |
| 1:5 | 0.258 |
| 1:10 | 0.429 |
| 1:20 | 0.432 |
| 1:60 | 0.433 |
| 1:80 | 0.429 |

The results in Table 1 indicates that a 10 molar excess of the reagent is necessary for achieving maximum absorbance. Hence, the same ratio is maintained throughout the studies.

*2.4 Order of addition of constituent solutions on the absorbance of the experimental solution*

The order of addition of the constituent solutions (buffer solution, Mo(VI) and the reagent solution) has no effect on the absorbance of the experimental solutions. Hence, it is not necessary to adhere to a particular order of addition of various constituents of the experimental solution.

*2.5 Effect of time on colour development and stability of the colour*

To study the effect of time on the absorbance, it shows that the colour development is instantaneous and remains constant for 20 hours.



Sponsored by the Indian Institute of Geomagnetism, Navi Mumbai-410218 (DST, Govt. of India)

*2.6 Adherence of the system to Beer's law*

To explore the possibility of employing the colour reaction for the determination of molybdenum(VI) keeping the reagent concentration constant, the absorbance of experimental solution is measured at 415nm .

The results are presented in the form of a plot of absorbance vs amount of Mo(VI) and shown in Fig. 3. The straight line plot obtained obeys the equation A= 0.0896C+0.0011. The linear plot between the absorbance and the amount of Mo(VI) (Fig.3) indicates that Beer's law is obeyed in the range of 0.479 – 11.993 µg/ml of Mo(VI).

The molar absorptivity and Sandell's selectivity are 0.864 ± 0.002 x $10^4$ l mol $^{-1}$ cm $^{-1}$and 0.0090 µg/cm$^2$ respectively. The standard deviation of the method for ten determinations of 4.797 µg/ml of Mo(VI) is 0.008. The correlation coefficient (γ) of the calibration equation of the experimental data is 0.9999. The effective range of concentration for accurate determination of Mo(VI) as ascertained from Ringbom plot is 0.500 to 10.990 µg/ml.

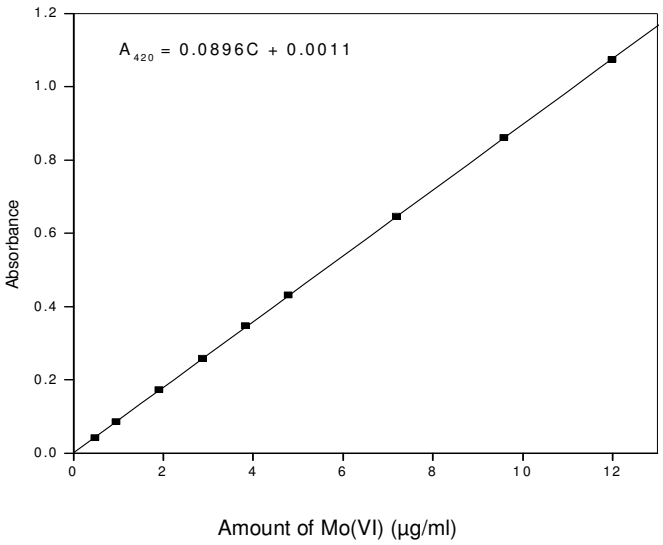



**Figure 3.** *Absorbance Vs amount of Mo(VI) (µg/ml); [2,4 – DHBPHBH] = 1.0 x $10^{-3}$M; pH = 3.0 ; λ = 420 nm.*

*2.7 Effect of foreign ions*

Various amounts of foreign ions that are generally associated with the metal ion in real samples are added to a fixed amount of Mo(VI) (4.797 µg/ml) solution and the absorbance is measured at 415 nm under Optimal conditions . The concentration (µg/ml) at which various ions do not cause an error of more than ± 3% in absorbance is taken as the tolerance limit and the results are presented in Table 2.

**Table 2.** Tolerance limit of foreign ions. Amount of Mo(VI) = 4.797 µg/ml; pH = 3.0

| Ion | Tolerance limit (µg/ml) | Ion | Tolerance limit (µg/ml) |
|---|---|---|---|
| Fluoride | 195 | Se (IV) | 39 |
| Chloride | 354 | Pb (II) | 103 |
| Bromide | 794 | Tl (III) | 204 |
| Iodide | 1260 | Zr (IV) | 18 |
| Carbonate | 600 | Cr (VI) | 10 |
| Nitrate | 620 | Hg (II) | 200 |
| Sulphate | 920 | Ag (I) | 101 |
| Phosphate | 980 | In (III) | 114 |
| Thiosulphate | 1120 | Co (II) | 59 |
| Oxalate | interferes | Te (IV) | 127 |
| Thiocyanate | 476 | W (VI) | 110 |
| Tartarate | interferes | Ce (IV) | 28 |
| Citrate | 272 | Ir (III) | 192 |
| Ascorbate | 875 | Al (III) | 27 |
| Thiourea | 771 | Mn (II) | 55 |
| EDTA | interferes | Cd (II) | 112 |
| | | Zn (II) | 63 |
| | | La (III) | 138 |
| | | Ni (II) | 55 |
| | | Fe(III) | interferes |
| | | Ti(IV)* | 50 |
| | | Cu(II)# | 65 |
| | | V(V) | interferes |

* Masked with fluoride
# Masked with thiosulphate

*2.8 Composition and stability constant of the complex*

The composition of the complex species is determined by Job's continuous variation method and mole ratio method.

*2.8.1 Job's method*

Equimolar solutions (5.0x$10^{-4}$M) of molybdenum(VI) and 2, 4- DHBPHBH are prepared and mixed in



Sponsored by the Indian Institute of Geomagnetism, Navi Mumbai-410218 (DST, Govt. of India)

different volume proportions keeping the total volume of the mixture constant. The Job's method is carried out and the results are presented in Fig. 4.

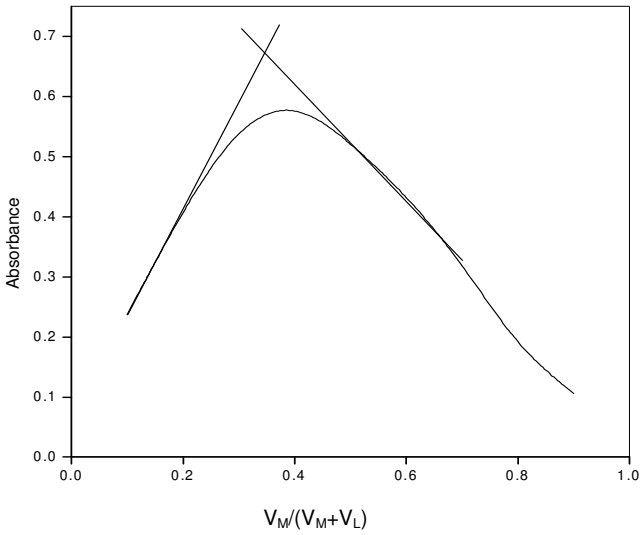



**Figure 4.** *Job's curve. [Mo (VI)] = [2,4 DHBPHBH] = 5.0 x $10^{-4}$M; pH = 3.0 ; λ = 420 nm.*

From the plot (Fig .4) it is seen that composition of the complex is 1:2 and the stability constant β as calculated from the Jobs method is 6.05 x$10^{11}$.

*2.8.2 Mole ratio method*

Mole ratio method carried out from a series of solutions containing 1.0 ml of molybdenum(VI) (5x$10^{-4}$M) solution and different volumes of 2,4 –DHBPHBH solution. The results are presented in Fig .5. The mole ratio plot confirms the composition as 1:2 [Mo(VI): 2,4-BHBPHBH].

## 3. APPLICATIONS

The present method for the determination of molybdenum(VI) is applied to steel and alloy samples.

*3.1 Proceedure*

Into a series of 10 ml volumetric flasks, each containing 5.0 ml of buffer solution (pH, 3.0), 1.0 ml of 0.1 M of fluoride [to mask Ti(IV)] solution, known aliquots of the sample solution and 1.0 ml of the reagent (1x$10^{-2}$ M) solution are added.

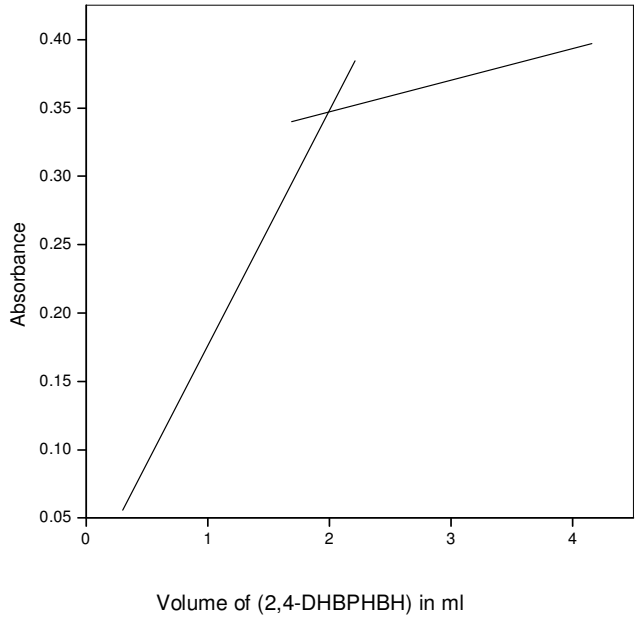



**Figure 5.** *Mole ratio plot. [Mo (VI)] = [2,4 DHBPHBH] = 5.0 x $10^{-4}$M; pH = 3.0 ; λ = 420 nm.*

The absorbance of these solutions is measured at 415 nm. From the measured absorbance the amount of molybdenum(VI) is computed by referring to preconstructed calibration plot at 415 nm. The results are presented in Table 3.

**Table 3.** Determination of Mo(VI) in alloy and steel samples

| Sample | Composition (%) certified | Composition (%) found* | Relative error (%) |
|---|---|---|---|
| Nickel-based high temperature alloy | | | |
| i) Udimet – 500[a] | 4.80 | 4.83 | +0.62 |
| ii) Udimet – 700[b] | 5.20 | 5.22 | +0.38 |

* Average of seven determinations.
Composition of samples (%)
(a) Cr 18; Co 18.5: Al 2.9: Mo 4.8: C 0.08: B 0.006; Zr 0.05; Ti 2.9
(b) Cr 1.5; Co 18; Al 4.3; Mo 5.21; C 0.08; B 0.003; Ti 3.5.



Sponsored by the Indian Institute of Geomagnetism, Navi Mumbai-410218 (DST, Govt. of India)

**REFERENCES CITED**

1. Sandell, E.B., *Colorometric Determination of Traces of Metals,* 1959, Third Edition, Interscience, New York.
2. Marezenko, Z., *Spectrophotometric Determination of Elements,* 1976, Ellis, Horweed Chichester, p. 361.
3. de Silva, M.E.M.S., *Analyst,* 1975, v. 100, p. 517.
4. Quin, B.F., and Brooks, R.R., *Anal. Chim. Acta.*.1975, v. 74, p. 75.
5. Norheim, G., Waasjoe, E., and Fresenius, Z. *Anal. Chem.* 1977, v. 286, p. 229.
6. Rodriguez, M.T., *Analyst,* 1982, v. 107, p. 41.
7. Boregowda, K., Padmarajaiah, N., and Shivalingam, S., *Analyst*, 1986, v. 111, p. 1397.
8. Podchainova, V.N., Yatsenko, V.A., and Dolgorev, A.V., *Zodsk. Lab.* 1974, v. 40, p. 243.
9. Rao, K. M., Reddy, T., Sreenivasulu and Rao, S.B., *J. Indian Inst. Sci.,* 1986, v. 66(1), p. 39–41.
10. Kavlentis, E., *Anal. Lett.,* 1988, v. 21, p. 107.
11. Murthy, K., Madhava, K., Sankara Reddy, P.B. and Rao, S.B., *Acta. Ciencia Indica,* 1989, v. 15, p. 89.

**ACKNOWLEDGEMENTS**

We thank Dept. of Chemistry, S.K. Uuniversity, Anantapur and Dr. S. Imthiyaz Ahmed, Principal, National P.G. College,Nandyal for providing infrastructure .We also thank Dr Y. Nagaraja Naidu, Principal, PSC & KVSC Govt. College, Nandyal and staff for their support.

Proceedings of the National Seminar on
"Impact of Scientific Advances on Society", August 18-19, 2015, p.40-44
St. Pious X Degree & PG College for Women, Hyderabad-500076.

# Kinetics and mechanism of protection of uridine-3´-monophosphate from sulphate radical anion by caffeic acid under anoxic conditions

**Sudha Swarga Midudhula[1,*], and Adinarayana Mundra[2]**

*[1]Department of Chemistry, St. Pious X Degree & PG College for Women, Nacharam,, Hyderabad-500076, Telangana, India*
*[2]Post-Graduate College of Science, Saifabad, Osmania University, Hyderabad-500004, Telangana, India.*
*[*]Sudhaswaraga@gmail.com*

## ABSTRACT

The oxidation of uridine-3´-monophosphate by sulphate radical anion ($SO_4^{\bullet-}$) has been followed by measuring the absorbance of uridine-3´-monophosphate at 262nm spectrophotometrically. The rates and the quantum yields ($\phi$) of oxidation of uridine-3´-monophosphate by sulphate radical anion have been determined in the presence of different concentrations of caffeic acid. Increase in [caffeic acid] is found to decrease the rate of oxidation of uridine-3´ -monophosphate suggesting that caffeic acid acts as an scavenger of $SO_4^{\bullet-}$ and protects uridine-3´-monophosphate from it. Sulphate radical anion competes for uridine-3´-monophosphate as well as for caffeic acid. From the results of experimentally determined quantum yields ($\phi_{exptl}$) of oxidation of uridine-3´-monophosphate in presence of different concentrations of caffeic acid and the quantum yields calculated ($\phi_{cal}$) $\phi_{cal} = \phi^0_{exptl} \times p$ , p is the probability of $SO_4^{\bullet-}$ reacting with uridine-3´-monophosphate in presence of caffeic acid and $\phi^0_{exptl}$ is the quantum yield of oxidation of uridine-3´-monophosphate in the absence of caffeic acid, assuming caffeic acid acting only as a scavenger of $SO_4^{\bullet-}$ radicals show that $\phi_{cal}$ values are lower than $\phi_{exptl}$ values. This observation indicates that caffeic acid might not be able to scavenge $SO_4^{\bullet-}$ as expected, and uridine-3´-monophosphate radicals may be competing for $SO_4^{\bullet-}$ and thus reducing the scavenging capacity of caffeic acid. These observations suggest that the uridine-3´-monophosphate radicals are totally reducing in nature, unlike transient radicals produced in case of uracil, thymine, thymidine, adenine and adenosine reaction with $SO_4^{\bullet-}$. The oxidation of D- Ribose by sulphate radical anion ($SO_4^{\bullet-}$) has been followed by measuring the absorbance of D- Ribose at 480nm spectrophotometrically using phenol sulphuric acid method. The oxidation of D- Ribose by $SO_4^{\bullet-}$ is one order of magnitude lower than the rate of oxidation of uridine-3´-monophosphate. Independent estimation of the sugar moiety in uridine-3´-monophosphate at different times also shows that sugar moiety is not oxidized considerably. Further rate of oxidation of uracil under similar condition is closer to uridine-3´-monophosphate. These results therefore indicate that the base moiety might be the site of attack by the sulphate radical anion in uridine-3´ -monophosphate.

*Keywords*: Oxidation of caffeic acid, protection of uridine-3´-monophosphate by caffeic acid, Oxidation by sulphate radical anion

## 1. INTRODUCTION

The primary events leading to DNA damage occur either from direct ionization of DNA itself or due to attack of radicals derived from the ionization of the immediate environment [1, 2].These radicals are mainly formed from water and the most damaging of them is the hydroxyl radical [3]. The study of the direct ionization process within DNA is hampered by the high yields of radicals formed on radiolysis of dilute aqueous solutions of DNA. One of the approaches to study the properties of radical species produced by the direct ionization of homopolynucleotides or DNA in aqueous solutions is by utilizing a strong one-electron oxidant such as $SO_4^{\bullet-}$. In polynucleotides and DNA, strand breakage has been reported to be induced within 100µs on reaction of $SO_4^{\bullet-}$ [4, 5]. The reactions of photolytically generated $SO_4^{\bullet-}$ with DNA model compounds [6, 7] have been reported to generate base radicals which subsequently abstract hydrogen from the sugar moiety, thus transferring the radical site, and sugar radicals so formed initiate strand breakage in polynucleotides or DNA. In order to understand the mechanism of damage to DNAand poly nucleotides by free radicals information about the nature and behaviour of the DNA base radicals is desirable. The reactions of $SO_4^{\bullet-}$ with pyrimidine bases and nucleosides along with the protection and repair reactions by caffeic acid are reported [8-11]. It has been observed that caffeic acid acts as an effective protecting agent against damage by $SO_4^{\bullet-}$ [8-11]. It is in this back ground we have carried out kinetic studies of photooxidation of uridine-3´-monophosphate in the absence and presence of caffeic acid to understand the site of attack of sulphate radical anion on uridine-3´-monophosphate and to characterize the nature of transient radicals produced. It is also of interest to evaluate the extent of protection offered by caffeic acid.



Sponsored by the Indian Institute of Geomagnetism, Navi Mumbai-410218 (DST, Govt. of India)

## 2. EXPERIMENTAL

Uridine-3´-monophosphate and peroxydisulphate were purchased from E.Merck, while caffeic acid was from Sigma chemicals and used as received. The solutions of caffeic acid, uridine-3´-monophosphate and peroxydisulphate were always prepared afresh with double distilled water. Stock solutions of uridine-3´ -monophosphate and caffeic acid were always freshly prepared and were deaerated by bubbling nitrogen. The solutions of potassium salt of peroxydisulphate was standardized using cerimetry using ferroin indicator. Peroxydisulphate solution was added to a measured excess of ferrous ammonium sulphate and back titrated with a standard ceric ammonium sulphate solution as reported by Kapoor et al. [12]. At room temperature this reaction is rapid enough for analytical purposes and equivalency of ferrous ion to peroxydisulphate is 2 to 1. Required amounts of caffeic acid was then injected as aqueous solution into the mixture of uridine-3´-monophosphate and peroxydisulphate solutions present in a specially designed 1-cm path length quartz cuvette which is suitable for both irradiations in the quantum yield reactor as well as for absorbance measurements. The absorbance measurements were made at 262 nm, which is the $\lambda_{max}$ of uridine-3´- monophosphate on a HITACHI UV-Visible spectrophotometer (model 3410). Irradiations were performed at room temperature (25$^{o}$C) with medium-pressure mercury lamp using Quantum yield reactor model QYR-20. The irradiations were interrupted at definite intervals of time and the absorbance were noted from which the rate of reaction and the quantum yields of oxidation are calculated. The light intensity at 254 nm was measured by peroxydisulphate chemical actinometry [13].

## 3. RESULTS AND DISCUSSION

$N_2$ saturated aqueous solutions of the reaction mixture containing uridine-3´-monophosphate ($0.5x10^{-4}$ mol $dm^{-3}$), peroxydisulphate ($4 x10^{-4}$ $moldm^{-3}$) and with varying concentrations of caffeic acid were irradiated and the absorbance at 262 nm ($\lambda_{max}$ of uridine-3´ -monophosphate ) with time were noted. The absorbance of uridine-3´-monophosphate in the reaction mixture at different intervals of irradiation time have been obtained by subtracting the contribution of absorbance of caffeic acid by carrying out a parallel experiment with caffeic acid alone at the same intervals of time measured under similar experimental conditions of the oxidation of uridine-3´ -monophosphate by sulphate radical anion in the presence of caffeic acid. From these the rates of oxidation of uridine-3´-monophosphate were calculated from the plots of absorbance versus time using microcal origin computer program on personal computer. The initial rates of oxidation of uridine-3´-monophosphate by sulphate radical anion have been found to decrease with increase in [caffeic acid].(Table.1). The quantum yields of oxidation of uridine-3´ -monophosphate were calculated from the rates of oxidation of uridine-3´-monophosphate by sulphate radical anion and the light intensity absorbed by peroxydisulphate at 254 nm, the wavelength at which peroxydisulphate is activated to sulphate radical anions. The quantum yields of oxidation of uridine-3´-monophosphate ($\phi_{exptl}$) at different [caffeic acid] are presented in Table.1. The $\phi_{exptl}$ values were found to decrease with increasing concentration of caffeic acid. The substances used in the present work viz., caffeic acid and/or uridine-3´-monophosphate did not undergo any chemical change on shining the light in the absence of peroxydisulphate. Caffeic acid has molar absorption coefficient 7500 $dm^3mol^{-1}cm^{-1}$ and uridine-3´-monophosphate has 8800 $dm^3mol^{-1}cm^{-1}$ at 254 nm wavelength at which peroxydisulphate is activated to $SO_4^{\bullet-}$ radicals. Due to this more light is being absorbed by caffeic acid and/or uridine-3´ -monophosphate and the concentration of $SO_4^{\bullet-}$ radicals produced from activation of peroxydisulphate should decrease with increase in concentration of caffeic acid and/or uridine-3´-monophosphate. Contrary to this the quantum yields of oxidation of caffeic acid and/or uridine-3´-monophosphate were found to increase with increase in concentration of caffeic acid [10] and/or uridine-3´-monophosphate (Table 2).

**Table 1.** Effect of [caffeic acid] on the quantum yields of photooxidation of Uridine -3´-monophosphate in presence of peroxydisulphate (PDS) under anoxic conditions.

| S.No | $10^5$ x [caffeic acid] (mol $dm^{-3}$) | $10^8$ x rate (mol $dm^{-3}$ $s^{-1}$) | $\phi_{exptl}$ | p | $\phi_{cal}$ | % Scavenging |
|---|---|---|---|---|---|---|
| 1 | 0.00 | 8.6 | 7.063 | 1.00 | 7.063 | 0.00 |
| 2 | 1.00 | 6.06 | 4.977 | 0.634 | 4.479 | 36.6 |
| 3 | 2.00 | 4.56 | 3.745 | 0.464 | 3.277 | 53.6 |
| 4 | 5.00 | 3.00 | 2.460 | 0.257 | 1.815 | 74.3 |
| 5 | 10.00 | 1.10 | 1.800 | 0.147 | 1.03 | 85.3 |

Light intensity = 1.01 x $10^{15}$ quanta $s^{-1}$
[PDS] = 4.00 x $10^{-4}$ mol $dm^{-3}$, [Uridine -3´-monophosphate] = 5.00 x $10^{-5}$ mol $dm^{-3}$,
pH~7.5, Temp = 298 K



Sponsored by the Indian Institute of Geomagnetism, Navi Mumbai-410218 (DST, Govt. of India)

**Table 2.** Rates of photooxidation of Uridine -3´-monophosphate in presence of peroxydisulphate (PDS) at various [Uridine -3´-monophosphate] in aqueous anoxic solution.

| $10^5$ x [Uridine -3´-monophosphate] (mol dm$^{-3}$) | $10^8$ x Rate (mol dm$^{-3}$ s$^{-1}$) | Quantum yield |
|---|---|---|
| 10.00 | 8.6 | 14.0 |
| 5.00 | 8.5 | 7.06 |
| 2.00 | 8.6 | 2.99 |

Light intensity = 1.01 x $10^{15}$ quanta s$^{-1}$
[PDS] = 4.00 x $10^{-4}$mol dm$^{-3}$
pH = 7.5, Temp = 298 K

These results suggest that the excited states of caffeic acid and/or uridine-3´-monophosphate subsequently transfer energy to peroxydisulphate to give $SO_4^{\bullet-}$ radicals by acting as sensitizers. Thus the efficiency of production of $SO_4^{\bullet-}$ radicals increase, which increases the quantum yields of oxidation of caffeic acid and/or uridine-3´-monophosphate.

Therefore in the present work we propose that caffeic acid as well as uridine-3´-monophosphate act as sensitizers and transfers energy to peroxydisulphate to create $SO_4^{\bullet-}$ radicals. This type of sensitization effect was proposed in similar systems earlier [14]. Since in this system there is competition between uridine-3´-monophosphate and caffeic acid for $SO_4^{\bullet-}$, the relative amounts of $SO_4^{\bullet-}$ reacting with uridine-3´-monophosphate decreases with increasing [caffeic acid]. The rate constant of the reaction of the sulphate radical anion with caffeic acid was reported [15] to be 1.24x$10^{10}$ dm$^3$mol$^{-1}$s$^{-1}$. The rate constant of the reaction of the sulphate radical anion with uridine-3´-monophosphate has been calculated by the uridine-3´-monophosphate competition method, which is very similar to the one choosen by Akhalaq et al [16] to determine the rate constant for the reaction of OH radicals with polyhydric alcohols in competition with KSCN. In the photolysis experiment, oxygen free $N_2$ –saturated solutions containing uridine-3´-monophosphate and varying amounts of caffeic acid were irradiated for 4 minutes and decrease of absorbance of uridine-3´-monophosphate was measured. The decrease of absorbance of uridine-3´-monophosphate reflects the number of sulphate radical anions that have reacted with uridine-3´ -monophosphate. From the rate constant of reaction of caffeic acid with $SO_4^{\bullet-}$ ($k_{\text{caffeic acid}+\ SO_4^{\bullet-}}$ = 1.24x$10^{10}$ dm$^3$mol$^{-1}$s$^{-1}$), The rate constant of $SO_4^{\bullet-}$ with uridine-3´-monophosphate ($k_{\text{uridine-3´ -monophosphate}\ + SO_4^{\bullet-}}$) can be calculated using equation (1).

$$\frac{[\text{Absorbance of uridine-3´-monophosphate}]_0}{[\text{Absorbance of uridine-3´-monophosphate}]_{\text{caffeic acid}}} = 1 + \frac{k_{(SO4^{\bullet-}+\ caffeic\ acid)}[caffeic\ acid]}{k_{(SO4^{\bullet-}+\ \text{uridine-3´-monophosphate})}[\text{uridine-3´-monophosphate}]} - (1)$$

Where [Absorbance of uridine-3´-monophosphate]$_0$ and [Absorbance of uridine-3´-monophosphate]$_{\text{caffeic acid}}$ indicate the decrease in the absorbance of uridine-3´-monophosphate in the absence and presence of caffeic acid respectively, in the same interval of time. Experiments of this kind can be carried out with great accuracy. The rate constant for the reaction of sulphate radical anion with uridine-3´-monophosphate has been calculated with five different concentrations of caffeic acid and average value obtained is 4.1 x$10^9$dm$^3$mol$^{-1}$s$^{-1}$.

The probability of $SO_4^{\bullet-}$ radicals reacting with uridine-3´-monophosphate {p ($SO_4^{\bullet-}$ + uridine-3´-monophosphate )} is calculated using the following equation.

$$p(SO_4^{\bullet-} + \text{uridine-3´-monophosphate}) = \frac{[\text{Uridine-3´-monophosphate}]k_{\text{uridine-3´-monophosphate}}}{[\text{Uridine-3´-monophosphate}]k_{\text{Uridine-3´-monophosphate}} + [\text{caffeic acid}]k_{\text{caffeic acid}}} - (2)$$

$k_{\text{uridine-3´-monophosphate}}$ and $k_{\text{caffeic acid}}$ are the rate constants of $SO_4^{\bullet-}$ with uridine-3´-monophosphate and caffeic acid respectively. Using the value of $\phi^0_{\text{exptl}}$ ($\phi^0_{\text{exptl}}$ is the quantum yield of oxidation of uridine-3´-monophosphate in the absence of caffeic acid) and p (p is the probability of $SO_4^{\bullet-}$ reacting with uridine-3´ -monophosphate given by Equation (2). We calculated a set of quantum yield values ($\phi_{\text{cal}}$) using equation (3)

$$\phi_{cal} = \phi^0_{exptl} \times p - (3)$$

These $\phi_{\text{cal}}$ values represent the quantum yield values for photooxidation of uridine-3´-monophosphate in the presence of caffeic acid corresponding to the situation where role of caffeic acid is restricted only to the scavenging of $SO_4^{\bullet-}$. If caffeic acid is acting as a scavenger alone, $\phi_{\text{cal}}$ are expected to be equal to $\phi_{\text{exptl}}$ values. However it is clear from the data in Table.1 that the calculated quantum yield values ($\phi_{\text{cal}}$) are smaller than the experimentally measured quantum yield values ($\phi_{\text{exptl}}$). This observation indicates that caffeic acid might



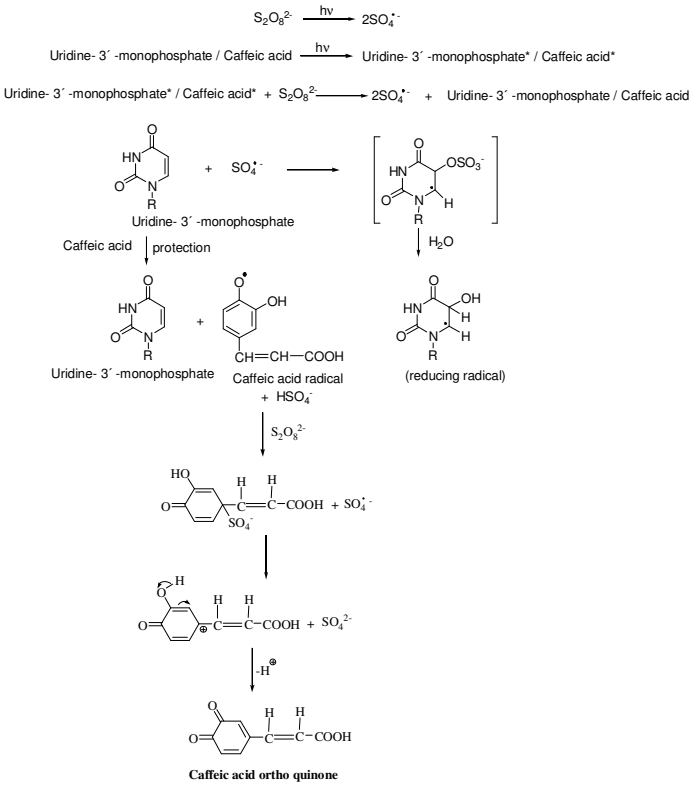
Sponsored by the Indian Institute of Geomagnetism, Navi Mumbai-410218 (DST, Govt. of India)

not be able to scavenge $SO_4^{\bullet-}$ as expected and uridine-3´-monophosphate radicals may be competiting more for $SO_4^{\bullet-}$ and thus reducing the scavenging capacity of caffeic acid. These observations suggest that the uridine-3´-monophosphate radicals are totally reducing in nature, unlike transient radicals produced in case of thymine, adenine and adenosine reaction with $SO_4^{\bullet-}$, which are oxidizing in nature [8,13,14]. It is pertinent to mention that the formation of reducing radicals in a similar system viz., deoxyuridine / $SO_4^{\bullet-}$ has been well reported [7].

From the rate constant of sulphate radical anion with caffeic acid and uridine-3´-monophosphate (Equation (2)), the fraction of $SO_4^{\bullet-}$ radicals scavenged by caffeic acid (Percentage scavenged = (1 – p) x 100) at different [caffeic acid] were calculated (Table.1). These values were a measure of protection of uridine-3´-monophosphate due to scavenging of $SO_4^{\bullet-}$ radicals by caffeic acid.

In the oxidation of pyrimidine nucleosides by OH radicals it has been reported that the base moiety is preferentially oxidized over the sugar moiety [17]. In poly U, it was reported that 93% of OH radicals add to the uracil moiety and only 7% abstract hydrogen atoms from the sugar moiety[18].

In order to understand the site of attack of $SO_4^{\bullet-}$ on uridine-3´-monophosphate i.e. at the base/sugar moiety, a quantitative estimation of the base and sugar moieties present in the nucleotide has been made simultaneously and independently under same kinetic conditions at different irradiation times. The results indicate that the sugar moiety is not significantly affected during the oxidation either in the absence or presence of caffeic acid. The rate of oxidation of D-ribose by $SO_4^{\bullet-}$ is lower than the rate of oxidation of uridine-3´-monophosphate under the same experimental conditions (Table.3). Further, the rates of oxidation of uridine-3´-monophosphate by $SO_4^{\bullet-}$ are comparable to those of the rates of oxidation of uracil (Table.3). These results indicate that the base moiety is preferentially attacked by $SO_4^{\bullet-}$ during the oxidation of uridine-3´-monophosphate. Therefore, the protection offered by caffeic acid is thought to be mainly against base moiety oxidation. The reactions of protection of uridine-3´-monophosphate are given in Scheme 1.




**Scheme 1.** Reactions of protection of uridine-3´-monophosphate.

## 4. CONCLUSIONS

Oxidation studies of uridine-3´-monophosphate in presence of various [caffeic acid] by sulphate radical anion have been carried out under different experimental conditions. From competition kinetic studies of uridine-3´-monophosphate and caffeic acid for $SO_4^{\bullet-}$, the rate constant of $SO_4^{\bullet-}$ with uridine-3´-monophosphate was calculated and also the percentage of protection of uridine-3´-monophosphate from $SO_4^{\bullet-}$ with caffeic acid has been calculated.

### REFERENCES CITED

1. Frankenberg-Schwager, *Radiat. Envir. Biophys*, 1990, v. 29(4) , p. 273.
2. Neill, P.O ´. and Fielden, E.M., *Adv. Radiat. Biol.*, 1993, v. 17, p. 53.
3. Roots, R., and Okada, S., *Radiat.Res*, 1975, v. 64, p. 306.
4. Andrew, R.G., and Edwards, J.O., *J. Org. Chem.*, 1971, v. 36(26), p. 4089.
5. Neill, P.O´., and Davies, S.E., *Int. J. Radiat. Biol.*, 1987, v. 52, p. 577.
6. Rashid, R., Mark, F., Schuchmann, H.P., and von Sonntag, C., *Int. J. Radiat. Biol.*, 1987, v. 59, p. 441.



Sponsored by the Indian Institute of Geomagnetism, Navi Mumbai-410218 (DST, Govt. of India)

7. Hildenbrand, K., Behrens, G., Schuite-Frohlinde, D., and Herak, J.N., *J. Chem. Soc*. Perkin Trans, 1989, v. 2, p. 283.
8. Sudha Swaraga, M., and Adinarayana, M., *Proceedings of Indian Academy of Sciences,* 2003, v. 115(2), p. 123.
9. Sudha Swaraga, M., Charitha, L., and Adinarayana, M., *Research Journal of Chemistry and Environment,* 2002, v. 6(4), p. 29.
10. Sudha Swaraga, M., and Adinarayana, M., *International Journal of Chemical Sciences,* 2014, v. 12(2) , p. 403.
11. Sudha Swaraga, M., and Adinarayana, M., *Proceedings of International Conference on New Dimensions in Chemistry and Chemical Technologies- Application in Pharma Industry* – JNTU (H). ISBN 978-93-82829-90-4.
12. Kapoor, S., Sharma, P.D., and Gupta, Y.K., *Talanta*, 1975, v. 22, p. 765.
13. Ravi Kumar, M., Thirupathi Rao, M., and Adinarayana, M., *Indian. J. Chem.*, 1998, v. 37, p. 346 A.
14. Sudha Swaraga, M., and Adinarayana, M., *Indian J. Biochem. Biophysics,* 2003, v. 40, p. 27.
15. Sudha Swaraga, M., Charitha, L., and Adinarayana, M., *J.Chem. Sci.,*2005, v. 117(4) , p. 345.
16. Akhalaq, M.S., Al-Baghdad, S., and von Sonntag, C., *Carbohydrate Res.*, 1987, v. 164, p. 71.
17. Deeble, D.J., and von Sonntag, C., *Int. J. Radiat. Biol.*, 1986, v. 49, p. 915.
18. Dizdaroglu, M., *Biochemistry*, 1985, v. 24, p. 4476.

**ACKNOWLEDGEMENTS**

The authors thank Department of Chemistry, Osmania University for providing facilities.

Proceedings of the National Seminar on
"Impact of Scientific Advances on Society", August 18-19, 2015, p.45-48
St. Pious X Degree & PG College for Women, Hyderabad-500076.

# Synthesis and comparative studies of $Sr_2CeO_4$:Eu phosphor

**Paleena Thulimilli[1,*], M. Sangeetha[1], N.V. Poornachandra Rao[2] and K.V.R. Murthy[3]**

*[1]Department of Physics, St.Pious X Degree & PG College for Women, Hyderabad-500076, India*
*[2]Department of Physics, Rajiv Gandhi University of Knowledge Technologies (RGUKT), IIIT, Basara, Telangana State, India*
*[3]Display Materials Laboratory, Applied Physics Department, Faculty of Technology and Engneering, M.S. University of Baroda,Vadodara-390001, India*
**leena4phy@gmail.com*

## ABSTRACT

Pure $Sr_2CeO_4$ and $Sr_2CeO_4:Eu^{3+}$(0.5, 1.0, 1.5, 2.0, 4.0 mol%) phosphors were synthesized by the sol-gel method and conventional solid-state reaction method.The samples fired at different temperatures $800^0$C , $1000^0$C and $1200^0$C for 3h.X-ray diffraction (XRD), scanning electron microscopy (SEM) and photoluminescence (PL) spectra were used to characterize the pure $Sr_2CeO_4$ and $Sr_2CeO_4:Eu^{3+}$phosphors. The XRD study confirms the structure of the system as orthorhombic and the calculated crystallite size of $Sr_2CeO_4:Eu^{3+}$ phosphoris 40nm.SEM images showed that the sol-gel synthesizes sample fired at $1200^0$C are spheroidal in shape and even at high temperature they appear less agglomerated. The spherical morphology has a positive effect on the optical property. $Sr_2CeO_4$ exhibits photoluminescence due to the charge transfer (CT) mechanism. The sample displays a broad emission spectrum which peaks at 467nm which is attributed to the energy transfer between the molecular orbital of the ligand and charge transfer state of the $Ce^{4+}$ ion. Upon excitation at 254nm wavelength, the emission spectrum of $Sr_2CeO_4:Eu^{3+}$phosphor emits a broad band range from 570-600nm with maximum intensity peak at 595nm (Orange red)(2.12eV).This phosphor is having excellent colour tunability of red light with different concentration of europium.

*Keywords*: Photoluminescence, XRD, SEM, phosphor, rare-earth ions, solid state reaction technique, sol-gel method

## 1. INTRODUCTION

The development of phosphors for the three primary colours attracts considerable interests in recent years due to their potential technological applications such as high-performance fluorescent lights and high-resolution display devices [1-3]. In the recent years, research on the phosphors used for white LEDs has become a hot topic and gained maturity. When excited, the oxide-based phosphors convert absorbed energy into electromagnetic radiation in ultraviolet, visible, infrared regions, and the luminescence of rare earth based phosphors also permits the development of trichromatic luminescence lighting. In 1998, a blue phosphor compound, $Sr_2CeO_4$, possessing one-dimensional chain of edge-sharing $CeO_6$ octahedra, was identified by Danielson and his co-workers with combinatorial chemistry [4]. It exhibited a blue–white emission band that peaks at 485 nm under 254 nm excitation. The luminescence was suggested to originate from a ligand-to-metal $Ce^{4+}$ charge transfer. In addition, it has been established that $Sr_2CeO_4$ exhibits photoluminescence under excitation with irradiation of ultra violet rays [5, 6]. $Sr_2CeO_4$ phosphor has been widely studied because of its importance in the realization of a new generation of optoelectronic and displaying devices. Recently, some groups began using all kinds of methods to fabricate this promising material and research its luminescent properties [7-10].

In this research article, we have studied on the synthesis, size, morphology and photoluminescence properties of pure and $Eu^{3+}$ ion doped $Sr_2CeO_4$ phosphors prepared by solid state reaction method and sol-gel method in air at $800^0$C, $1000^0$C and $1200^0$C. The prepared materials were characterized by XRD, SEM and photoluminescence techniques. PL studies of $Eu^{3+}$ doped $Sr_2CeO_4$ phosphor reveals that the emission colour varies from blue to red. This phosphor has a good potential for technological applications.

## 2. EXPERIMENTAL METHODS

Pure and dysprosium ion doped $Sr_2CeO_4$ were synthesized by the conventional solid state reaction method and sol-gel method. The dopant concentration in $Sr_2CeO_4:Eu^{3+}$ varied from 0.5-4.0 mol% range.Strontium Nitrate($Sr(NO_3)_2$) assay(99.995%) Sigma-Aldrich Chemie, Inc,Germany, Cerium Nitrate ($Ce(NO_3)_3$ assay (99.5%), Europium Nitrate ($Eu(NO_3)_3$), Citric Acid, Ethylene Glycol and Liquid ammonia ($NH_3$) assay (99.9%), National Chemicals, Nutan Gujarat Industrial Estate, Vadodara, India, were used as starting materials to prepare pure and $Eu^{3+}$doped $Sr_2CeO_4$ phosphors. The stoichiometric mixture of these staring materials were thoroughly homogenized in an agate mortar and pestle for 1hr and then put into an alumina crucible. Different samples were obtained after subsequent thermal treatment at $800^0$C, $1000^0$C and $1200^0$Cfor 3 h in muffle furnace in air with a heating rate of 5°C/min. Finally the samples were allowed to cool down to room temperature.

In sol-gel technique the starting materials were $Sr(NO_3)_3$, $Ce(NO_3)_3.6H_2O$, Citric Acid, Ethylene Glycol



Sponsored by the Indian Institute of Geomagnetism, Navi Mumbai-410218 (DST, Govt. of India)

and Liquid ammonia ($NH_3$. The nitrates were first dissolved in around 20ml of double distilled water and kept for stirring on a magnetic plate at room temperature until it becomes transparent in color and all the salt have mixed. Gradually the temperature of the plate was increased to 40-50°C. After a certain time of continuous stirring, citric acid was added to the transparent solution. The pH of the resulting solution was maintained 6-7 by adding droplets of ammonia. The temperature of the solution was raised to 60-80°C. The solution at this stage becomes milky in colour due to the precipitation taking place in the solution due to citric acid acting as a chilating agent. After few hours of stirring Ethylene glycol was added to the solution and stirring was maintained. The solution now changes its colour and becomes yellow, becoming more viscous and the formation of gel takes place. The starting materials used are nitrates in aqueous media, which form stable gels through gelation with citric acid, followed by cross-linking after polycondensation of ethylene glycol at increased temperature.

Phase identification of the powders was carried out by the X-ray powder diffraction using RIGAKU D'MAX III Diffractometer having Cu Kα radiation (λ=1.54nm). The scan range was kept from $5^0$ to $80^0$ at the scan speed of $0.05^0$ per second.The microstructures of the samples were studied using a scanning electron microscope (SEM) (JSM-5610LV, JEOL). The scanning continues time is 10s, and 2θ range is from 15 to $60^o$.The photoluminescence (PL) emission and excitation spectra were recorded with a spectrofluorophotometer (SHIMADZU, RF-5301 PC) equipped with a Xenon lamp as excitation source. All the spectra were recorded at room temperature. Emission and excitation spectra were recorded using a spectral slit width of 1.5 nm.

## 3. RESULTS AND DISCUSSION

*3.1 XRD studies of $Sr_2CeO_4$: $Eu^{3+}$phosphor*

The crystal structure of the obtained product was identified by X-ray diffraction analysis (XRD). Fig.1 shows the typical X-ray diffraction (XRD) patterns of $Sr_2CeO_4$*:$Eu^{3+}$*phosphor synthesized with sol-gel and solid state reaction method. Fig.2 shows the XRD patterns of $Sr_2CeO_4$*:$Eu^{3+}$*phosphor calcined at $800^0$C and $1000^0$C.The XRD spectra consist of three strong peaks and several weak peaks. The obtained powder XRD have broadened reflexes, which indicates the nanocrystallinity of the products. The intensity of peaks reflected the high degree of crystallinity of the nanoparticles. However, the

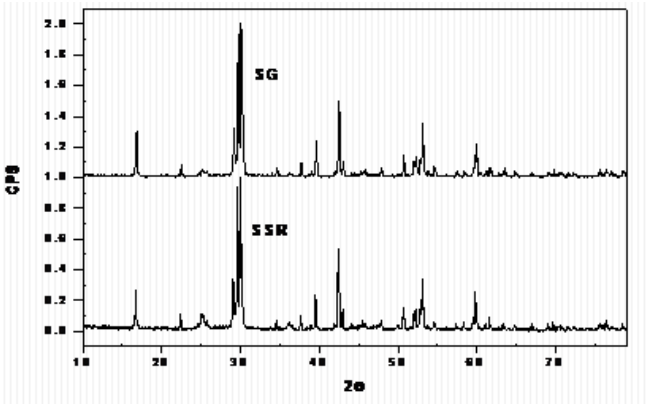



**Figure 1.** *XRD pattern of Eu doped $Sr_2CeO_4$ phosphor synthesized with sol-gel and solid state reaction technique.*

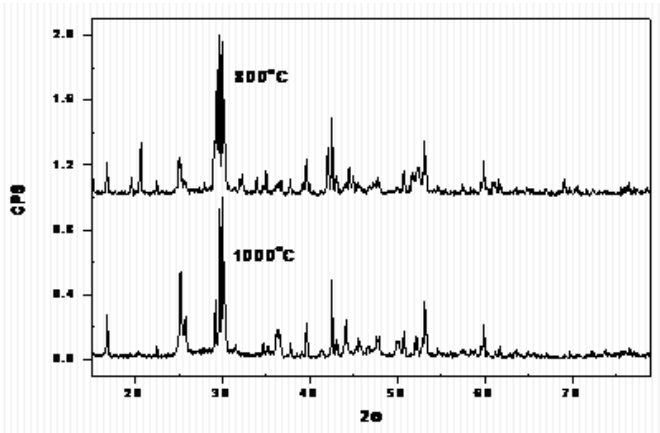



**Figure 2.** *XRD pattern of Eu doped $Sr_2CeO_4$ phosphor synthesized with sol-gel and solid state reaction technique at $800^0$C and $1000^0$C.*

diffraction peaks are broad which indicating that the crystalline size is very small. The XRD study confirms the structure of the system as orthorhombic. The average crystallite size can be estimated from the peak broadening using Scherer's relation D= 0.9 λ / β cosθ, where λ is the wavelength of the X-ray (λ=1.54$A^0$), β is the broadening of diffraction line measured at half of its maximum intensity (FWHM:full width at half maximum), θ is the Bragg's diffraction angle and D is the particle diameter size. Using the strongest peak of diffraction pattern of the $Sr_2CeO_4$*:$Eu^{3+}$*phosphor, the average crystallite size was found to be 40nm.

*3.2 Scanning Electron microscope of $Sr_2CeO_4$: $Eu^{3+}$ phosphor*

The scanning electronic micrograph of Eu doped $Sr_2CeO_4$ phosphor is shown in Fig. 3. The sample



Sponsored by the Indian Institute of Geomagnetism, Navi Mumbai-410218 (DST, Govt. of India)

exhibits grain like morphology with different sizes and shape. At low magnification the particles appear agglomerated and at high enough magnification, the nature of the individual crystallites is clearly evident.

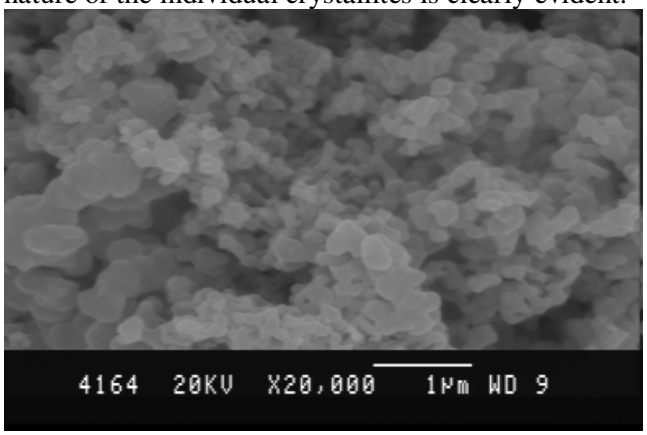



**Figure 3.** *SEM image of Eu doped $Sr_2CeO_4$ phosphor.*

*3.3 Photoluminescence studies of $Sr_2CeO_4$:$Eu^{3+}$ phosphor*

A series of $Sr_2CeO_4$:$Eu^{3+}$ phosphor with different concentrations (Eu=0.5,1.0, 1.5, 2.0, 4.0 mol%) were prepared and the effect of doped $Eu^{3+}$ concentration on the emission spectra was investigated.Fig.4 shows the emission spectrum of $Sr_2CeO_4$:Eu (0.5, 1.0, 1.5, 2.0, 4.0 mol%) phosphor under excitation wavelength of 254nm.The PL emission spectrum under 254nm excitation wavelength exhibits a well-known characteristic $Eu^{3+}$ emission.

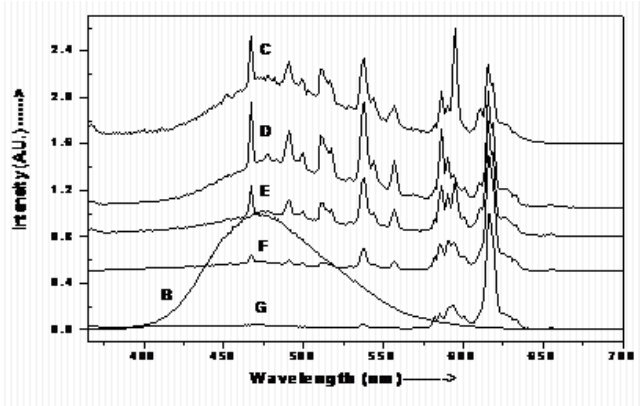



**Figure 4.** *Emission spectrum of $Sr_2CeO_4$:Eu (0.5, 1.0, 1.5, 2.0, 4.0 mol%) phosphor synthesized by sol-gel method [$\lambda_{ex}$=254].*

Figure 4 shows the emission lines of $Eu^{3+}$ doped $Sr_2CeO$ particles monitored under 254nm excitation wavelength was characterized by a broad band ranging from 400 to 600 nm due to f→$t_1$g of $Ce^{4+}$ around 467 nm(Blue). Emission spectrum curves with mole percentage of europium shown in Table-1.

**Table1**. Emission spectrum curves with mole percentage of europium

| S. No. | Sample Name | Percentage of Europium |
|---|---|---|
| 1 | $Sr_2CeO_4$ Curve B | 0.0 |
| 2 | $Sr_2CeO_4$ Curve C | 0.5 |
| 3 | $Sr_2CeO_4$ Curve D | 1.0 |
| 4 | $Sr_2CeO_4$ Curve E | 1.5 |
| 5 | $Sr_2CeO_4$ Curve F | 2.0 |
| 6 | $Sr_2CeO_4$ Curve G | 4.0 |

The emission spectra for $Sr_2CeO_4$ (curve-B) shows a broad band due to f→$t_1$g of $Ce^{4+}$ around 467 nm. This blue emission band at 467 nm is attributed to the$Ce^{4+}$–$O^{2-}$ charge transfer transitions in $Sr_2CeO_4$ host. The interesting feature of these spectra is the appearance of europium transition from $^5D_2$→$^7F_0$ (467nm) which is very rare, since the general oxide host have higher photon energy and thus a nonradiative loss from a higher 5D state due to multiphonon relaxation. There are few transitions which are magnetic dipole (MD) like $^5D_0$→$^7F_1$, $^5D_1$→$^7F_0$ and $^5D_2$→$^7F_0$ rest of all the transitions that appear are the electric dipole (ED).As the $Eu^{3+}$ concentration increases, the relative intensity of both $^5D_0$→$^7F_0$transition at 595 nm and the $^5D_0$→$^7F_2$ transition at 616 nm increased whereas the intensity of $^5D_0$→$^7F_1$and $^5D_1$, $^5D_2$→$^7F_J$ transition decreased.

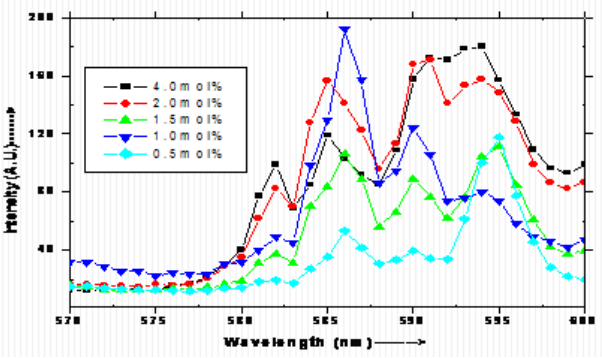



**Figure 5.** *Extended emission spectra of $Sr_2CeO_4$:Eu (0.5, 1.0, 1.5, 2.0, 4.0 mol%) phosphor synthesized by sol-gel method [$\lambda_{ex}$=254].*

Figure 5 shows the extended emission lines of $Eu^{3+}$ doped $Sr_2CeO$particles monitored under 254nm excitation wavelength was characterized by a broad band



Sponsored by the Indian Institute of Geomagnetism, Navi Mumbai-410218 (DST, Govt. of India)

ranging from 400 to 600 nm. The emission spectra of $Eu^{3+}$ contain not only the characteristic transition lines from the lowest excited $^5D_0$level but also those from higher energy levels ($^5D_1$ and $^5D_2$). In Fig. 5, the strongest emission peak located at 595 nm showing prominent and orange red light is due to the $^5D_0 \rightarrow {}^7F_1$ magnetic dipole transition of $Eu^{3+}$[11,12].

Comparison between sol-gel and the solid state reaction sample (0.5mole % of Eu) has been shown in Fig. 6. There is a remarkable difference in the emission spectra of the sol-gel and solid state reaction technique, the spectra is almost similar at all the wavelengths except at the 580-630nm. The most important difference is the generation of the high intensity 595nm(Orange red) peak and with small hump at 616nn (Red) for the sol-gel sample which is not seen in the solid state reaction sample. These are due to splitting of $^5D_0 \rightarrow {}^7F_1$ and $^5D_0 \rightarrow {}^7F_2$ transition levels which are not observed in the solid state reaction specimen. This shows that the crystal field splits the levels ($^7F_1$ and $^7F_2$). , further; this splitting may be correlated to the small crystal size of the sol-gel prepared sample, the smaller size facilitates the crystal field to split further.

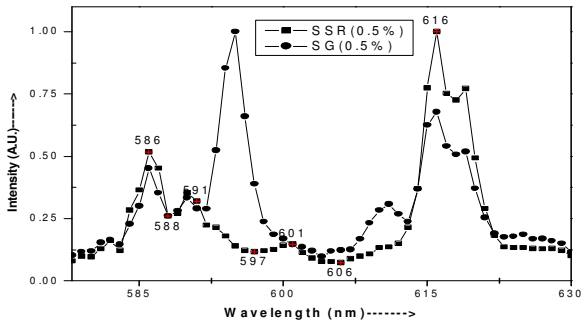



**Figure 6.** *Emission spectrum of $Sr_2CeO_4$:Eu (0.5mol%) phosphor synthesized by sol-gel method and solid state reaction method [$\lambda_{ex}$=254].*

## 4. CONCLUSIONS

The main conclusions that can be drawn by studying the effect of europium doping on the luminescence properties of the $Sr_2CeO_4$ are as follows:

(i) $Sr_2CeO_4$ blue phosphor and europium doped $Sr_2CeO_4$ phosphor were synthesized by sol-gel method and solid state reaction method.

(ii) Spectroscopic studies of pure and rare earth doped $Sr_2CeO_4$ phosphors are investigated.

(iii) The XRD study confirms the structure of the system as orthorhombic.

(iv) The photoluminescence spectra reveal that the intensity of emission increases when thepreparatory techniques is varied from solid state reaction to sol-gel.

(v) The emission spectra of $Sr_2CeO_4$ at the corresponding peak excitation value showed broad spectrum in the region 300-700 nm with a peak around 467 nm. Comparison with solid state reaction revealed a marked difference in the emission characteristics from 580nm-630nm for the 0.5mol% doped europium sample. This may be due to the nanocrystal size (40nm) of the phosphor synthesized by sol-gel method.

(vi) Greater splitting of the $^5D_0 \rightarrow {}^7F_1$, $^5D_0 \rightarrow {}^7F_2$ when compared with solid state reaction and few additional lines were seen at 597nm and 614nm for the sol-gel prepared sample.

(vii) Excellent tunablity of phosphor observed when doped with various concentrations of europium.

**REFERENCES CITED**

1. Shi, S., Li, J., and Zhou, J., *Materials Science Forum*, 2005, v. 475-479, p. 1181-1184.
2. Chen, W., Li, F., and Yu, J., *Materials Letters*, 2006, v. 60, p. 57-62.
3. Khollam, Y.B., Deshpande, S.B., Khanna, P.K., Joy, P.A., and Potdar, H.S., *Materials Letters*, 2004, v. 58(20), p. 2521-2524.
4. Gomes, J., Pires, A.M., and Serra, O.A., *Quim. Nova*, 2004, v. 27, p. 5.
5. Hirai, T., and Kawamura, Y., *Journal of Physical Chemistry B*, 2004, v. 108, p. 12763-12769.
6. Xing, D., Shi, J., and Gong, M., *Materials Letters*, 2005, v. 59, p. 948-952.
7. Kang, M., and Choi, S., *Journal of Materials Science,* 2002, v. 37, p. 2721-2729.
8. Hong, S.K., Jung, D.S., Lee, H.J., and Kang, Y.C., *Korean J. Chem. Engg*., 2006, v. 23, p. 496-498.
9. Nag, A., and Kutty, T.R.N., *Journal of Materials Chemistry*, 2003, v. 13, p. 370-376.
10. Sankar, R., and Subba Rao, G.V., *Journal of Electrochemical Society*, 2000, v. 147, p. 2773-2779.
11. Zhang, C., Shi, J., Yang, X., Lu, L., and Wang X., *J. Rare Earths*, 2010, v. 28(4), p. 513.
12. Seema, R. and Kalarikkal, N., *Proceeding of ICNM*, 2009, 6–8 April.



Sponsored by the Indian Institute of Geomagnetism, Navi Mumbai-410218 (DST, Govt. of India)

Proceedings of the National Seminar on
"Impact of Scientific Advances on Society", August 18-19, 2015, p.49-51
St. Pious X Degree & PG College for Women, Hyderabad-500076.

# Isolation and identification of microbial community in coal mine dust of SCCL, Godavarikhani

**P. Jyothi Chaitanya[1,*], Dhatri Madduru[2], J.Sri Devi[1] and N. Lakshmi Bhavani[3]**

[1]*Department of Microbiology, Government Degree College for Women, Begumpet, Hyderabad-500016 Telangana, India.*
[2]*Department of Biotechnology, R.B.V.R.R. Degree College for Women, Narayanguda, Hyderabad, Telangana, India.*
[3]*Plant Tissue Culture and Plant Molecular Genetics Lab., Department of Botany, University College of Science, Saifabad, Hyderabad-500004, Telangana, India.*
[*] *jyothichaitanay1983@gmail.com*

## ABSTRACT

Present investigation mainly focused on the isolation and identification of microorganisms present in the soil dust of the SCCL (Singareni Collieries Company Limited) coal mines of Godavarikhani, Karimnagar. Samples were collected from 3 places i.e under excavation ($U_1$) and one nearer to the excavation ($U_2$) and one outside the excavation ($S_1$). The colour and texture of the soil was different in 3 places. Collected material was serially diluted and made into $10^{-1}$ to $10^{-10}$ dilution and inoculated on basal medium. On the agar plate we found different kinds of bacteria on $S_1$ than $U_1$ and $U_2$. On the basal medium small colonies were seen. Based on the cultural characteristics, biochemical tests, staining colonies were identified as the methanogens in both the samples of $U_1$ and $U_2$, where as organisms like *Klebsiella pneumoniae, Streptococci* sp.*, staphylococci* sp. *Pseudomonas* sp. and *E.coli* in the samples of $S_1$. From this study it may be concluded that the surface sample showed more pathogenic microorganisms compared to the underground samples. Presence of more methanogenic than the pathogenic microorganisms in the underground samples may be due to mining activity. Further the 16s rRna analysis is to be carried out to find out the specific species of methanogens.

*Keywords*: SCCL, excavation, methanogens, pathogenic microorganisms

## 1. INTRODUCTION

Methanogens are a group of bacteria belonging to the domain Archaea and phylum Euryarcheota. They can be classified into six orders namely *Methanomicrobiales,Mithanocellales, Methanosarcinales, Methanobacteriales, Methanococcales and Methanopyrales.* These are the organisms capable of producing methane. Methane can be classified under trace gas due to its global warming potential. It also increases ozone and water vapour in tropospheric and stratospheric regions respectively which can increase radioactive force of the gas.

Methanogens have distinct cellular characteristics when compared to Eubacteria such as peptidoglycan in the cell wall of methanogens is replaced by pseudomurein (Methanobrevibacter and Methanobacterium), heteropolysaccharide (Methanosarcina) and protein in Methanomicrobium. All methanogens have coenzyme $F_{420}$ and coenzyme M/2-mercaptoethanesulfonic acid which is methylated to produce methane [1]. Methanogens employ various pathways for generation of methane. Common pathways include methanol and $CO_2$ reduction, acetate cleavage, as well as from a variety of methylated compounds. Based on the pathway used the genes will differ for one species to other. For instance, methyl coenzyme M reductase (*mcrA*) is used in the reduction of methyl group bound to co-enzyme M, which is the last step in generation of methane [2].

Methanogens are strict anaerobes and are mostly found in arid soil. Coal mines soils are the best source for isolation of methanogens. Coal bearing sediments are rich in organic matter and carbon which can be utilized by methanogenic subsurface microbial community. Biogenic methane can be produced from coal material under anoxic conditions. Biodegradation of coal is performed by bacteria by fermentation of polymers and monomers to produce fatty acids, organic acids, alcohols and/or hydrogen and carbon dioxide which can be utilized by methanogens to produce methane [3].

In our present study, we made an attempt to identify the methanogenic and other microbial community profile from different soil samples i,e under excavation ($U_1$) and one nearer to the excavation ($U_2$) and one outside the excavation ($S_1$).

## 2. MATERIALS AND METHODS

### *2.1 Soil samples and soil characterization*

Soil dust samples were collected form SCCL (Singareni Collieries Company Limited) coal mines of Godavarikhani, Karimnagar in January 2015. Samples were collected from 3 places i.e under excavation ($U_1$) and one nearer to the excavation ($U_2$) and one outside the excavation ($S_1$). The colour and texture of the soil was different in 3 places.



Sponsored by the Indian Institute of Geomagnetism, Navi Mumbai-410218 (DST, Govt. of India)

### *2.2 Isolation of microbes*

Microbes from soil sample were isolated using serial dilution method. The samples were serially diluted from 10-1 to 10-10 dilutions.

### *2.3 Culturing and enrichment of microbes*

Microbes were inoculated on Basal medium (Table 1).

**Table 1.** Basal agar medium

| *Constituent* | *Amount* |
|---|---|
| $KH_2PO_4$ | 0.14 g |
| $CaCl_2.2H_2O$ | 0.14 g |
| KCl | 0.34g |
| $MgCl_2.6H_2O$ | 2.8 g |
| $MgSO_4.7H_2O$ | 3.5g |
| NaCl | 20.0g |
| $Fe(NH_4)_2(SO_2).6H_2O$ | 0.002g |
| $NH_4Cl$ | 0.25g |
| $Na_2SeO_4.10H_2O$ | 0.0037g |
| $NaHCO_3$ | 5.0g |
| Yeast Extract | 2.0g |
| $Na_2S.9H_2Ob$ | 0.5 g |
| Trypticase | 2.0g |
| Sodium acetate | 1.25g |
| L-Cysteine hydrochloride. $H_2O$ | 0.5g |
| Trace mineral solution | 10 ml |
| Vitamin solution | 10 ml |
| Leucine | 0.5g |
| Isoleucine | 1.0g |
| Calcium Pantothenate | 50µg |
| $NiCl_2.6H_2O$ | 0.5g |
| agar | At final concentration of 1.5 % (Wt./Vol) |
| Distilled $H_2O$ | 1,000 ml |

### *2.4 Biochemical tests*

Biochemical tests were performed to further confirm the presence of methanogens in the sample. The tests performed were IMViC test, Triple sugar iron, Starch hydrolysis and Catalase test.

### *2.5 Staining*

FA (Fluorescent antibody) staining was used to identify the colonies as methanogens in samples $U_1$ and $U_2$. The antibody directly interacts with the methanogenic colonies. The fluorescence was measured at 420nm. Whereas bacteria of colonies from sample S1 were stained using gram staining.

## 3. RESULTS

### *3.1 Cultural characteristics*

After 10 days small colonies were found on agar plates containing basal medium. They are slow growing colonies. On microscopic observation long rods with 0.5mm diameter are observed form $U_1$ and $U_2$ samples. Whereas Circular, raised colonies from $S_1$ sample were observed. This indicates that $U_1$ and $U_2$ samples may contain methanogens while, $S_1$ sample contains eubacteria such as *E. coli.*

### *3.2 Biochemical tests*

The results obtained for various biochemical tests are shown in Table 2.

**Table 2.** Results of biochemical tests

| *S. No* | *Test* | *Methanogens* | *E.coli* | *Klebsiella pneumoniae,* | *Streptococci sp.,* | *staphylococci sp.* |
|---|---|---|---|---|---|---|
| 1 | Indole | +Ve | +Ve | -Ve | -Ve | -Ve |
| 2 | Methyl red | +Ve | +Ve | -Ve | +Ve | +Ve |
| 3 | Citrate | +Ve | -Ve | +Ve | +Ve | +Ve |
| 4 | Triple sugar ion | +Ve | +Ve gas | -Ve | -Ve | -Ve |
| 5 | Starch hydrolysis | -Ve | +Ve | -Ve | -Ve | +Ve |
| 6 | Catalase | -Ve | +Ve | +Ve | -Ve | +Ve |
| 7 | Mannitol | -Ve | +Ve | +Ve | +Ve | +Ve |
| 8 | Voges Proskauer | -Ve | -Ve | +Ve | +Ve | +Ve |

### *3.3 Staining*

Microscopic observation of colonies from sample $U_1$ and $U_2$ revealed presence of methanogens as the antibodies specifically interacted with colonies. Gram staining of sample $S_1$ revealed presence of *E.coli.*

## 4. DISCUSSION AND CONCLUSION

Methanogenic archaea are the group of microbes with ability to produce methane. They usually produce methane through reduction of $CO_2$ and $H_2$ [4]. Methanogens are present in gut of rumen and soil under anoxia conditions. In soil, anaerobic methanogenesis takes place in anoxic microsites by methanogens [5].

Coal mines are good source of methanogens. As coal is rich in carbon and organic matter it can be degraded by microbes to produce methane. Coal mines can contribute for about 7% of global methane content. Beckmann et al 2011 studied methane production and isolated methanogens form abandoned coal mines from Germany and concluded that coal mines are rich in methanogens and can contribute to the production of substantial amount of methane [6].



Sponsored by the Indian Institute of Geomagnetism, Navi Mumbai-410218 (DST, Govt. of India)

From our present study, based on cultural characteristics, biochemical tests and staining of colonies we conclude that the surface sample showed more pathogenic microorganisms compared to the underground samples. Presence of more methanogenic than the pathogenic microorganisms in the underground samples may be due to mining activity. Further the 16s rRna analysis has to be carried out to find out the specific species of methanogens.

**REFERENCES CITED**

1. Hook, S.E., Wright, A.G., and McBride, B.W., *Methanogens: Methane Producers of the Rumen and Mitigation Strategies*, 2010, p. 1-11.
2. Angel, R., Claus, P., and Conrad, R., *ISME J.*, 2012, v. 6(4), p. 847-862.
3. Gründger, F., Jiménez, N., Thielemann, T., Straaten, N., Lüders, T., Richnow, H.-H., and Krüger, *Frontiers in Microbiology*, 2015, v. 6, p. 200.
4. Thauer, R.K., Kaster, A-K., Seedorf, H., Buckel, W., and Hedderich, R., *Nature Reviews Microbiology*, 2008, v. 6, p. 579-591.
5. Silva, S.N., Guzm, S.Y., Dendooven, L., and Lunaguido, M., *Pedosphere*, 2014, v. 24(3), p. 291-307.
6. Beckmann, S., Lueders, T., Kru¨ger, M., von Netzer, F., Engelen, B., and Cypionka, H., *Applied and Environ. Microbiol*., 2011, p. 3749–3756.



Sponsored by the Indian Institute of Geomagnetism, Navi Mumbai-410218 (DST, Govt. of India)

Proceedings of the National Seminar on
"Impact of Scientific Advances on Society", August 18-19, 2015, p.52-55
St. Pious X Degree & PG College for Women, Hyderabad-500076.

# Assessment of various phytochemicals and antimicrobial activity of fenugreek (*trigonella foenum-graecum*): a common Indian spice

**P. Jyothi Chaitanya[1,*], B. Vijaya Lakshmi[2] and N. Lakshmi Bhavani[3]**

[1]*Department of Microbiology, Govt. Degree College for Women, Begumpet (Osmania University), Hyderabad-500016, Telangana, India*
[2]*Department of Botany, Govt. Degree College for Women, Begumpet (Osmania University), Hyderabad-500016, Telangana, India*
[3]*Plant Tissue Culture and Plant Molecular Genetics Lab., Department of Botany, University College of Science, Saifabad (Osmania University), Hyderabad-500004, Telangana, India*
*jyothichaitanay1983@gmail.com*

## ABSTRACT

Fenugreek (*Trigonella foenum-graecum* L.), plant is widely distributed all over the world and belongs to the family Fabacecae. The yields can be significant increase in quantity and quality through the suitable management of cultivation, irrigation and harvesting. The plant contains active constituents such as alkaloids, flavonoids, steroids, Saponins etc. It is an old traditional medicinal plant and used as a one of the spice. It has been commonly used as a traditional medicine and food. Fenugreek is known to have hypoglycemic, hypocholesterolaemic and Anti inflammatory effects. Recent research has identified that fenugreek as an important medicinal plant which is very potential for curing diseases and also as a source for preparing raw materials of pharmaceutical industry, like in steroidal hormones. This present research work is aimed to investigate the phytochemicals from leaf extracts of *Trigonella foenum-graecum* L. Seed powder of Fenugreek was dissolved in different solvents viz., ethanol, methanol, chloroform, acetone, water and petroleum ether and these extracts are subjected to screen for their phytochemicals. Results revealed the presence of saponins, steroids, phenols, flavonoids, terpenoids, alkaloids, cardiac glycosides, reducing sugars, tannins and protiens. In the present investigation, the methanol extracts and water extracts showed more number of phytochemicals than the chloroform, acetone and pet ether. Apart from these the petroleum ether extracts showed very less amount of phytochemical constituents. We hope that the present study will be helpful for the phytochemists and pharmacologists for the detection of novel compounds for the study.

*Keywords*: Seed extract, *trigonella foenum-graecum* L, secondary metabolites

## 1. INTRODUCTION

*Trigonella foenum-graecum* (Family Fabaeace) is called methika in Ayurveda and used as medicine for the treatment of wounds, abscesses, arthritis, bronchitis and digestive disorders etc. it is printed in since from older times this plant also eaten in winters as to improve immunity and protects heart, brain and other vital organs of body through its medicinal properties. In traditional Chinese Medicine it is also used for kidney problems and conditions affecting the male reproductive tract. The recent researches have proved it beneficial for Atherosclerosis, Constipation, Diabetes, High cholesterol and Hypertriglyceridemia. According to Indian Herbal Pharmacopoeia [1] , the seeds of fenugreek contain alkaloids, flavonoids, saponins, amino acids, tannins and some steroidal glycosides, proteins etc. Ansari [2] described that the standardization of fenugreek seeds is done for the establishment of quality and identity profile of the drug for the purpose of safety monitoring and overall quality assurance of the industrially as well as commercially important drug .since there is a few literature regarding the standard protocol of the phytochemical analysis of fenugreek seeds. Therefore, in the present investigation an attempt has been made to standardize fenugreek seeds by using phytochemical analysis and to analyse their antimicrobial activity.

## 2. MATERIAL AND METHODS

The healthy and disease free seeds of *Trigonella foenum-graecum* L seed material was collected from the cantonment area of Sainikpuri, Hyderabad, Telangana, India and cultivated seeds of *Trigonella foenum-graecum* L was collected from the Sainikpuri in the month of August, 2014. Collected plant material was washed thoroughly in running tap water, shade dried in open air separately. Powder of the both the seeds is obtained by grinding them mechanically. About 100 gm of each dried powder of the plant were soaked separately in 100 ml of different solvents like methanol, ethanol, chloroform, pet ether and acetone in conical flasks and then subjected to agitation on a rotary magnetic shaker for about 72 hours. After three days the plant extracts were subjected to filtration, filtered with No 42 Whatman filter paper separately. Concentrated extracts was preserved in sterilized air tight labeled bottles and preserved in refrigerator at 4˚C until required for further use. The extract was filtered under reduced pressure using rotary flash evaporator and subjected for further preliminary



Sponsored by the Indian Institute of Geomagnetism, Navi Mumbai-410218 (DST, Govt. of India)

phytochemical tests. Different tests conducted for the identification of phytochemicals is adopted by using the methods described by [3, 4].

*2.1 Test for alkaloids*

Alkaloids are confirmed by a cream colour precipitate was produced by adding to the 5ml of extract 5ml of 2N HCL is added and boiled then the mixture is filtered. To the filtrate a few drops of Mayer's reagent is added.

*2.2 Test for saponins*

Saponins are tested by boiling 5ml of extract in 10ml of distilled water in a test tube and are shaken vigorously for about 30 seconds. The test tube is allowed to settle for half an hour. Formation of froth indicates the presence of saponins.

*2.3 Test for tannins*

Tannins are tested by adding a few drops of 1% lead acetate to 5 ml of plant extract. Appearance of yellow precipitate indicates the presence of tannins.

*2.4 Test for phenols*

Phenols are tested by adding 2ml of ferric chloride solution to 2ml of plant extract. Appearance of bluish green colour solution indicates the presence of phenols.

*2.5 Test for steroids*

To test the presence of steroids 1ml extract was dissolved in 10ml of chloroform and equal volume of concentrated sulphuric acid was added from the walls of the test tube. Appearance of red colour in the upper layer and yellow with green fluorescence indicates the presence of steroids.

*2.6 Test for cardioglycosides*

To 1ml of extract glacial acetic acid, few drops of ferric chloride and then finally concentrated sulphuric acid were added from the walls of the test tube. Appearance of the reddish brown at the junction of two layers and the bluish green colour in the upper layer indicates the presence of cardiac glycosides.

*2.7 Test for anthraquionones*

5ml extract was boiled with 10ml of sulphuric acid and filtered while hot. The filtrate was shaken with 5ml of chloroform the chloroform layer was pipetted out into another test tube then 1ml of dilute ammonia is added. The resulting solution was observed for colour changes. The change in colour indicates the presence of anthraquinones.

*2.8 Test for flavonoids*

To one ml of the extract, a few drops of dilute sodium hydroxide are added. An intense yellow colour was produced in the plant extract, which became colorless on addition of few drops of dilute acid. This indicates the presence of flavonoids.

*2.9 Test for carbohydrates*

To the 1ml of extract add 5 to 10 drops of Fehling's solution. Then the mixture was subjected to boiling for 15 minutes. Appearance of brick red precipitate indicates the presence of carbohydrates.

*2.10 Test for terpenoids*

1ml of the extract was dissolved in 1ml of chloroform; 1ml of acetic anhydride was added following the addition of 2ml of concentrated sulphuric acid. Formation of reddish colour indicates the presence of terpenoids.

*2.11 Anti microbial activity*

Nutrient agar medium is used for the antibacterial screening test. The nutrient agar medium plates were prepared by pouring 15ml of nutrient agar media into sterile Petri plates. Twenty four hours old cultures of the organisms to be tested were used. Inoculate the plates with test organism. Various concentrations of the wood extracts were transferred into the sterile filter paper disc and the plates were allowed to stand for one hour for pre-diffusion of extracts to occur in agar disc diffusion method. The plates were then incubated at $37^0$C for 24 hours.

*2.12 Test organisms*

Microbial cultures obtained from the Department of Microbiology, University College of Science, Osmania University, Hyderabad, India. Among seven bacterial species investigated four gram negative bacteria *(E.coli, Salmonella typhi, Klebsiella pneumonia),* gram positive bacteria (*Sterpococci, Bacillus subtilis, Bacillus cereus*) All the bacterial were maintained at 4° C Nutrient agar slants respectively.



Sponsored by the Indian Institute of Geomagnetism, Navi Mumbai-410218 (DST, Govt. of India)

*2.13 Preparation of concentrations*

Methanol, ethanol and pet ether seed extracts of *Trigonella foenum-graecum* L were prepared as a different concentrations (100µg/ml, 250mµ/ml, and 500µg/ml) to get the final drug concentration 10µg/ml,25µmg/ml, 50µg/ml and 75µg/ml respectively, control (DMSO) and standard (streptomycin 10µg/ml for bacteria). Concentrations of extracts were prepared by disc diffusion method; discs with 9mm diameter were prepared using No1 Whatman filter paper and sterilized by autoclaving. Then, the discs had been impregnated with different concentrations of extracts.

## 3. RESULTS AND DISCUSSION

The phytochemical analysis of *Trigonella foenum-graecum* L seed extracts were tested by different precise tests. Methanol, ethanol, petroleum ether, chloroform, acetone seed extracts of *Trigonella foenum-graecum* L analyzed for phytochemical compounds such as tannins, saponins, flavonoids, steroids, alkaloids, phenols, terpenoids. Phytochemical analyses (Table 1) explain that the presence of terpenoids, tannins, flavonoids, alkaloids in all the extracts. Whereas steroids and phenols are found to be present in acetone, pet ether and chloroform only those were not observed in ethanol and methanol. Saponins are found in acetone extracts only.

**Table 1.** Preliminary Phytochemical analysis of seed extracts of *Trigonella foenum-graecum* L.

| S. No. | Phytochemicals | Methanol | Ethanol | Chloroform | Pet ether | Acetone | Water |
|---|---|---|---|---|---|---|---|
| 1 | Tannins | + | + | + | + | + | + |
| 2 | Phenols | - | - | + | + | + | + |
| 3 | Saponins | + | + | _ | _ | + | + |
| 4 | Alkaloids | + | + | + | + | + | + |
| 5 | Flavonoids | + | + | + | + | + | + |
| 6 | Anthraquinones | - | - | - | - | - | _ |
| 7 | Terpenoids | + | + | + | + | + | + |
| 8 | Cardiac glycosides | + | + | + | + | + | _ |
| 9 | Steroids | - | - | + | + | + | _ |
| 10 | Carbohydrates | + | + | + | _ | + | + |
| 11 | Aminoacids | + | + | _ | _ | + | + |

+ Indicates the presence the presence of phytochemicals
- Indicates the absence the presence of phytochemicals

The bacterial microorganisms *Psuedomonas aureus, Streptococci, Salmonella typhi, Bacillus aureus, Klebsiella pneumonia* and *Bacillus subtilis* were employed for the test of antibacterial activity (Table 2). Among all the solvent extracts tested extracts of methanol and ethanol were found to more active towards the tested bacterial organisms. Table 3 explains the antifungal analysis revealed that the maximum activity of solvents against fungi in order of *Fusarium, Mucor, Rhizopus* and *Aspergillus niger.* Among all the solvent extracts tested extracts of methanol and ethanol were found to more active towards the tested fungal organisms.

**Table 2.** Antibacterial activities of *Trigonella foenum-graecum* L seed extracts

| Solvents | Concentration (µl) | Zone of inhibition in mm | | | | | |
|---|---|---|---|---|---|---|---|
| | | *Klebsiella pneumonia* | *Streptococci* | *Salmonellatyphi* | *Bacillus cereus* | *Paeudomonas aeruginosa* | *Bacillus subtilis* |
| Methanol | 5 | 3 | 15 | 7 | 9.6 | 6.3 | 9.8 |
| | 10 | 3 | 18 | 8 | 13 | 10.5 | 15.3 |
| | 15 | 8 | 20 | 11 | 15.1 | 16.8 | 18.1 |
| | Control Streptomycin 10µg/ml | 8 | 22 | 13.2 | 17 | 20 | 19.2 |
| Ethanol | 5 | 2 | 8.7 | 3 | 7.5 | 5.9 | 8.9 |
| | 10 | 3 | 10 | 5 | 10 | 9.6 | 13.8 |
| | 15 | 11 | 18.5 | 8 | 15 | 7.9 | 17 |
| | Control Streptomycin 10µg/ml | 8 | 22 | 13.2 | 17 | 15 | 19.2 |
| Petether | 5 | - | 2.4 | 2.5 | 2.8 | 3 | 4.4 |
| | 10 | - | 3 | 4 | 5 | 3.4 | 8.7 |
| | 15 | - | 4.5 | 6.5 | 6.3 | 4.7 | 9.5 |
| | 20 Control Streptomycin 10µg/ml | 8 | 22 | 13.2 | 17 | 15 | 19.2 |
| Acetone | 5 | - | 0.5 | 1.3 | 3 | 1.6 | 2.9 |
| | 10 | - | 3 | 2 | 4 | 2 | 4.9 |
| | 15 | - | 3.8 | 3.5 | 4.6 | 3 | 5.0 |
| | Control Streptomycin 10µg/ml | 8 | 22 | 13.2 | 17 | 15 | 19.2 |
| Water | 5 | - | 2.5 | 3.3 | 3 | 3.6 | 4.9 |
| | 10 | - | 3 | 2 | 4 | 2 | 4.9 |
| | 15 | - | 5.8 | 5.8 | 6.6 | 6.8 | 7.0 |
| | Control Streptomycin 10µg/ml | 8 | 22 | 13.2 | 17 | 15 | 19.2 |



Sponsored by the Indian Institute of Geomagnetism, Navi Mumbai-410218 (DST, Govt. of India)

**Table 3.** Antifungal activities of *Trigonella foenum-graecum* L seed extracts

| Extracts | Concentration (µg/ml) | Zone of inhibition in mm | | | |
|---|---|---|---|---|---|
| | | *Aspergillus Niger* | *Fusarium* | *Rhizopus* | *Mucor* |
| Methanol | 5 | 1.8 | 2 | 2 | 3.1 |
| | 10 | 3 | 4 | 2.2 | 4 |
| | 15 | 5 | 4.8 | 5 | 5.2 |
| | Control Ketocnozole 10µg/ml | 7 | 8 | 8 | 10 |
| Ethanol | 5 | 1.5 | 1.6 | 1.5 | 1.6 |
| | 10 | 2.2 | 2 | 1.8 | 2.1 |
| | 15 | 3 | 3.2 | 3.8 | 3.6 |
| | Control Ketocnozole 10µg/ml | 7 | 8 | 8 | 10 |
| Pet ether | 25 | 1.8 | 2.8 | 2 | 1.8 |
| | 50 | 2.2 | 3 | 3 | 2.8 |
| | 75 | 3.6 | 3.9 | 3.9 | 4 |
| | Control Ketocnozole 10µg/ml | 7 | 8 | 8 | 10 |
| Chloroform | 25 | 2.5 | 1.3 | 2 | 2 |
| | 50 | 4.2 | 2 | 2.8 | 2.5 |
| | 75 | 5 | 6 | 5.2 | 5.9 |
| | Control Ketocnozole 10µg/ml | 7 | 8 | 8 | 10 |

## 4. CONCLUSION

Flavonoids and Phenols can protect the human body from the oxidative stress which may cause many diseases, including cancer, cardiovascular problems and ageing [5]. The variations in flavonoids and saponins may be associated with variety of plant, geographical conditions, methods of extraction and solvent used [6]. Alkaloids and flavonoids are the phytochemicals widely used as antiviral, antibacterial, antiamoebial and anticancer agents. Phenols and flavonoids are the groups of secondary metabolites are having great importance as cellular support material because they form the integral part of cell wall structure by polymeric phenolics [7]. In this present study we are concluding that the seeds of *Trigonella foenum-graecum* L can be utilized as an alternative source of useful drugs.

**REFERENCES CITED**

1. *Indian Herbal Pharmacopoeia*, 1999, v.1, p. 32-38, Indian Drugs Manufacturing Association, Mumbai, Regional Research Laboratory Jammu Tavi, 33.edn.
2. Ansari, S.H., *Essentials of Pharmacognosy*, 2005, Birla Publication Pvt. Ltd, p. 492-559.
3. Thamilmarai Selvi, B.S., Ahamed, J., and Theivandran, G., *Ad. Plant Sci*., 2011, v. 24, p. 81-85.
4. Jyothichaitanya, P., and Lakshmi Bhavani, N., *Ad. Plant Sci*., 2013, v. 26(11), p. 531-534, ISSN 0970-3586.
5. Robards, K., Prernzler, P.D., Tucker, G., Swatsitang, P., and Glover, W., *Food Chem*., 1999, v. 66, p. 401-436.
6. Jane, R.R., and Patil, S.D., *Intl. J. Sci. Nat.,* 2012, v. 3(1), p.153-158, ISSN 2229 – 6441.
7. Gupta V.K., Singh, G.D., Singh, S., and Kaul, A., *Medicinal Plants: Phytochemistry, Pharmacology and Therapeutics*, 2010, Daya Publishing House, Delhi.



Sponsored by the Indian Institute of Geomagnetism, Navi Mumbai-410218 (DST, Govt. of India)

Proceedings of the National Seminar on
"Impact of Scientific Advances on Society", August 18-19, 2015, p.56-57
St. Pious X Degree & PG College for Women, Hyderabad-500076.

# Impact of scientific advancement on the health of the modern society

**P. U. V. N. Manendra Rao***

*Govt. P. G. College of Physical Education*
*Domalguda, Hyderabad, India*
**pmrao4phyedn@gmail.com*

## ABSTRACT

Physical inactivity is a primary cause of most chronic diseases. Sedentary life style, obesity cause insulin resistance, which develops diabetes. The prevalence of this form is increasing in both developed and developing countries, owing to the increasing prevalence of obesity and sedentary lifestyles. Cardiovascular disease (CVD) is the leading cause of death worldwide and mostly in Asia. The root causes of this modern epidemic are sedentary stressful urban lifestyles and high-calorie diets rich in saturated fats, salt, and simple sugars. Fast food is the term given to food that can be prepared and served very quickly. The most important factors which hurt our health are sedentary lifestyle, Fast foods and addiction to mobile phone and internet. Sedentary life style leads to obesity and other degenerative diseases. The sophisticated life style because of the scientific advancement causing many health hazards among the modern youth.

*Keywords*: Sedentary life style, cardio vascular diseases (CVDs), obesity and diabetes

## 1. INTRODUCTION

Chronic diseases are major killers in the modern era. The scientific advancement provided the modern society with many sophisticated commodities and gadgets. Physical inactivity is a primary cause of most chronic diseases. Sedentary life style, obesity cause insulin resistance which develops diabetes. Cardiovascular disease (CVD) is the leading cause of death worldwide and mostly in Asia. The root causes of this modern epidemic are sedentary stressful urban lifestyles and high-calorie diets rich in saturated fats, salt, and simple sugars. In most Asian and Middle Eastern countries, outside East Asia, prevalence of CVD and its risk factors are high and still rising, while the rising mortality is among the highest in the world. The most important factors which hurt our health are sedentary lifestyle, fast foods, addiction to mobile phone and internet and attracting to western life due to globalization.

## 2. FAST FOODS

Fast food is the term given to food that can be prepared and served very quickly. Fast food can also be defined as any food that contributes little or no nutrient value to the diet, instead provides excess calories and fat. Fast food may include salted snack foods, gum, candy, sweet desserts, chips, hot pies, pasties, sandwiches, burgers, croissants, kebabs, pizzas, chicken, soups, and salads.It also includes drinks, for instance, milkshakes, and carbonated beverages. Fast food increases your weight. The higher your BMI, the higher your risk of obesity and chronic diseases, such as type 2 diabetes, high blood pressure, cardiovascular disease, gallstones and cancer.

### *2.1 Disadvantages of fast food*

When you feel like eating something and think of food, the things come to mind first is the taste, odor or color. Fast foods create a much higher risk of heart disease because of the high level of saturated or trans fats found in much of the food. Those fats can clog the arteries and, over time, contribute to high cholesterol levels. Fast foods also cause obesity. Obesity is a major pediatric public health problem. Adolescents are a priority population for intervention strategies. Obesity threatens to become the 21st century's leading health problem. As more nations become industrialized and urbanized, the prevalence of obesity will inevitably rise. Being obese can induce multiple metabolic abnormalities that contribute to cardiovascular disease, diabetes mellitus, and other chronic disorders. Obesity is the gateway for all degenerated diseases like diabetes. A peptic ulcer which is also known as PUD or peptic ulcer disease is the most common ulcer of an area of the gastrointestinal tract that is usually acidic and thus extremely painful. Doctors believe that stress, spicy foods, and alcohol cause most ulcers, constipation and indigestion. Habit of taking fast foods leads to "Away from the Family Gathering", "Irregular Timing of Eating", "Waste of Money", "Lack of Essential Nutrients", "Spikes Your Blood Sugar", "Damages Your Heart", "Obesity Risk". Anyway, fast foods are "Fast Now", "Potentially Fatal Later".

## 3. CELL PHONE

Every day, we are swimming in a sea of electromagnetic radiation (EMR) produced by electrical appliances, power lines, wiring in buildings, and a slew of other technologies that are part of modern life. From the dishwasher and microwave oven in the kitchen and the clock radio next to your bed, to the cellular phone you hold to your ear—sometimes for hours each day—



Sponsored by the Indian Institute of Geomagnetism, Navi Mumbai-410218 (DST, Govt. of India)

exposure to EMR is growing and becoming a serious health threat.

*3.1 Smart phone*

A smart phone could be defined as a mobile phone that has additional functions similar to personal digital assistant devices. Smart phone use in health care work settings presents both opportunities and challenges. The benefits could be severely undermined if abuse and overuse are not kept in check. Some research conducted on mobile phone bans in England, as mobile phones are very popular there amongst teenagers. The cultures of societies are underestimated determinants of their population health and well-being. This is as true of modern western culture, including its defining qualities of materialism and individualism, as it is of other cultures. Mobile phones (MPs) progressed from a tool of the privileged few to a gadget for the masses. We live in a high-tech world of electronics, constantly strolling through invisible fields of radio waves, television waves, microwaves, radar, and Wi-Fi networks. In the 1980s in the Nordic countries and in the 1990s in the United States, a new source of radio frequency waves came into widespread use: The cell phone, which emits non ionizing radio waves through an antenna commonly held close to the head. By 2009, the cell phone had become an integral part of everyday life, with more than 285 million subscribers to cell phone service in the United States (91% of the population) and more than 5 billion worldwide. With the World Health Organization (WHO) and the US National Cancer Institute concluding that there is no conclusive or consistent evidence that no ionizing radiation emitted by cell phones is associated with cancer risk. Electromagnetic radio waves emitted from cell phones could damage DNA and lead to cancer; it may therefore seem surprising that a monograph committee of the International Agency for Research on Cancer (IARC), an agency of the WHO, recently announced that cell phones may be "possibly carcinogenic to humans".

## 4. CONCLUSION

The progression of the science is essential for the survival of the human being and to avail sophisticated livelihood. But at the same time we should realize that how the technology encroaching and keeping us away from the nature. Without breaking human relations and welfare youth should utilize the modern gadgets.

**REFERENCES**

1. Peet, R.K. *Annual Review of Ecology and Systematics,* 1974, v. 5, p. 285-307.
2. Ramahi, T.M., *Asia Pac. J. Public Health*, 2010, v. 22(3), p.83S-89S.
3. Trovato, G.M., *Trovato EPMA Journal,* 2012, v. 3, p. 8.
4. Gill, P.S., Kamath, A., and Gill, T.S., *Risk Manag. Healthc. Policy*, 2012, v. 5 p. 105–114.
5. Acharya, J.P., Acharya, I., and Waghrey, D., *IJMRHS*, 2013, 2(3), p. 388-394.



Sponsored by the Indian Institute of Geomagnetism, Navi Mumbai-410218 (DST, Govt. of India)

Proceedings of the National Seminar on
"Impact of Scientific Advances on Society", August 18-19, 2015, p.58-60
St. Pious X Degree & PG College for Women, Hyderabad-500076.

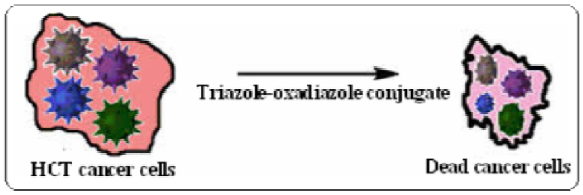
# Environmentally benign click assisted synthesis and antiproliferative activity study of triazole-oxadiazole conjugates

**P. Neeraja[1], S, Srinivas[2], K. Mukkanti[3], P. K. Dubey[4] and S. Pal[5,*]**

[1]*Department of Chemistry, DVR College of Engineering & Technology, Kashipur village, Medak District, Telangana-502285*
[2]*BIOCON LTD, Plot No 213, 214 & 215, IDA phase-2 , Pashamylaram, Medak District,Telangana-502307*
[3]*IST JNTUH, Hyderabad-500085.*
[4]*Department of Chemistry, Niper, Hyderabad-500037*
[5]*Department of Chemistry, MNR Degree & PG College, Kukatpally, Hyderabad-500085*
[*]*sarbani277@yahoo.co.in*

## ABSTRACT

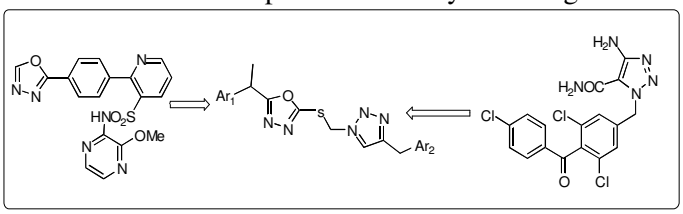
A series of novel hybrid molecules designed by connecting two important heterocyclic scaffolds, for example, triazole and oxadiazole moieties have been synthesized for the generation of a library of molecules. These compounds were synthesized through a multi-step sequence consisting of copper-catalyzed azide-alkyne cycloaddition (CuAAC) as a key step in aqueous media. All the synthesized compounds were isolated simply by filtration and well characterized by spectral data IR, NMR and Mass. These compounds were further used to test for cytotoxic properties against HCT-15 human colon cancer.




*Keywords*: Oxadiazole-triazole conjugates, eco-friendly synthesis, CuAAC, HCT-15

## 1. INTRODUCTION

Among isomeric oxadiazoles compounds, 1,3,4-oxadiazole is a noteworthy pharmacophore for the development of new drugs. Compounds containing 1,3,4-oxadiazole cores have wide range of pharmacological activity including antibacterial, antifungal, analgesic, anti-inflammatory, antiviral, anticancer, antihypertensive, anticonvulsant, and anti-diabetic properties [1]. They are also bioisosteres for carboxylic acids, esters and carboxamides. Two examples of compounds containing the 1,3,4-oxadiazole unit currently used in clinical medicine are: Raltegravir®, an antiretroviral drug [2] and Zibotentan® an anticancer agent [3]. On the other hand, although 1,2,3-triazole does not occur in nature but is present in variety of synthetic potential bioactive compounds [4]. Carboxyamidotriazole a well known calcium ion channel blocker also acts as oncological drug. Therefore we anticipated that combination of these two in a single hybrid molecule may lead to new anti cancer agent (Scheme 1). We became interested in the synthesis and pharmacological evaluation of library of compounds. Our intention was to identify small molecule as cytotoxic agent having attractive chemical scaffold for the development of new cytotoxic agent.



**Scheme 1**. *Design of the hybrid molecules.*

Globally, colorectal cancer is the third most common type of cancer making up about 10% of all cases. In 2012 there were 1.4 million new cases and 694,000 deaths from the disease [5]. In continuation of our interest as a part of ongoing research we deceided to check anticancer activity of our compounds against colorectal cancer cell lines.

## 2. PRESENT WORK

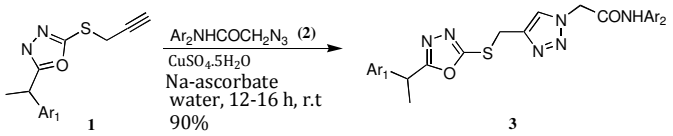
### *2.1 Chemistry*

Melting points were determined by open glass capillary method on a Cintex melting point apparatus and are uncorrected. IR spectra were recorded on a Perkin-Elmer spectrometer using KBr pellets. $^1$HNMR spectra were recorded on a Bruker ACF-300 machine and a Varian 300 and 400 MHz spectrometer using $CDCl_3$ or DMSO-$d_6$, with reference to tetramethylsilane as an internal reference. $^{13}$CNMR spectra were recorded on a 75 MHz spectrometer. Elemental analyses were performed by Varian 3LV analyzer series CHN analyzer. Mass spectra were recorded on a Jeol JMC D-300 instrument by using Electron ionization at 70 ev. All reactions were monitored by TLC on pre-coated silica gel plates. Column chromatography was performed on 100-200 mesh silica gel (SRL, India) using 10-20 times (by weight) of the crude product. All the carboxylic acids used are commercially available.



Sponsored by the Indian Institute of Geomagnetism, Navi Mumbai-410218 (DST, Govt. of India)

To synthesize the target hybrid compounds, oxadiazole moiety was synthesized by following known procedure. Different carboxylic acids were subjected to esterification, acid hydrazide formation and finally reaction with carbon disulphide afforded the aforementioned oxadiazole which on propargylation produced terminal alkynes in 80-86% yield. 2+3 cycloaddition to afford finally oxadiazole-1,2,3-triazole conjugate was synthesized from aromatic amines using 2-chloroacetyl chloride and was treated with KI to yield iodo derivative, which on subsequent treatment with sodium azide converted into corresponding organic azide, $ArNHCOCH_2N_3$ according to the literature procedure. Next CuAAC addition, the best example of click reaction [5] was performed using 1 and 2. Compound 1 (1 mmmol) was treated with the azide, (2**,** 1 mmol) in 5 mL water at room temperature in the presence of pre-catalytic system $CuSO_4$ (1 mmol) and sodium ascorbate (1 mmol) to afford target hybrid molecule (3, Scheme 2, Table 1).




**Scheme 2.** *Synthesis of 3.*

The structure of the synthesized compound 3 has been elucidated by mass, IR, $^1H$ and $^{13}C$ NMR spectroscopic measurements. Appearance of a singlet at $\delta$ 5.2 – 5.0 ppm in $^1H$ NMR spectrum confirmed the presence of one methylene groups attached to triazole nitrogen. The one more methylene signal of allylic group between oxadiazole and triazole ring appeared at $\delta$ approximately 4.5 – 4.3 ppm as expected. $^{13}C$ NMR spectrum of the product displayed three singlets at $\delta$ 62.3, 55.6 and 51.4 ppm for three aliphatic carbon atoms as expected from the molecular structure.

In order to study the effect of additive like PTC cycloaddition reaction of 1a and 2a was carried out in the presence of TBAB (15 mol %) in water (Table 2). The use of lower quantity of TBAB was also examined (6 and 2 mol %) and found to be less productive as the progress was slow.

**Table 1.** List of the hybrid molecules (3)

| Compound | $Ar_1$ | $Ar_2$ | Time (h) | Yield |
|---|---|---|---|---|
| 3a | p-isobutylphenyl | Ph | 16 | 88 |
| 3b | -do- | p-chlorophenyl | 14.5 | 82 |
| 3c | -do- | p-bromophenyl | 16 | 85 |
| 3d | -do- | p-nitrophenyl | 20 | 76 |
| 3e | -do- | m-bromophenyl | 19 | 81 |
| 3f | -do- | m-chlorophenyl | 16 | 80 |

**Table 2.** Standardization of PTC

| S.No | % of PTC | TIME |
|---|---|---|
| 1. | 2% | 12 h |
| 2. | 6% | 15 h |
| 3. | 15% | 8 h |

*2.2 Biological (anti-cancer) activity*

The newly synthesized derivatives were evaluated for *in vitro* cytotoxic activity against human HCT-15 for colon cancer cell line using Adriamycin as standard (Table 3). The compound 3f showed the best activity/ highest toxicity with $IC_{50}$ value 11.1.

**Table 3.** $IC_{50}$ values of 3 against HCT-15 cell lines[a]

| Compound | 3a | 3b | 3c | 3d | 3e | 3f | Adriamycin |
|---|---|---|---|---|---|---|---|
| $IC_{50}$ | 30. 9 ±0.35 | 15.5 ±0.16 | 33.4 ±0.33 | 29.4 ±0.19 | 17.5 ±0.18 | 11.1 ±0.16 | 0.8± 0.15 |

[a]All the values are the average of the experiments done in triplicates.

## 3. GENERAL PROCEDURE

*3.1 Chemistry*

All the reactions were carried out in water using compound **1** (1.0 mmol), **2** (1.0 mmol), copper sulphate (1 mmol, 0.24 g ), sodium ascorbate (1 mmol, 0.20 g) and 15mol% PTC. After stirring the reaction mixture in water the reaction mixture was triturated with cold water and filtered to isolate the desired product**.** The product isolated was well characterized by NMR, IR and mass spectra.

*3.2 MTT assay for cytotoxicity*

The viability of the cells was assessed by MTT [3,4,5-dimethylthiazol-2-yl)-2-5-diphenyltetrazoliumbromide] assay, which is based on the reduction of MTT by the mitochondrial dehydrogenase of intact cells to a purple formazan product. Adriamycin, a known anticancer drug was used as a reference compound in this assay. Cells were plated in a 96-well plate. After 24 h, they were treated with different concentration (0–10 µM) of different test compounds diluted appropriately with culture media for 48 h. Cells grown in media containing



Sponsored by the Indian Institute of Geomagnetism, Navi Mumbai-410218 (DST, Govt. of India)

equivalent amount of DMSO served as positive control and cells in medium without any supplementation were used as negative control. After the treatment, media containing compound were carefully removed by aspiration. 100 µl of 0.4 mg/ mLMTT in PBS was added to each well and incubated in the dark for 4 h. 100 µl of DMSO was added to each well and kept in an incubator for 4 h for dissolution of the formed formazan crystals. Amount of formazan was determined by measuring the absorbance at 540 nm using an ELISA plate reader.

## 4. CONCLUSIONS

Triazole-oxadiazole derivatives were synthesized in aqueous medium in presence of 15 mol % PTC, identified by $^{1}$H NMR, $^{13}$C NMR, IR and Mass spectral analysis. The derivatives were screened for cytotoxic activities against colon cancer cell lines.

**REFERENCES CITED**

1. de Olivera, C.S., Lira, B.F., Filho, J.M.B-, Lorenzo, J.G.F. and de Athayde-Filho, P.F., *Molecules*, 2012, v. 17, p. 10192-10231.
2. Bostron, J. Honger, A., Llinias, A., Wellner, E. and Plowright, A.T., *J. Med. Chem.*, 2012, v. 55, p. 1817-1830.
3. Savarino, A., *Expert Opni. Investig. Drugs*, 2006, v. 15, p. 1507-1522.
4. Praveena, K.S.S. Murthy, N.Y.S. and Pal, S., *J. Chem. Pharm. Res*., 2015, v. 7(5), p. 506-522.
5. World Cancer Report (*World Health Organization*), 2014, Chapter 1.1. ISBN 9283204298.
6. Kolb, H.C., Finn, M.G. and Sharpless, K.B., *Angew. Chem. Intl. Ed*., 2001, v. 40, p. 2004.

**ACKNOWLEDGEMENTS**

The authors P. Neeraja and S. Srinivas thank DVR College of Engineering &Technology for encouragement & CFRD, Osmania Uuniversity for spectra.

Proceedings of the National Seminar on
"Impact of Scientific Advances on Society", August 18-19, 2015, p.61-63
St. Pious X Degree & PG College for Women, Hyderabad-500076.

# Early detection of electrical problems through infrared thermography

**Pooja Das Sharma***

*Schneider Electric, Milestone 87, Vadodara- Halol Highway, Kotambi, P.O : Jarod, Vadodara- 391510, India*
*pdassharma26@gmail.com

## ABSTRACT

This paper presents a brief account on the use of infrared thermography to detect and tackle the electrical problems through periodic inspection.

*Keywords*: thermography, infrared radiation, electrical panel, safety

## 1. INTRODUCTION

There are innumerable inventions/discoveries that have either direct or indirect impact on us and some of them have been able to change our life style. The contribution of electro-magnetic waves in this respect perhaps knows no bound. Electromagnetic waves are typically described either by frequency ($f$), or wavelength ($\lambda$) or by photon energy ($E$) according to the following equations:

$$f = \frac{c}{\lambda}, \quad \text{or} \quad f = \frac{E}{h}, \quad \text{or} \quad E = \frac{hc}{\lambda},$$

where $c$ = 299792458 m/s is the speed of light in a vacuum and $h = 6.62606896\times10^{-34}$ J·s = $4.13566733\times10^{-15}$ eV·s is the Planck's constant.

The shortest wavelength of the spectrum is characterized by gamma rays having wavelengths of ~$10^{-12}$ m (the size of atomic nucleii), whereas the longer wavelengths on the opposite end representing the radio waves can be several orders of magnitude long, ~$10^{3}$ m (the size of a multistoried building). The limitation with human eye is that it can see only a part of the electromagnetic spectrum that falls in the visible range ($\lambda$= 4 to $7\times10^{-7}$ m), similar to a digital camera.

The purpose of this article is to dwell on a brief window of the electromagnetic spectrum and highlight some significant applications of infrared thermography in the field of electrical engineering. Thermography is routinely used in industries to minimize failure, so that safety and reliability are assured automatically. Such advancement was possible due to researches performed over the last couple of centuries using electromagnetic radiation falling in the infrared region ($\lambda$=~$10^{-5}$ m). It may be pointed out that this radiation is perceived by us in the form of heat energy. Every object with a temperature above absolute zero emits heat. Even ice cubes, which are at subzero temperature, emit infrared radiation. The higher the temperature of an object, the greater is the infrared radiation emitted.

The credit of infrared imaging technique (thermography) in its present form goes to the pioneering discoveries by Herschels duo, the father and son. While the senior Herschel performed his famous experiment in 1800 AD to measure the temperature of different colors of the spectrum that eventually led to the discovery of infrared radiation (Fig. 1), the son was more interested in photography. Using carbon suspension in alcohol, he could record the heating rays on the infrared side of the spectrum by creating an evaporograph image. This image was termed by him as a thermogram. Today the thermal imaging devices (infrared thermography) have wide range of applications that include diverse fields in industries, agriculture, military, medicine and climate control [1-8].

## 2. PRINCIPLE OF THERMOGRAPHY & ELECTRICAL PROBLEM DETECTION

The sensor in an infrared thermometer receives a small amount of energy radiated from an object and generates an electrical signal. This signal is amplified and converted into voltage output. An analog-to-digital converter digitizes the voltage output. This is followed by solving a temperature equation by an inbuilt arithmetic unit based on Planck's black body radiation law, emissivity

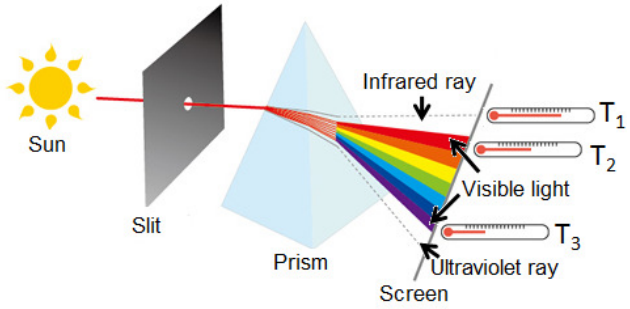



**Figure 1.** *Senior Herschel tried to measure the temperature of different colors of the electromagnetic spectrum by placing thermometers on these colors. He noticed that the hottest part of the spectrum $T_1$ was in a place where there was no visible color at all. It was at a pot beyond the red end of the spectrum. He also noted that $T_1 > T_2 > T_3$.*

from the object and ambient temperature. The temperature reading appears within a fraction of a second. For infrared imaging (thermography), radiation emanating



Sponsored by the Indian Institute of Geomagnetism, Navi Mumbai-410218 (DST, Govt. of India)

from an object is focused by optics (similar to a camera) onto an infrared detector. The infrared information received by the sensor is then passed to the image processing unit. The processing circuitry converts the infrared detector data into an image, which is viewed on a standard video monitor (Fig. 2).

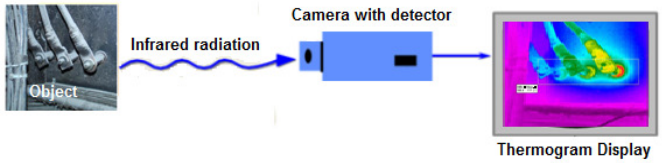



**Figure 2.** *Scheme showing thermographic image.*

Majority of electrical problems are preceded by a change in thermal characteristics and temperature. As the electrical current flows through a circuit, heat is generated due to the internal resistance of the components/parts. This means that over a period of time the amount of heat generated gets increased due to which the contact surface of the circuit weakens. This ultimately leads to system failure or in some cases generate arc flash, causing fire. The best way to minimize risks stemming from electrical or mechanical origin is to detect the problems early. The use of infrared camera is probably the most efficient and cost-effective way [9] so that periodic thermographic inspection of relevant panels can be carried out routinely. The common areas of failure include electrical insulation, terminals, and related components. Excessive friction originating from mechanical problems can also cause breakdowns if equipment is not lubricated properly. Such problem areas include bearings, gears, couplings, pulleys, conveyors and chain drive systems of electrical motors. In the domain of electrical engineering alone infrared thermography therefore finds wide applications that include (i) monitoring and measurement of bearing temperatures in large motors or other rotating equipment, (ii) identifying hot spots in electronic equipments and transmission lines, (iii) detecting leaks in sealed vessels, (iv) finding faulty insulation in process pipes or other insulated processes, (v) finding faulty terminations in high power electrical circuits, (vi) locating overloaded circuit breakers in a power panel, (vii) identifying fuses at or near their current rated capacity, (viii) identifying problems in electrical switch gear, (ix) abnormal heating of radiator fins of oil-filled transformers, (x) identifying defective coils of chokes or inductors, and (xi) capturing process temperatures etc.

Figure 3 and 4 present a few visuals that are collected from different sources. The idea of presenting these figures is to make aware the general readers as to how a trained thermographer uses this tool to detect electrical problems. Various electrical applications show that overloaded/loose contacts, which do not show any anomaly to the eye (top panel), are characterized by different temperature profiles in the thermographic images (bottom panel). Thus the thermographic images can detect the heated contact as problematic that eventually may result in failure (Fig. 3), necessitating immediate attention/repair/replacement.

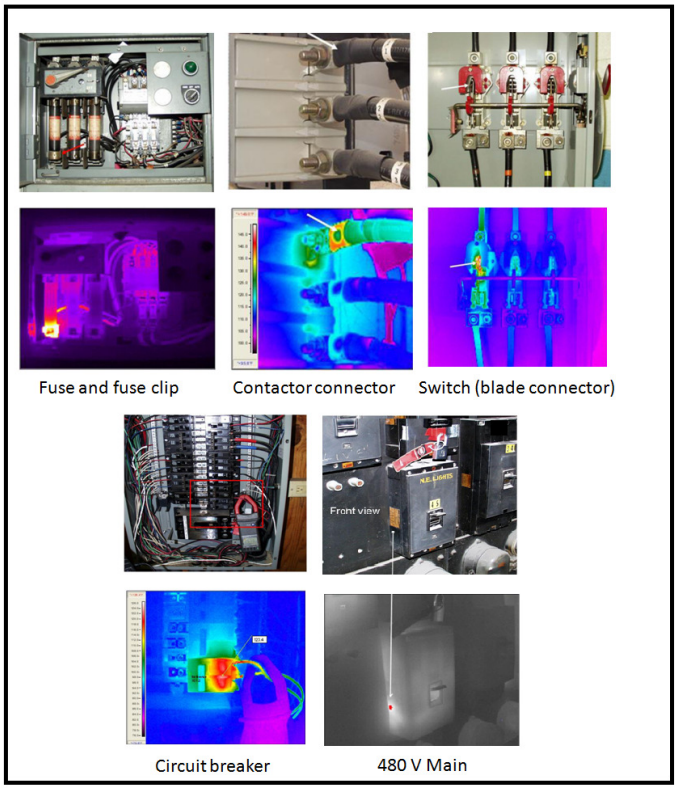



**Figure 3.** *Examples of infrared thermal images. The common electrical problems as colored anomaly in the infrared images indicate presence of hot spots.*

Thermal image is used for evaluating performance of printed circuit boards (Fig. 4). Design engineers achieve an overall understanding of the loading of current and voltage on the components and thereby improve the circuit for reducing internal circuit temperature rise and high reliability in terms of performance. Thermal image of transformer radiator showing anomaly indicates either low oil level or oil flow blockage. Hot temperature on top side and comparatively cool on bottom side indicates no blockage and confirms low oil level (Fig. 4). Problems in electric motors usually occur within T-box connections, visible conductor



Sponsored by the Indian Institute of Geomagnetism, Navi Mumbai-410218 (DST, Govt. of India)

connections, rotors or bearings. All of these problems involve overheating. Wear in the motor is documented in infrared thermography (Fig. 4).

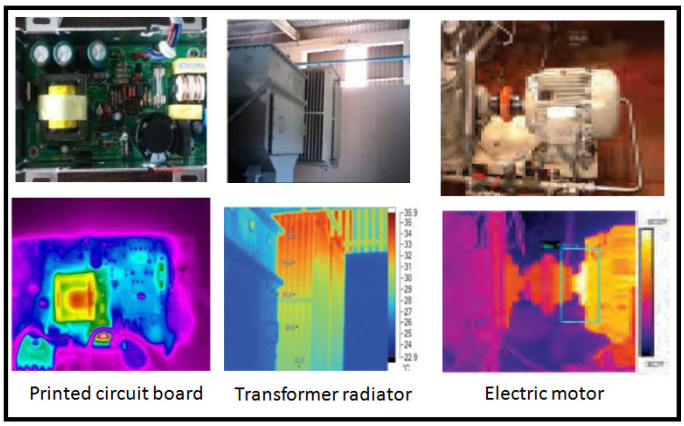



**Figure 4.** *More examples of electrical appliances (top panel) used in different industries with their infrared thermal images (bottom panel).*

## 3. CONCLUSIONS

Infrared thermography is a highly reliable and cost-effective preventative maintenance solution. With adequate training and education, the technique can be adopted for minimizing failure. This would ensure profit, safety and reliability in various operations.

## REFERENCES CITED

1. Korendo, Z., and Florkowski, M., *Power Engineering Journal*, 2001, v. 15(1), p. 33-42.
2. Verma, A.K., Ray, A.K., Singh, S.P., Banerjee, D., and Samuel, S., *Indian Pulp and Paper Technical Association (IPPTA)*, 2009, v. 21(2), p. 55-58.
3. Balaras, C.A., and Argiriou, A.A., *Energy and Buildings*, 2002, v. 34(2), p. 171-183.
4. Manickavasagan, A., Jayas, D.S., White, N.D.G. and Paliwal, J., *CSAE/SCGR Meeting*, 2005, Paper No. 05-002, Winnipeg, Manitoba (Canada).
5. Pašagić, V., Mužević, M. and Kelecc, D., **BRODO***GRADNJA***,** 2008, v. 59, p. 123-130.
6. Kerr, J., *NZHTA Tech Brief Series*, 2004, v. 3(3), (on-line) http://nzhta.chmeds.ac.nz/thermography_ breastcancer.pdf
7. Gulyaev, Y.V., Markov, A.G., Koreneva, L.G. and Zakharov P.V., *IEEE Engineering in Medicine and Biology Magazine*, 1995, v. 14(6), p.766–771.
8. Gottschalk, K., *Infrared Thermography Recent Advances and Future Trends*, C. Meola (ed.), Bentham Science Publishers, 2014, pp. 103-132.
9. Stockton, G.R., *The World of Infrared,* 2012, (on-line) http://www.stocktoninfrared.com/are-electrical-switchgear-surveys-still/



Sponsored by the Indian Institute of Geomagnetism, Navi Mumbai-410218 (DST, Govt. of India)

Proceedings of the National Seminar on
"Impact of Scientific Advances on Society", August 18-19, 2015, p.64-67
St. Pious X Degree & PG College for Women, Hyderabad-500076.

# Drug resistance and plasmid profiling of *Pseudomonas* isolated from Hyderabad regions

**Pritha Ghosh***

*Department of Microbiology, St. Pious X Degree & PG College for Women, Nacharam,, Hyderabad-500076, Telangana, India*
*mukherjeepritha79@gmail.com

## ABSTRACT

*Pseudomonas* is a genus of gamma proteobacteria belonging to larger family of pseudomonads. It is a rod shape, gram negative, aerobic, non-sporing with polar flagella. The strains of *Pseudomonas* now a days, recognized as an emerging opportunistic pathogen of clinical relevance. *Pseudomonas* strain genome sequences have made the genus an excellent focus for scientific research; the best studied species includes *P.aeruginosa*, in its role as an opportunistic human pathogen. The samples used in this project were isolated from different sources from various regions of Hyderabad.

A total of 40 strains were implemented in this work to gain an insight on antibiotic resistance of various *Pseudomonas* isolates obtained and their plasmid profile. Its multi drug resistance action was done by placing antibiotics discs on Muller Hinton agar. And the resistant isolates were further checked for plasmid profile using Brinboim and Dolly method.

Hence this work is an effort to investigate the plasmid presence, profiling and their involvement in resistance to different antibiotics

*Keywords*: Pseudomonas, multi drug resistance, plasmid profiling

## 1. INTRODUCTION

*Pseudomonas* is a genus of gamma proteobacteria, belonging to the larger family of pseudomonads. Recently, 16S rRNA sequence analysis has redefined the taxonomy of many bacterial species [1]. *Pseudomonad''* literally means 'false unit', being derived from the Greek *pseudo* (‘false’) and *monas* (‘a single unit'). The term "monad" was used in the early history of microbiology to denote single-celled organisms. Because of their widespread occurrence were observed early in the history of microbiology. Soon afterwards, pseudomonads were isolated from many natural niches, and a large number of species names were originally assigned to the genus. New methodology and the inclusion of approaches based on the studies of conservative macromolecules have reclassified many strains [2]. Several different epidemiological studies indicate antibiotic resistance is increasing in clinical isolates [3]. In the year 2000, the complete genome sequence of a *Pseudomonas* species was determined; more recently, the sequence of other strains have been determined, including *P. aeruginosa* strains PAO1 (2000), *P. putida* KT2440 (2002), *P. fluorescens* Pf-5 (2005), *P. syringae* pathovar tomato DC3000 (2003), *P. syringae* pathovar syringae B728a (2005), *P. syringae* pathovar phaseolica 1448A (2005), *P. fluorescens* PfO-1 and *P. entomophila* L48 [3]. An article published in the journal *Science* in 2008 showed *Pseudomonas* may be the most common nucleator of ice crystals in clouds, thereby being of utmost importance to the formation of snow and rain around the world [4, 5]. The members of the genus demonstrate a great deal of metabolic diversity, and are able to colonise a wide range of niches [6]. Their ease of culture *in vitro* and availability of an increasing number of *Pseudomonas* strain genome sequences has made the genus an excellent focus for scientific research; the best studied species include *P. aeruginosa* in its role as an opportunistic human pathogen, the plant pathogen *P. syringae*, the soil bacterium *P. putida*, and the plant growth promoting *P. fluorescens*.

The primary cause of antibiotic resistance is genetic mutation in bacteria. The prevalence of antibiotic resistant bacteria is a result of antibiotic use both within medicine and veterinary medicine. The greater the duration of exposure the greater the risk of the development of resistance irrespective of the severity of the need for antibiotics. As resistance becomes more common there becomes a greater need for alternative treatments. However despite a push for new antibiotic therapies there has been a continued decline in the number of newly approved drugs [7]. Antibiotic resistance therefore poses a significant problem. If a bacterium carries several resistance genes, it is called multiresistant or, informally, a superbug or super bacterium. Being Gram-negative bacteria, most *Pseudomonas spp.* are naturally resistant to penicillin and the majority of related beta-lactam antibiotics, but a number are sensitive to piperacillin, imipenem, ticarcillin, tobramycin, or ciprofloxacin [8]. Their resistance to most antibiotics is attributed to efflux pumps, which pump out some antibiotics before the antibiotics are able to act. This low susceptibility is attributable to a concerted action of multidrug efflux pumps with chromosomally-encoded antibiotic resistance genes (e.g. *mexAB-oprM*, *mexXY*, etc., [9]) and the low permeability of the bacterial cellular envelopes. Acquired resistance is either by mutation in chromoso-



Sponsored by the Indian Institute of Geomagnetism, Navi Mumbai-410218 (DST, Govt. of India)

mally-encoded genes, or by the horizontal gene transfer of antibiotic resistance determinants.

Plasmids have been found to play an important role in development of antibiotic resistance. Resistance gene can occur on chromosomes, transferable plasmid, transposons or jumping gene and specialized transposons called integrons that can assemble multiple resistance genes in to cassette [10]. The evolution of multidrug resistant plasmid often involves a site specific integration of antibiotic- resistance determinants [11]. It has been suggested that urban effluents may contain antibiotics due to the dependence on these chemicals in medical care and people's daily life [12]. This pollution may contribute to the maintenance or even spread of antibiotic resistant bacteria in the environment [13]. An attempt was made to identify plasmid or chromosome mediated determinants of *P. aeruginosa* to confer resistance to antibiotics. The present study was undertaken to investigate the antibiotic resistance traits in bacteria isolated from wastewater. An additional aim of this study was to isolate plasmids from the resistant soil bacteria.

## 2. MATERIALS AND METHOD

Sewage and soil samples were procured from various regions of Hyderabad (A.P).

### *2.1 Isolation of Pseudomonas*

The collected samples were serially diluted (10 fold). $10^{-3}$, $10^{-4}$ and $10^{-5}$ dilutions were plated on Cetrimide agar media by spread plate technique. The plates were incubated at $37^0$C for 24 hours. A total of 40 strains were isolated out of which 12 isolates of *Pseudomonas* were characterized. Morphological and biochemical properties of the bacteria were investigated according to Bergey's manual of determinative bacteriology [14]. On the basis of staining techniques, IMVIC, oxidase test, catalase test, hydrolysis of nitrate and pigment production.

### *2.2 Multidrug resistance profile*

Out of 40, 12 were used for further studies. Isolates were analyzed for the presence of drug resistance by the method of Bauer *et.al.* [15] on Mueller Hinton agar (HiMedia.) by using commercial available paper discs. The antibiotic discs used in this study were Amp10– Ampicillin 10 Amp 10, Lin10 – Lincomycin 10, Pen10 – Penicillin 10, Cot – Cotrimetazole, Tet 30 – Tetracycline 30, Nrflx– Norfloxacin, Amp25– Ampicillin 25. Isolates showed varied resistance to the antibiotic used for experimental studies. Analysis of bacterial isolates was performed by making use of standard antibiotic discs. Selected isolates were used for plasmid profiling.

### *2.3 Plasmid profiling*

Plasmid profile was carried out using the alkaline lyses method as described by Brinboin and Dolly Method [16]. Plasmid samples were electrophoresed through 0.8% agarose (Sigma) in TBE buffer at 100V, 60mA for 1hour. The gel was stained in 0.5µg/ml of ethidium bromide solution. The DNA samples were subjected to electrophoresis along with standard supercoiled DNA ladder (Chromos Biotech, Hyderabad). Detection of plasmid done by horizontal gel electrophoresis. Visualization of bands was done in Gel document unit.

## 3. RESULTS

### *3.1 Morphological and phenotypic characteristics*

Morphological and phenotypic characteristics were examined for each all of which were consistent with the description of typical pseudomonad to Bergey's manual of determinative bacteriology which describes the genus as being Gram-negative, nonspore forming, motile, straight or slightly curved rods. The strains gave positive results for Citrate, Catalase, Nitrate and Oxidase. Diffusible greenish to brownish pigment was observed in the experimental isolates characterized for *P. aeruginosa*.

### *3.2 Multidrug resistance*

Out of 12 isolates of *Pseudomonas* included in the present study only eight strains of *P. aeruginosa* were positive for multiple antibiotic resistance.

### *3.3 Plasmid profile*

*P. aeruginosa* isolates were examined for the presence of plasmid. In the present study, isolates were devoid of plasmids but were resistant to all antibiotics, an observation which indicates that resistance to these antibiotics is chromosomal.

## 4. DISCUSSION

Bacteria are the most sensitive organisms in natural ecosystem they possess an unique adaptive feature which help them acquire high resistance to different environmental factors [17]. Dissemination of antibiotic resistance, among bacteria is one of the most obvious example [18-23]. Pseudomonas is a physiological versatile and flourishes as a saprophytes in multiple environments and disinfection solutions too [24], but in



Sponsored by the Indian Institute of Geomagnetism, Navi Mumbai-410218 (DST, Govt. of India)

the last 2 decades the organisms have become increasingly recognized as the aetiological agents in variety of serious infections [25]. Indiscriminate use of anti microbial drugs also adds up to its resistance of different antibitotics. In additional to inate resistance, acquired additional resistance due to plasmids is also a problem which needs a broader insight to study various subjects related to pseudomonas To date in general bacteriological studies with sanitary pollution & bacterial number and only limited studies were aimed at the problem of bacterial resistance to antibiotics .Moreover this problem is of a greater significance in the ecology of those micro organisms and in the public health risk [26-27]. The present study was designed to determine pseudomonas isolates obtained from various environmental samples and to investigate plasmid presence and their involvement in resistance to different antibiotics.

A total of 40 strains were taken for experimental analysis out of which 12 isolates of *Pseudomonas* were characterized based on gram morphology and biochemical tests. Present study also gives insight on multi drug resistance. Our experimental data shows that out of 12, 8 were found to be highly resistant to different antibiotics (Table 1).

**Table 1.** Experimental data

| S. No | Test required | IS 1 | IS 2 | IS 3 | IS 4 | IS 5 | IS 6 | IS 7 | IS 8 |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Gram Staining | - | - | - | - | - | - | - | - |
| 2 | Spore Staining | Non spore forming | Non spore forming | Non spore forming | Non spore forming | Non spore forming | Non spore forming | Non spore forming | Non spore forming |
| 3 | Motility | + | + | + | + | + | + | + | + |
| 4 | Indole | - | - | - | - | - | - | - | - |
| 5 | Methyl red | - | - | - | - | - | - | - | - |
| 6 | VP test | - | - | - | - | - | - | - | - |
| 7 | Citrate utilization | + | + | + | + | + | + | + | + |
| 8 | Oxidase | + | + | + | + | + | + | + | + |
| 9 | Catalase | + | + | + | + | + | + | + | + |
| 10 | Nitrate reduction | + | + | + | + | + | + | + | + |

Sexual contact through the formation of bridge of pillus is common among gram negative bacilli and other species. This may involve chromosomal or extrachromosomal plasmid DNA transfer. Plasmids are extra chromosomal DNA, which carries resistant gene through generation which confers bacterial resistance [28].

In order to examine if there is plasmid involvement in antibiotic resistance mentioned above, plasmid extraction with alkaline lysis method was applied in our study. From the results of plasmid extraction experiment ,it was found that ,the strains were devoid of plasmids but were resistant to all most all antibiotics used there by indicating that resistance to these antibiotics is chromosomal, an observation which co relates with the previous literature data . Although the relationship between plasmid-medi- ated antibiotic resistance and alterations in virulence is established, [29-32]. The association of chromosomally- mediated resistance and virulence has received less attention. Spontaneous mutationsin chromosomal genes occur at a frequency of $10^{6}$-$10^{8}$/cell division. In relation to antibiotic resistance, such mutations usually involve genes encoding the target site, or cell structures affecting access to the target site. The other factor for the absence of plasmids may be attributed to fertility inhibition, a phenomena which is a result of the activity of multi-sub unit repressor encoded by two *fin genes* which acts on operator and prevents transcription of genes required for transfer. Most R-plasmids posses *active fin repressor* which may accounts for low transfer frequency.

## 5. CONCLUSION

From the above discussion it is shown that isolates exhibiting the drug resistance was not due to the plasmid mediated. In the view of these studies, it is evident that the bacterial strains were able to grow in the presence of antibiotics. This property of antibiotic resistance in these bacteria may be important to get an insight to study horizontal gene transfer mechanism and may be linked to the distribution of these resistances in nature. Resistance to antibiotics is widespread among bacteria and relation with transferable plasmids should be further studied. Environmental contamination with antibiotics in conjugation with the presence of resistant bacteria and their resistance genes affects the biodiversity of natural ecosystems. Presence of antibiotics there by determine a reduction in the levels of microbial diversity by the suppression or reduction of susceptible organisms, like bacteria and thus altering the balance of natural microcosm.



Sponsored by the Indian Institute of Geomagnetism, Navi Mumbai-410218 (DST, Govt. of India)

**REFERENCES CITED**


1. Anzai, Y., Kim, H., Park, J.Y., and Wakabayashi, H., *Int. J. Syst. Evol. Microbiol.*, 2000, v. 50, p.1563–1589.
2. Cornelis, P., (ed.), 2008, Caister Academic Press. ISBN 978-1-904455-19-6, ISBN 1904455190, http://www. hori zonpress.com/pseudo.
3. Van Eldere, J., *J. Antimicrob. Chemother.*, 2003, v. 51 (2), p. 347–52.
4. *From snowflake formation to growth of bacterial colonies.*
5. *The rain making bacteria.*
6. Hassett, D., Cuppoletti, J., Trapnell, B., Lymar, S., Rowe, J., Yoon, S., Hilliard, G., Parvatiyar, K., Kamani, M., Wozniak, D., Hwang, S., McDermott, T., and Ochsner, U., *Adv Drug Deliv. Rev.*, 2002, v. 54 (11), p. 1425–1443.
7. *The Journal of Antibiotics*, 2010, v. 63, p. 423-430.
8. Robicsek, A., Jacoby, G.A., and Hooper, D.C., *Lancet. Infect. Dis.*, 2006, v. 6 (10), p. 629–640.
9. Hardie, et. al., 2009, Caister Academic Press. ISBN 978-1-904455-42-4.
10. Shlaes, D.M.., Gerding, D.N,. John, J.F. Jr., Duncan, R.A. and Craig, W.A., *Infect. Contral Hosp Epidemiol.,* 1997, v. 18, p. 275-291.
11. Spencer, D.H., Kas, A., Smith, E.E., Smis, E.H. and Olson, M.V. *J. Bacteriol.*, 2003, v. 185, p. 1316-1325.
12. Levy, S.B., Sci. Am., 1998, v. 278, p. 46–54.
13. Gon˜i-Urriza, M., Capdepuy, M., Arpin, C., Raymond, N., Caumette, P., Quentin, C., *Appl. Environ. Microbiol.*, 2000, v. 66, p.125–132.
14. Holt, G.H., Kreig, N.R., Sneath, P.H.A., Staley, J.T. and Williams, S.T., *Bergey's Manual of Determinative Bacteriology,* 1997, 9th Edn., Williams and Wilkins, New York.
15. Bauer, A.W., Kirby, W.M.M., Sherris, J.C., and Turck, M. *American Journal of Clinical Pathology*, 1966), v. 45, p. 494–496.
16. Davis, L.G., Dibner, M.D. and Battey, J.F., 1986, Elsevier Science Publishing Co. Inc., New York .
17. Lobova ,T.I, Maksimova, E.Y. Popova, L.Y., and Pechurkin, N.S., *Aquat.Ecol.*, 2002, v. 36, p. 229-307.
18. Chandrasekharan, S., Venkatesh, B. and Laithakumari, D., *Curr.Microbiol.*,1998, v. 37, p. 347-351.
19. Gomes:- Lus, R., *Int. Microbiol.*, 1998, v. 1, p. 279-284.
20. Ho, M.W., Traavik, T., Olsvik,.T,T., Appeser, B., Howard, C.V., Von Weizsacker, C. and McGavin, G.C., *Microbial. Ecol.Health Dis.*, 1998, v. 10, p. 33-59.
21. Van Elsass, J.D., McSpadder–Gardener, B.B., Wolters, A.C., and Smit, E., *Applied Environ. Microbiol.*, 1998, v. 64, p. 880-889.
22. Radu, S., Mutalib, S.S., Rusul, G., Haasan, Z., and Yeang, L.K., *Microbios.*, 2001, v. 407, p. 39-47.
23. Shoemaker, N.B., Vlamkis, H., Hayes and Sayers, A.A., *Applied Environ. Microbiol.*, 2001, v. 67, p. 561-568.
24. Govan, T.R.W. *Mackey and Mc Carty's Practical Medical Microbiology,* (Colle, .J.G., Frasier, A.G., Marmion, B.P., and Simmon's, A., Eds.), 1996, 14th Edition, pp. 414-416, Churchill Livingstone, New York.
25. Neu, H.C., *J. Antimicrobe Chemother* (Suppl. B), 1983.
26. Papadakis, J.A , Mavridou, Richardson, S.C., Lampiri, M and Marcelou, U., *Water Res.*, 1997, v. 3, p. 799- 804.
27. Qureshi, A.A. and Qureshi, M.A., *Multiple Water Air Soil Pollut.*, 1992, v. 61, p. 47-56.
28. Naik, U.B., Jalil, J., Bhatnase, Naik, V.B., and Dhore, R., 2010, v. 1(1), p. 37-44, Research India Publications, ISSN 0976-5867.
29. Laporta, M.Z., Silva, M.L.M., Scaletsky, I.C.A., and Trabulsi, L.R., *Infect. Immun.*, 1986, v. 51, p. 715-717.
30. Wachsmuth, I.K., Falkow, S., and Ryder, R.W., *Infect. Immun*. 1976, v. 14, p. 403407.
31. Echeverria, P., Verhaert, L., Ulyangco, C.V. et al., *Lancet.*, 1978, v. 2, p. 589-592.
32. Lacey, R.W., Chopra, I., *J. Med. Microbiol.*, 1975, v. 8, p. 137-147.




Sponsored by the Indian Institute of Geomagnetism, Navi Mumbai-410218 (DST, Govt. of India)

Proceedings of the National Seminar on
"Impact of Scientific Advances on Society", August 18-19, 2015, p.68-70
St. Pious X Degree & PG College for Women, Hyderabad-500076.

# Growth of mobile applications and its impact

**P. Soumya Sree Laxmi[*] and K. Sandhya Sree[#]**

*Department of Computer Science, St.Pious X Degree & PG College for Women, Nacharam, Hyderabad-500076, India*
[*]*pabbathisoumya@gmail.com*
[#]*sandhyak_sree@rediffmail.com*

## ABSTRACT

Mobile applications (or Mobile apps) use and development is growing rapidly in modern society. People of different age group are using mobile apps for different purpose. Smartphone developers are rising with never ending innovative Mobile apps. This tremendous growth is showing deep impact on the society. This paper provides an overview on the growth of mobile apps development and its effect on the society.

*Keywords*: Smart phones, mobile apps, social impact

## 1. INTRODUCTION

Computers have made everything and anything reachable to mankind. Adding to these mobile applications are running on a small hand held mobile device which is moveable, easy to use and accessible from anywhere and any place. Earlier days mobiles were used as a medium for sending and receiving calls. Mobile is how the world communicates today. Smart phones play an increasingly important role in our daily lives from collecting information to news, entertainment, payments, socializing and shopping, people use mobile phones more and more and they don't go to mobile sites instead download mobile apps to perform these activities. Application software developers also have to consider a lengthy array of screen sizes, hardware specifications and configurations because of intense competition in mobile software and changes within each of the platforms [1].

Mobile applications (or mobile apps) are compact programs developed to work on a smart phone, tablets and feature phones. Mobile apps fall broadly into three categories: native, web based, and hybrid [2, 3]. Native applications run on a device's operating system and are required to be adapted for different devices. Web-based apps require a web browser on a mobile device. Hybrid apps are 'native-wrapped' web apps.

- Native Apps : These apps are installed in the device. They do not need any data transfer to the server and works in the device without network as the data about the app is stored in the device itself. For example, Notes and Reminder in iPhones.
- Hybrid Apps (Web): Apps are installed in the device and always require internet connection to run and function. For example, Social Networking Apps (Facebook, Twitter), Instant Messengers (Whatsapp, Skype), E-Commerce (E-bay, Flipkart)
- Hybrid Apps (Mixed): Apps are installed in the device and may or may not require internet connection to run and function. For example, games, screen apps, etc.

## 2. IMPACT OF MOBILE APPLICATIONS ON SOCIETY

Mobile apps became one of the common sources for many business partners and even individuals. The major impacts of Mobile apps include business, education, health and social life. Mobile technology has drastically changed the cultural norms and behavior of individuals. The impacts are both at the positive side and also at the negative side.

### *2.1 Business*

The impact of Mobile apps has created new dimensions on business. Different mobile operating system vendors have their own mobile application technology hence having a different market for Mobile Applications. The most common one are iPhone application market, BlackBerry application market, Android market, Microsoft mobile Application market. These online market places enable users to download useful mobile applications on need basis. Though advertising is an old concept but the features of Smartphone have made it more effective and no doubt it is an additional positive impact of Mobile application for business. Mobile application publisher, distributor and service provider are getting large revenue by providing ads as a part of mobile application [4]. However as a negative effect increase in mobile apps had a drastic effect on the PC market according to surveys.

### *2.2 Education*

Any efforts in improving the quality of education have been always appreciated. Mobile apps have emerged as a knowledge database. People no longer do require carrying all those bundles of magazines and books, or 'stay tuned' to catch the latest headlines, but can easily read them all on our devices. Growing internet connectivity and speed has helped us to keep in touch with the most recent updates regarding almost every sphere or field. No matter whether you're a businessman seeking latest information on stocks and shares or students willing to get the latest pieces of information there are apps to do the work for them. However as a



Sponsored by the Indian Institute of Geomagnetism, Navi Mumbai-410218 (DST, Govt. of India)

negative effect, increase in mobile apps usage leads to distraction among students and encourages bulling and hazing according to the recent surveys.

*2.3 Health*

With the latest technological updates in software, new Mobile apps are developed which helps in monitoring once health related issues. There are a huge number of Mobile applications to facilitate the users to manage prescriptions, promote alternative treatment options, provide price comparisons and validate prescriptions. In near future we see a breed of mobile applications, which enables doctors and parents to monitor a patient/child blood glucose levels at any point during the day. However as a negative effect according to surveys, increase in mobile apps usage in kids who carry smart phones day long for playing games and videos leads to poor eye sight and mobile radiations may affect their health.

*2.4 Social*

Social networking could only be felt after apps made it possible for users to update their statuses, broadcast their words, share local news and events and use those shared by others from the portability of a mobile system. Even in today‘s busy world Smartphone with Mobile apps such as Whatsapp, Twitter, Facebook etc had made possible for us to remain connected with our friends and family all the time. However as a negative effect Mobile apps became an addiction. Surveys show that Smartphone addiction is interfering with night‘s sleep effecting not only their social but also family life.

## 3. LIMITATIONS OF MOBILE APPLICATIONS

Mobile apps have become an extreme fantasy among all generations but still have some limitations which need to be addressed. Each manufacturer of smart phones tends to use a different operating system such as Android, BlackBerry, Windows, Symbasis, iPhone, etc. Developing web applications for smart phones has many constraints which a developer must overcome. Some of the limitations are:

- Visible: the content or feature is accessible from visual means. It may be nested in sub-sections or child pages, but the content is nonetheless accessed from visible navigational elements such as buttons or links.
- Convention : by relying on mobile design conventions you may hide content and only display it when the user employ certain gestures such as swipe or shake, or when the user drags content around such as pull-to-refresh.
- Variable Connectivity: Even in the era of fast cellular networks and ubiquitous Wi-Fi, coverage is not universal or equally good. Phone users frequently complain about connectivity problems. Every new page load translates into a significant waiting time when the network does not cooperate.
- Display Resolution: Comparing to the laptops resolution, mobile devices has less resolution resulting in low quality images.
- No right-click: With the traditional computers right click allows a user to open any page and view simultaneously where as mobile devices do not have a traditional right-click option.
- Fewer Contexts: The smaller screens on touch devices results in reduced context that makes it more difficult for the user to get an overview of the page.

## 4. PRESENT AND FUTURE OF MOBILE APPLICATIONS

The research firm reiterates the various factors that may be contributing to the growth, from advancements in network technologies to the lowering of mobile data usage cost, growing adoption of smart phones around the world, and a continuous increase in application usability. As more and more people turn to smart phones capable of browsing the web, developers will have to come up with better methods of cross-platform development to allow applications to scale multiple platforms seamlessly. With the enhancement to 4G bandwidth and connectivity issues will be less of a constraint when developing applications. The IBM Tech Trends Survey [5], conducted on 2000 IT developers and specialists across 87 countries and getting response. According to the survey, 55% IT professional expect that, mobile software application development for devices such as iPhone and Android, and even tablet PCs like iPad, will surpass application development on all other traditional computing platforms by 2015.

## 5. CONCLUSIONS

As we continue to move into the uncertainty of future, we seem to gradually become more and more tech-savvy, especially the younger generation. Every single day something new is happening somewhere, and thus the



Sponsored by the Indian Institute of Geomagnetism, Navi Mumbai-410218 (DST, Govt. of India)

dynamic nature of technology continues to progress. There are several ways that we can control and minimize the negative impacts of Mobile apps in society. In order to understand the positive and negative impact of Mobile apps it is even more important to educate the users on how to use them smartly. Proper guidance to the users and better security access controls to the smartphones should be provided to reap the fruits of the emerging technology.

**SUGGESTED REFERENCES**

1. Software Development Discussion Paper: An overview of mobile development in the context of current technology.
2. Masi, E., G. Cantone, Mastrofini, M., Calavaro, G., and Subiaco, P., *Proceedings of International Conference on Mobile Computing, Applications, and Services.*, ser. MobiCASE'4, 2012, p. 64–79.
3. http://www.computerworld.com.au/whitepaper/371126/native-web-or-hybrid-mobile-app-development/download/
4. Mogg, T., 2012, http://www.digitaltrends.com/mobile/smartphone-sales-exceed-those-of-pcs-for-firsttime-apple-smashes-record/
5. IBM Survey, 2010, http://www.fiercemobilecontent.com/press-releases/ibm-survey-itprofessionals-predict-mobile-and-cloud-technologies-will-dominateenter

Proceedings of the National Seminar on
"Impact of Scientific Advances on Society", August 18-19, 2015, p.71-72
St. Pious X Degree & PG College for Women, Hyderabad-500076.

# Point spread function of asymmetrically apodized slit aperture

**R. Komala* and P. Sangeetha Lakshmi**

*Department of Physics, St.Pious X Degree & PG College for Women, Nacharam, Hyderabad-500076, India*
*komala.rajanala@rediffmail.com*

## ABSTRACT

A shift in central maximum position and suppression in central maximum intensity has been obtained by introducing three level asymmetric pupil function. The good side has steep central maxima while the bad side has broadened central maxima. The asymmetry in point spread function has been found to increase with the introduction of the edge strip and increase in apodisation parameter within the slit aperture.

*Keywords*: Point spread function, asymmetric apodization, resolution

## 1. INTRODUCTION

In order to improve the results of an optical system, there are two methods namely modification of the optical system and the post detection processing. The former one involves optimization of the optical system itself and the latter involves operations on the systems output. In many situations the first one is followed by changing the pupil function with suitable apodization. Apodisation is the technique that modifies the imaging properties of an optical system such that the system impulse response does not show ringing by manipulating its entrance pupil. It is one aspect of the wide range technique of spatial filtering which filters the unwanted ringing around the PSF [1]. To realize direct image of faint object which is in the close proximity of very bright object could be technologically feasible by introducing asymmetric apodization. The point spread function (PSF) of an optical system with asymmetric apodization has been found to possess a so-called good side and a bad side [2]. The asymmetry in the PSF has been found with introduction of edge slits and amplitude apodiser in the central region [3, 4]. This technique is aimed to obtain high contrast and improved resolution. The studies on modification of PSF is very much in demand due to its applications in various areas of day to day life. The quality of image can be improved in the study of micro organisms under a microscope and to study weak spectral lines in presence of bright spectral lines [5].

## 2. THEORY

Within the frame of scalar diffraction theory, the amplitude impulse response of a one-dimensional optical imaging system with the pupil function may be written as

$$A(u) = \int_{-1/2}^{1/2} t(x) exp(i2ux) dx \qquad (1)$$

where $x$ is the coordinate in the pupil plane, $u$ is the dimensionless diffraction co-ordinate in the image plane and $t(x)$ is the pupil function of the optical system.

Taking into account the requirement of obtaining improved side-lobe suppression and narrowing the central peak in part of the diffraction pattern, we propose, for a one-dimensional pupil of unit width, the following phase and amplitude three- level pupil function $t(x)$:

$$\boldsymbol{t(x)} = \begin{cases} \boldsymbol{exp(-i\pi/2) = -i} & \boldsymbol{-1/2 \le x < 1/2 + b} \\ \boldsymbol{1 - 4\beta x^2 + 4\beta x^4} & \boldsymbol{-1/2 + b \le x \le 1/2 - b} \\ \boldsymbol{exp(i\pi/2) = i} & \boldsymbol{1/2 - b < x \le 1/2} \end{cases} \qquad (2)$$

where β is the apodization parameter controlling the degree of non-uniformity of the transmission over the specified region of the pupil. The range values it takes are $0 \le \beta \le 1$. It is clear that for $\beta = 0$, $t(r) = 1$ which implies uniform transmittance over the central region of the pupil. For non zero values of β the central region behaving as a three different regions with non-uniform transmittance. Because of exceptionally deep reduction ability and constant working angles throughout the regions of considered edge strips, we consider the odd (anti-symmetric) phase functions.

Fig. 1 shows the PSF of unapodised and asymmetrically apodised pupil functions. For chosen slit width

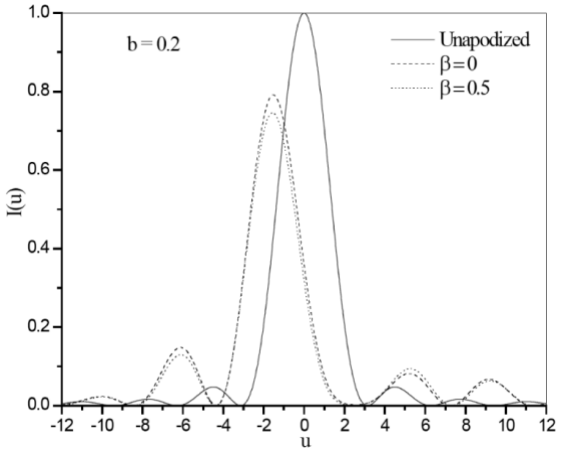



**Figure 1.** *Effects of edge slit width and a central region apodization on intensity profile and shift in position of central maximum.*



Sponsored by the Indian Institute of Geomagnetism, Navi Mumbai-410218 (DST, Govt. of India)

b and for different values of apodization parameter β as a function of the normalized pupil co-ordinate from center to end of the central region. The amplitude distribution in the focal region may be written as

$$A(u) = A_0(u) + A_1(u) + A_2(u) \quad (3)$$

$$A_1(u) = \int_{-1/2}^{-1/2+b} -iexp(i2ux)dx$$

$$A_0(u) = \int_{-1/2+b}^{1/2-b} (1 - 4\beta x^2 + 4\beta x^4)exp(i2ux)dx$$

$$A_2(u) = \int_{1/2-b}^{1/2} iexp(i2ux)dx$$

It means that the resultant complex amplitude distribution in the focal region is the sum of the diffraction fields $A1(u)$ and $A2(u)$ contributing by the narrow edge slits with opposite transmittances *-i* and *i* and the field $A0(u)$ by the central region covered with an amplitude apodizer.

The intensity PSF *I(u)* which is the real measurable quantity can be obtained by taking the squared modulus of *A(u)*. Thus,

$$I(u) = |A(u)|^2 \quad (4)$$

## 3. RESULTS AND DISCUSSION

The results of investigations on the effects of asymmetric apodization on intensity distributions in the image plane of an optical system have been obtained from Eq. (4) as a function of diffraction coordinate u varying from -12 to +12 by employing a twelve-point Gauss quadrature numerical method of integration. Gaussian quadrature possesses most important desirable properties such as positivity of the weights, rapid convergence, mathematical elegance, etc. It is extremely efficient and accurate [6]. Hence, we have chosen this method to evaluate integrals. An iterative method has been developed and applied to the position and intensity of central maximum. The performance of the designed pupil functions is described by the asymmetric point spread functions of a slit and depicted in Fig.1. In this figure the unapodized or Airy PSF is represented by the solid curve for easy comparison. The PSFs are graphically represented in Fig. 1 for b=0.2 when the central region of the slit is apodized with β. It can be seen from this figure that on the left half axis (bad side) the central peak is broadened, shifted, while on the right half axis (good side) the central peak is narrower. It tells us that the good side in which a steep central peak is achieved at the cost of worsening its counterpart. However, the magnitude of these effects depends on b value and the reduction in central peak intensity is increasing with the degree of apodization. However, the shifting of central maximum provides high contrast only in a narrow region on good side. This small dark zone is particularly important in the case of resolution of two line objects which are widely varying in their intensity and very close to each other. The results obtained in our investigation are clearly demonstrating that the central peak is narrowing on good side with the strip width for any given value of apodising parameter.

**REFERENCES CITED**

1. Mills, J.P., and Thompson, B.J., *Coherent Optical Systems SPIE Milestones series*, 1996, 119, SPIE Optical Engineering Press, Ellingham.
2. Cheng, L., and Siu, C.G., *Meas. Sci. Technol.*, 1991, v. 2, p. 198.
3. Reddy, A.R.N, Komala, R., Goud, M.K., and Goud, S.L., *AIP Conf. Proc.*, 2011, 1391, 341.
4. Komala, R., Reddy, A.R.N, Goud, M.K., and Goud, S.L., *Acta Physica Polonica*, A 2012, 2714.
5. Kowalczyk, M. Zapata-Rodriguez, C.J., and Martinez-Corral, M., *Appl. Opt*., 1998, v, 37, p. 8206.
6. Mathews, J.H., and Fink, K.D., *Numerical Methods Using Matlab*, 2004, Pearson Prentice Hall, New Jersey.



Sponsored by the Indian Institute of Geomagnetism, Navi Mumbai-410218 (DST, Govt. of India)

Proceedings of the National Seminar on
"Impact of Scientific Advances on Society", August 18-19, 2015, p.73-74
St. Pious X Degree & PG College for Women, Hyderabad-500076.

# Determination of sodium metal ions in various junk foods by flame photometry

**Rani Padmini***

*Department of Biochemistry, St. Pious X Degree & PG College for Women, Nacharam, Hyderabad-500076, Telangana, India*
**ranepadmini@gmail.com*

## ABSTRACT

Sodium (from Latin Natrium) is an abundant element which is soft silvery-white and highly reactive metal. Its atomic number is 11. It exists in numerous minerals such as feldspars, sodalite and rock salt. It is a member of alkali metals and its only stable isotope is $^{23}Na$. It was first isolated 1807 by the electrolysis of sodium hydroxide. Sodium is an essential element for all animals and some plants. In animals, sodium ions are used against potassium ions to build up charges on cell membranes, allowing transmission of nerve impulses when the charge is dissipated. It is therefore classified as dietary inorganic macromineral. Sodium chloride is the principal source of sodium in diet and is used as seasoning and preservation. Sodium levels in various junk food is analyzed by flame photometry. By using flame photometry (more accurately called flame atomic emission spectroscopy) the species are examined in the spectrometer in the form of atoms. The technique allows quantitative analysis of the analyte metal in the sample solution, a total of 15 junk food samples were analyzed by using flame photometry. Therefore various junk food samples analyzed are categorized into three as food containing high level, medium level, and low levels of sodium.

*Keywords*: Sodium, sodium ions, sodium chloride, flame photometry, junk food, hypertension, hypernatremia, cardiac problem

## 1. INTRODUCTION

Sodium is an essential element for human and animal lives and for some plant species. Its melting and boiling points are 97.8° and 883°C, respectively. Sodium shows exothermic reactions with water. Sodium or its compound when exposed into flame imparts yellow color. Most important sodium compounds are common salt (NaCl ), baking soda ($NaHCO_3$), caustic soda (NaOH), Borax ($Na_2B_4O_7.10H_2O$) etc.

Sodium chloride is the principal source of sodium in diet, the daily recommended levels of sodium is 2.3 gm/day. A normal serum sodium level is 135-145mEq/Liter (mEq/L).

In human and animals, sodium ions are necessary for regulation of blood and body fluids, transmission of nerve impulses, certain metabolic functions, heartbeat regulation, important ion in extracellular compartment. It helps in maintaining optimum level of salt and water balance in the body, thereby preventing the body from attaining the condition called as hypernatremia. An excess of body water caused by drinking will result in too low sodium level in blood causing hyponatremia.

Sodium is important in brain and nerve function to maintain osmotic balance by $Na^+/K^+$ ATPase pump. It also plays a major role in generating muscle contractions by creating electrical potential gradient. Cells rely on sodium to cause signal transduction [1]. In $C_4$ plants, it aids in metabolism, in regeneration of (PEP) Phosphoenol pyruvate and chlorophyll synthesis. It acts as a substitute for potassium for maintaining turgor pressure [2].

Some of the sodium containing compounds like sodium pyrophosphate, trisodium citrates, are used as emulsifying agent, buffering agents.

Sodium plays, several roles [3] in specific food types (Table 1).

**Table 1.** Role of sodium

| | |
|---|---|
| In ready to eat cereals | To improve flavor and texture |
| Baked goods like bread, beverages | Fermentation , reduces the stickiness of dough |
| Pickles, jams | Improves shelf life and helps to control growth of molds |
| Meat | Flavor and preservation, help increase water binding |
| Milk , fruits, vegetables | Source of nutrient |

## 2. MATERIALS AND METHODS

A total of 15 junk foods are analyzed for the levels of sodium by using flame photometry. The technique uses a flame that evaporates the solvent and also sublimates and atomizes the metal and then excites a valence electron to an upper energy state. Light is emitted at characteristic wavelength for each metal as the electron returns to the ground state that makes qualitative determination possible. Flame photometer use optical filters to monitor for the selected emission wavelength produced by the analyte species.

### *2.1 Preparation of standard solution*

Stock: Weigh accurately 254mg of "Anal R" quality of NaCl into a 100ml volumetric flask through funnel. Add



Sponsored by the Indian Institute of Geomagnetism, Navi Mumbai-410218 (DST, Govt. of India)

deionized water to the flask, dissolve the NaCl, and make ip the solution to the mark with deionized water. This stock standard solution contains 1000mEq/100ml of Na.

Working standard solution: The stock standard solution is diluted to 1:100 with deionized water and the same is used to prepare working standard solutions of 40 ppm, 60 ppm, 80 ppm, 100 ppm and 120 ppm.

*2.2 Sample used*

The samples used are – 1) Amul cheese 2) Nutrilite Butter 3) Panipuri masala 4) Pav Bhaji masala 5) Maggie masala 6) Britannica cashew Biscuits 7) Lays chips 8) Act II popcorn 9) Kurkure 10) Kissan Tomato sauce 11) Weikfield soya sauce 12) Cadbury chocolate 13) Appy fizz 14) Coca Cola 15) Ajinomoto.

*2.3 Sample processing*

Prepare HCl solution by diluting 500ml of concentrated with 220 ml water. Weigh 5gm of sample, add 50ml of the above prepared HCl solution, bring it to boil for 5min and then filter through Whatmann No #1 filter paper. Measure the volume of extract obtained and then makes it up to 100ml .from this extract make the required dilutions needed for the experiment.

The analysis is done by using flame photometer with following steps.

(i) Feed the instrument with deionized water before feeding with blank to clean the nebulizer.

(ii) Feed the blank. Blank used in the experiment is 0.5% HCl solution.

(iii) Feed the standard of appropriate concentration that is 40ppm, 60ppm, 80ppm, 100ppm and 120ppm.

(iv) Feed the unknown biological samples of appropriate dilutions.

(v) The Na levels are viewed using the view options of instrument

## 3. RESULTS, DISCUSSION AND CONCLUSION

A total of 15 samples were analyzed (Table 1). Based on the analysis the various junk foods, they are categorized as having high, moderate and low levels of Na.

Junk foods containing high levels of Na include ajinomoto, soya sauce, panipuri masala, cheese, pav bhaji masala, maggie masala. The increased levels of sodium can be because of NaCl or sodium containing compounds like sodium citrate, sodium glutamate etc. The addition of salt is for the purpose of flavor and also preservation.

**Table 1.** Levels of sodium and sodium chloride in 1:10 diluted sample

| Sample Name | Ppm values ( 1:10) | Mg of sodium /5gm of sample | Mg of NaCl/5gm of sample |
|---|---|---|---|
| Ajinomoto | 263.9 | 263.9 | 670.3 |
| Coca Cola | 1.8 | 1.8 | 4.6 |
| Appy fizz | 0.1 | 0.1 | 0.3 |
| Cadbury Choclate | 6.8 | 6.8 | 17.3 |
| Soya Sauce | 195.2 | 195.2 | 495.8 |
| Kissan Tomato Sauce | 43.6 | 43.6 | 110.7 |
| Kurkure | 36.7 | 36.7 | 93.2 |
| Act II popcorn | 37.4 | 37.4 | 94.9 |
| Lays chips | 25.7 | 25.7 | 64 |
| Biscuits | 14 | 14 | 35.6 |
| Maggie masala | 184.4 | 184.4 | 468.4 |
| Pav Bhaji masala | 62.7 | 62.7 | 159.5 |
| PaniPuri Masala | 243.5 | 243.5 | 618.5 |
| Nutrilite Butter | 35.6 | 35.6 | 90.4 |
| Cheese | 54.6 | 54.6 | 141.2 |

Junk foods containing moderate levels of Na include biscuits, potato chips, butter, kurkure, and popcorn and tomato sauce. In tomato sauce and cheese sodium is added as a preservative, whereas in chips and popcorn etc. it is added for the flavor.

Junk foods containing low levels of Na are chocolate, appy fizz and coca cola. Sodium is added in the form of sodium carbonate and sodium bicarbonate.

The result of the analysis in both the packaged and take away foods showed a wide range in sodium levels. Healthy adults should limit the sodium intake to 2300mg/day to avoid hypertension, hypernatremia, obesity, cardiac problems, and gastro intestinal problems, such as ulcer etc. People with hypertension should limit to 1500mg/day. The amount of sodium level must be restricted to lower amounts than 1500mg/day for the people with cardiac problems, liver cirrhosis, kidney disease etc. Thus it is recommended that people should consume foods with moderate level of sodium.

**REFERENCES CITED**

1. Laragh, J.H., *New England Journal of Medicine*, 1985, v. 313, p. 1330-1340.
2. Kering, M. K., *Ph.D. dissertation*, 2008, University of Missouri-Columbia.
3. Desmond, E., *Regarding salt in foods: Practical strategies*, Kilcast, D., and Angus, F., (eds.), 2007, pp. 235-255, Cambridge, UK, Woodhead.



Sponsored by the Indian Institute of Geomagnetism, Navi Mumbai-410218 (DST, Govt. of India)

Proceedings of the National Seminar on
"Impact of Scientific Advances on Society", August 18-19, 2015, p.75-77
St. Pious X Degree & PG College for Women, Hyderabad-500076.

# Delusional disorder: an altered perception

**Sikta Bandopadhyay***

*Department of Zoology, St. Pious X Degree & PG College for Women, Nacharam,, Hyderabad-500076, Telangana, India*
*siktab@gmail.com

## ABSTRACT

Delusional disorder, the contemporary conceptualization of paranoia, is an uncommon condition characterized by the presence of one or more nonbizarre delusions and the relative absence of associated psychopathology. Delusion has attracted enormous attention because it occurs in a large number of psychiatric as well as medical conditions. No systematic research on paranoia took place for more than half a century and modern investigations on delusional disorder were not done earlier. Hereditary factors and association with inherited personality factors may play a part, in the psychological maldevelopment. However, there is an urgent need for the study of extended case series utilizing modern neurophysiological and neuropsychological investigative methods. Here, in this article, the etiology and clinical features are briefly discussed.

*Keywords*: Delusional disorder, etiology, dopamine, D2receptor, gene, pHVA

## 1. INTRODUCTION

Delusional disorder is a psychiatric disorder in which the central feature is the presence of delusions in the absence of other symptomatology. Since the beginning of psychiatry, delusional disorder has been at the center of attention and continuing to engender controversy till today. Delusions have been regarded as the hallmark of insanity in Western cultures, long before psychiatry became a branch of medicine [1]. In contemporary classification system of mental disorders, such as Diagnostic and statistical manual, 4th edition (DSM-IV) and International Classification of Diseases, 10th edition (ICD-10), delusions are considered as cornerstone symptoms for the diagnosis of psychotic disorders. Delusional formation is a fascinating and enigmatic psychic process, which has been the object of numerous scientific debates and theoretical models, but of surprisingly few empirical studies [1, 2]. Delusions has been defined as a false belief that is firmly maintained in spite of incontrovertible and obvious proof or evidence, in spite of the fact that other members of the culture do not share the belief. Systematic study of the phenomenology of delusions, however, is a relatively recent enterprise and many fundamental questions remain unanswered.

## 2. HISTORICAL OVERVIEW OF DELUSIONAL DISORDER

Historically, the concept of delusional disorder is derived from the classic Greek concept of *paranoia.* The term paranoia, from which the modern adjective paranoid is derived, has a long and chequered history. It has probably given rise to more controversy and confusion of thought than any other term used in psychiatry. The word paranoia was derived from the Greek *Para* (beside) *nous* (mind). It was used in ancient Greek literature to mean "out of mind", i.e., of unsound mind or insane. Kahlbaum [3] used the name paranoia and first applied the term to a chronic delusional disorder. Kraepelin [4] also recognized a condition that he called *paranoia*, characterized by a persistent delusional system in the absence of hallucinations and personality deterioration.

## 3. EPIDEMEOLOGY

Delusional disorder, an uncommon, probably heterogeneous group of illness, has a prevalence of 0.03 % and incidence 1-3 new cases/1,00,000 population. Epidemiological data suggests that delusional disorder is a separate condition or is an atypical form of schizophrenia and mood disorders [5]. It is far less prevalent than schizophrenia and mood disorders. The age of onset is later than in schizophrenia although men tend to experience the illness at earlier ages than women [6]. The observed sex ratio is different from that of mood disorder, which occurs disproportionately among women.

## 4. THE CONCEPT OF FORM AND CONTENT

Delusion, as "the basic characteristic of madness" [7], has appropriately attracted an enormous amount of theoretical interest but remarkably little is known with any certainty. Arthur [8] in his classic review concluded: "delusion can still claim to be the most outstanding and baffling behaviour symptom of mental illness" [7], has appropriately attracted an enormous amount of theoretical interest but remarkably little is known with any certainty. The problem of delusion is one of the basic problems of psychopathology and has impaired an impressive diversity of theoretical speculation. According to the Diagnostic and Statistical Manual of Mental Disorders Text Revisions (DSM-IV-TR), published in 1994, it defines the core psychopathological features of delusional disorder as persistent, nonbizarre delusions not explained by other psychotic disorders. The delu-



Sponsored by the Indian Institute of Geomagnetism, Navi Mumbai-410218 (DST, Govt. of India)

sions are unusual yet they refer to different aspects of life that might occur, such as being conspired against, cheated on, physically ill, in love, jealous and so forth. Delusions are categorized according to their content. The degree of hostility and suspiciousness may be such that violent or aggressive behaviour results. Litigious behaviour is common among such patients. However, some patients, notably those with somatic delusions, may not display hostility, anger, or even suspiciousness to any considerable degree.

## 5. CLINICAL FEATURES AND CLASSIFICATION OF THE DISEASE

Principal features include,

a) Non-bizzare delusions of at least 1 month's duration.
b) Criterion A for Schizophrenia has never been met, although tactile and olfactory hallucinations may be acceptable if they are related to the delusional theme.
c) Apart from the impact of the delusion(s) or its consequences, functioning is not markedly impaired and behaviour is not obviously odd or bizarre.
d) Concurrent mood episodes, if present, are belief relative to the duration of the delusional disorder.
e) The disturbances are not the direct outcome of a drug or medication or of a medical disorder.

Subtypes are Erotomanic, Grandiose, Jealous, Persecutory, Somatic, Mixed and Unspecified or other.

Delusions are sufficiently idiosyncratic that sharp distinctions and inclusive classifications have remained elusive. Nash listed 44 varieties of delusions and admitted that the list is not yet complete. Vast differences can be seen in the content of any single variety of delusions. The current classificatory systems bypass the etiological discussion by implementing pure symptomatological criteria closely to the Kraepelinian category of paranoia [9]. A general scheme of descriptions of delusions has been suggested by many are shown in Table 1.

## 6. FAMILIAL PATTERN OF DELUSIONAL DISORDER

Family studies that have begun to appear in the literature indicate the possible specific family transmission of delusional disorder. It has been reported that delusional disorder is more likely to be associated with a family history of such traits as suspiciousness, jealousy,

**Table 1.** Showing nine of the most common and dramatically distinct types of delusion

| | |
|---|---|
| 1. | Delusion of Persecution |
| | Delusions of Reference |
| | Delusions of Loss of Property |
| | Delusions of Poison or infection |
| | Delusions of Influence |
| | Delusions of Innosence |
| 2. | Nihilistic Delusions |
| 3. | Delusions of ill health |
| | Hypochondriasis |
| | Monosymptomatic hypochondriasis |
| | Somatic Delusions |
| 4. | Delusions of Grandeur |
| 5. | Delusions of Poverty |
| 6. | Delusions of Love |
| 7. | Delusions of Jealousy |
| 8. | Delusions of Possession |
| 9. | Delusions of Reduplication |

secretiveness and the presence of paranoid behaviour or delusions [10]. Some studies have found that delusional disorder is more common among relatives of individuals with schizophrenia than others [10, 11].

## 7. ETIOLOGICAL MODELS OF DELUSIONAL DISORDER

The knowledge of etiology of delusional disorder is scanty and highly speculative, as little modern research has been conducted. A general outline of the etiological factors is described as below.

### *7.1 Genetic basis of delusional disorder*

Human genetics research has generated enormous amount of data about the genetic differences among individuals and groups. Investigation of these differences has transformed our understanding of the origins and nature of human diseases [12-14].

The discovery of Dopamine receptor genes associations with delusional disorder implies that at least part of their genetic basis lies in the Dopaminergic receptor system [15]. D2S allele was found to be



Sponsored by the Indian Institute of Geomagnetism, Navi Mumbai-410218 (DST, Govt. of India)

strongly associated with the disease along with the TH1 allele with a moderately strong association. It may be conceived that the polymorphism of the DR and/or TH gene could be the part of the genetic basis underlying the hyperdopaminergic state and delusional etiology of the disease [16], Serretti et. al. [17] demonstrated a significant association between the Ser311Cys variant and delusional features in major psychoses in Italian patients.

Few studies have also been implicated the possible involvement of HLA association with delusional symptomatology in major psychosis The first HLA association study was reported in delusional disorder [18]**.** Since then several studies from our laboratory have implicated that involvement of gene polymorphisms of HLA system in the etiopathology of delusional disorder. Debnath et al. [19] demonstrated a significant association between the HLA-A*03 allele and delusional disorder in Indian patients.

### *7.2 Organic brain factors*

Gorman and Cummings [20] have proposed that delusional illnesses of organic origin have underlying features in common, particularly temporal lobe or limbic involvement and an excess of dopamine activity in certain areas of the brain. It is very possible that organic brain factors are much more common than we suspect in delusional disorder, especially in younger males who have previously abused alcohol or drugs or have suffered a head injury in the past, and in older patients (more commonly female) who suffer from effects of an aging brain [21].

### *7.3 Biochemical evidence*

High level of pHVA was found in the delusional disorder patients when compared with the healthy controls suggesting the dopamine hypothesis of the disease [16, 22].

## 8. CONCLUSION

Delusions are a key clinical manifestation of psychosis and have particular significance for the diagnosis of delusional disorder. Although common in several psychiatric conditions, they also occur in a diverse range of other disorders ( including brain injury, intoxication, somatic illness). Delusional disorder is significant precisely because altered perception, often making them resistant to change. Taking these genetic and biochemical approaches will enhance our understanding of the psychotic symptoms manifested by the disease and may move us closer to the consilience between the biology and phenomenology of delusions.

**REFERENCES CITED**

1. Berrios, G.E., *Brit. J..Psychiatry,* 1991, v. 159 (suppl 14), p. 6-13.
2. Butler, R.W., and Braff,, D.L., *Schizophr. Bull.,*1991, v. 17, p. 633-647.
3. Kahlbaum, K.L., *Psychiatrische Wochenschrift*, 1863, v. 14, p.125-128.
4. Kraepelin, E., 1989, Livingstone Publisher, Edinbburg.
5. Kendler, K.S., and Hays, P., *Arch. Gen. Psychiatry*, 1980, v. 38, p. 547-551.
6. Hsiao, M.C., Liu, C.Y., Yang Y.Y., and Yeh, E.K., *Psy. Cin. Neurosci*., 1999, v. 53(6), p. 673-.676.
7. Jasper, K., *General Psychopathology*, 1963, 7th ed., Manchester University Press, pp. 65-72.
8. Arthur, A.Z., *Am. J. Psy.,* 1964, v. 121, p. 105-115.
9. Gabriel, E., *Psychopathology*, 1987, v. 20, p. 87-91.
10. Winokur, G., *Psychopathology,* 1986, v. 19(1-2), p. 30-34.
11. Watt, J.A.G*., Am. J. Psy.,* 1985, v. 142, p. 1456-1458.
12. Cavalli- Sforza, L.L., and Bodmer, W.F., *The Genetics of Human Populations*, 1971, pp. 559-561, Freeman & Co, San Fransisco.
13. Bamshad, R.M., Mastan, N., Raviprasad, B.V., Reddy, G.P., and Ricker C.E.,*Genome Res. J.,* 2001, v. 11, p. 994-1004.
14. Collins, A., Lonjou, C., and Morton, N.E, *Genetics*, 2003, v. 165, p. 2213-2233.
15. Bandopadhyay, S., Singh, B., Bera, N.K., Das, S.K., Nayak, C.R., and Chaudhuri, T.K., *NBU J. Anim. Sci*., 2008, v. 2(1):, p. 90-94.
16. Chaudhuri, T.K., and Banerjee, S., *Dopaminergic System in the Etiopathology of Delusional Disorder: Delusional Disorder and Dopamine Receptor*, 2012, LAMBERT Academic Publishing (U.K.).
17. Serretti, A., Lilli, R., Lorenzani, C., Lattuada, E., and Smeraldi, E., *Am. J. Med. Genet,,* 2000, v. 105, p. 283-290.
18. Chaudhri, T.K., and Das,S.K.,*ASIETTA*, 1997, Sydney.
19. Debnath, M., Das, S.K, Bera, N.K, Nayak, C.R., and Chaudhuri, T.K., Ind. J. Psychiatry, 2000, v. 42(3), p. 275-279.
20. Gorman, D.G., and Cummings, J.L., *Seminars in Neurology*, 1990, v. 10, p. 229-238.
21. Munro, A. *Can. J. Psychiatry,* 1988, v. 33, p. 171-174.
22. Bandopadhyay, S., Singh, B., Bera, N.K., Das, S.K., Nayak, C.R., and Chaudhuri, T. K., *Int. J. Chem. Sci*., 2009, v. 7(3), p. 1583-1590.



Sponsored by the Indian Institute of Geomagnetism, Navi Mumbai-410218 (DST, Govt. of India)

Proceedings of the National Seminar on
"Impact of Scientific Advances on Society", August 18-19, 2015, p.78-79
St. Pious X Degree & PG College for Women, Hyderabad-500076.

# Utility of viral load in antiretroviral therapy

**Sri Laxmi Kandula**

*Department of Biochemistry, St. Pious X degree & PG College for Women, Nacharam, Hyderabad-500076, Telangana, India*
**srilaxmikandula14@gmail.com*

## ABSTRACT

Globalization affects all facets of human life , including health and well being. The HIV/AIDS epidemic has highlighted the global nature of human health. Globalization has given rise to a trend towards finding common solution to health challenges. Molecular techniques that quantify and detect circulating HIV RNA have led to a new understanding of the pathogenesis of HIV disease and a new surrogate marker for use in clinical management.

*Keywords*: Viral load, p24 antigen, CD-4 T-Cell

## 1. INTRODUCTION

Prior to the ability to quantify virion associated HIV-RNA in the circulation, measurement of disease was by quantitative viral culture, by p24 antigen levels or indirectly by CD4 T-cell enumeration. However , since most patients have no detectable virus or p24 antigen in the plasma during the period of latency following primary infection when their CD4 T-cell count was essentially normal, the virus was thought to be "silent" during this period. High levels of detectable virus by culture or p24 antigen were known to coincide with the fall in CD4 T-cell count to levels below 200/mm3 and the onset of AIDS-associated symptoms. This perspective changed when the p 24 antigen method was modified to break apart the antibody- antigen complexes by acid hydrolysis. This method, referred to as immune-complex dissociated p24 antigen method(ICD-P24) demonstrated that viral p24 antigen was indeed present at various levels during the period of clinical latency, reflecting active viral replication. There are now three commercially available assays that quantify HIV-RNA load in plasma and that detect some level of HIV-RNA in essentially all infected individuals: bDNA( branched DNA), RT-PCR( reverse transcription polymerase chain reaction) and NASBA (nucleic acid sequenced based amplification). While CD4 T-cell count measurements have great biologic variability, viral load measurements remain remarkably stable in clinically asymptomatic patients as long as antiretroviral therapy is not changed.

## 2. VIRAL LOAD TEST

This test measures the amount of HIV in the blood. Generally it is used to monitor treatment progress or detect early HIV infection. Results of this test are reported as the number of HIV copies per milliliter of blood. The goal of HIV therapy is to suppress HIV replication to the point where the amount of active HIV is below the sensitivity of the HIV viral load test being used.HIV RNA levels in the plasma usually correlate with the stage of disease, making them a good predictor of disease progression. Viral load tests are also sensitive tool for examining the effect of anti-HIV therapies. The combined use of CD4+ counts and viral load testing will provide a more complete picture of a person's risk of disease progression and response to therapy. CD4+ cell counts indicate the status of an individual's immune system, where as viral load tests indicate the activity of the virus.

## 3. PROCEDURE

HIV RNA in plasma can be quantitated by nucleic acid amplification technologies, such as the Polymerase Chain Reaction (PCR). The COBAS AMPLICOR uses PCR technology to achieve maximum sensitivity and dynamic range for the quantitative detection of HIV-1 RNA in EDTA anti-coagulated plasma. It is an in-vitro diagnostic nucleic acid amplification test for the quantitation of HIV-1 RNA in human plasma. The test can be used to assess patient prognosis by measuring the baseline HIV-1RNA level or to monitor the effects of anti retroviral therapy by measuring changes in plasma HIV-1 RNA levels during the course of antiretroviral treatment. The test is based on five major processes:

a) Specimen preparation to isolate HIV-1 RNA

b) Reverse transcription of the target RNA to generate complementary DNA (cDNA).

c) PCR amplification of target cDNA using HIV-1 specific complementary primers

d) Hybridization of amplified products to oligonucleotides detection probes specific to the target.

e) Detection of the probe bound amplified products by colorimetric determination.

## 4. ANTIRETROVIRAL THERAPY

Antiretroviral therapy (ART, Fig. 1) for treatment of HIV-1 infection has significant prevention benefits, reducing the risk of secondary HIV-1 transmission by over 90% [1, 2]. Mathematical models suggest that providing ART to all HIV-1 infected persons and achieving sustained viral suppression could substantially reduce population-level HIV-1 incidence [3, 4]. Earlier treatment is now recommended in many settings as a



Sponsored by the Indian Institute of Geomagnetism, Navi Mumbai-410218 (DST, Govt. of India)

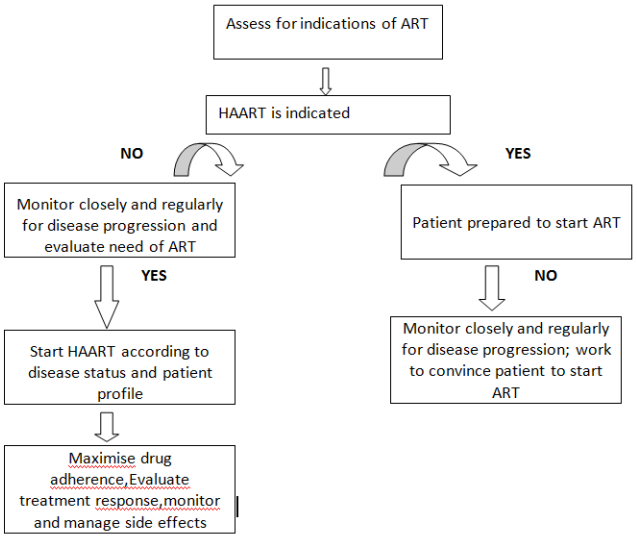



**Figure 1.** *Algorithm for ART.*

result of mounting evidence for treatment and prevention benefits of ART initiation early in the course of HIV-1 infection [5, 6]. Plasma viral load is the primary predictor of HIV-1 transmission and could be incorporated into ART initiation guidelines to target individuals with an increased risk of transmission. Guidelines for initiation of ART for HIV-1 infected persons have generally been based on CD4 T cell count and symptoms of advanced HIV-1 disease. Current WHO guidelines recommend ART initiation for WHO clinical stage 3 and 4 infections and at CD4 counts ≤350 cells/μL regardless of stage.

## 5. CONCLUSION

Inclusion of viral load in ART initiation guidelines could permit targeting ART resources to HIV-1 infected persons who have a higher risk of transmitting HIV-1.

### REFERENCES CITED

1. Cohen, M.S., Chen, Y.Q., McCauley, M., Gamble, T., and Hosseinipour, M.C., *N. Engl. J. Med.* , 2011.
2. Donnell, D., Baeten, J.M., Kiarie, J., Thomas, K.K., and Stevens, W., *Lancet*, 2010, v. 375, p. 2092–2098.
3. Granich, R.M., Gilks, C.F., Dye, C., De Cock, K.M., and Williams, B.G., *Lancet*, 2009, v. 373, p. 48–57.
4. Dodd, P.J., Garnett, G.P., and Hallett, T.B., *AIDS,* 2010, v. 24, p.729–735.
5. Thompson, M.A., Aberg, J.A., Hoy, J.F., Telenti, A., Benson, C., et al., *JAMA*, v. 308, p. 387–402.
6. *European AIDS Clinical Society Guidelines*, 2011, Version 6.



Sponsored by the Indian Institute of Geomagnetism, Navi Mumbai-410218 (DST, Govt. of India)

Proceedings of the National Seminar on
"Impact of Scientific Advances on Society", August 18-19, 2015, p.80-82
St. Pious X Degree & PG College for Women, Hyderabad-500076.

# Positive impact of PSB biofertilisers in agriculture

**S. Sreedevi***

*Department of Microbiology, St. Pious X Degree & PG College for Women, Nacharam, Hyderabad-500076,Telangana, India*
*sreedevi163@yahoo.com*

## ABSTRACT

Converting soil insoluble phosphates (both organic and inorganic) to a form available for plants is a necessary goal to achieve sustainable agricultural production. Phosphate solubilizing Bacteria (PSB) are an important means in achieving this goal for improved plant growth and yield. PSB are a group of beneficial bacteria capable of hydrolyzing organic and inorganic phosphorus from insoluble compounds. Use of PSB as inoculants increases P uptake by plants and thus play a role in plant phosphorus nutrition by enhancing its availability to plants. The role of PSB as biofertilisers in agriculture is discussed in detail in the current review. This review is focused on various aspects of PSB, their occurrence, mechanism of action, role in phosphorus nutrition, and their efficacy in promoting plant growth.

*Keywords*: Sustainable agriculture, biofertilisers, PSB, phosphate solubilisation

The development of science and technology is the result of greatest creative abilities and activities of humankind. Science has originated, evolved and advanced because of curiosity in human beings to explore, to know, and to understand the nature and the world around. There has been a continuous learning process in society leading to acquisition of tremendous knowledge from which applications have grown. Mostly, scientific advancements and accomplishments were related largely to felt needs, although, a few were motivated by a desire to know and understand nature. It was essential to ensure that the applications were based on ethical and moral values and principles, benefitting the human society as a whole. The impact of science on society was visible in every part of our living: in agriculture, medicine and health care, telecommunications, transportation, computerization and so on. One aspect of science, which has always been of great interest to individual scientists, and more recently to the scientific community as a whole, is MICROBES IN AGRICULTURE.

Today food production globally is adequate for the present population. However, in future, there will be even more people to feed. There is no more significant arable/ cultivable land available. There is often the felt need to develop the science and technology to improve agriculture and thus increase the crop yield. Biotechnology holds the promise of higher yields and disease free crops. But genetic engineering arouses fears because one moves across species boundaries, causing much more difficult and uncertain risks, compared to physical engineering systems. Therefore, it is important to continuously monitor the progress and ensure there is no place for complacency. The applications of scientific progress have to benefit humanity keeping in harmony with nature.

A considerable number of bacterial species are considered to be beneficial to higher plants. Science and technological advancement has played a big role in changing the face of agriculture. It has provided enormous capabilities to use existing microbes or to create new microbes and their microbial products to be applied in agriculture. They can be used as biofertilizers or control agents (biopesticides) for agriculture improvement [1]. Application of these microbes as inoculants enhances an abundant population of active and effective microorganisms in the rhizosphere region which in turn increases plant ability to uptake more nutrients. This resulted in increased production and abundant food supply as well as production of high quality products.

Biofertilizers are microbial inoculants of bacteria, algae, and fungi alone, or in combination, and they augment the availability of nutrients to the plants. These products enhance soil fertility by fixing atmospheric nitrogen and by mineralization of P & K. The global biofertilizers market, by type, is dominated by the nitrogen-fixing segment as nitrogen is the most essential nutrient for plants. The various microorganisms used as nitrogen-supplying biofertilizers are rhizobium, actinorhizae, azotobactor, and azospirillum. They are used for leguminous as well as non-leguminous crops. These products are used to grow other crops as well, especially rice and sugarcane.

Phosphate-solubilizing bacteria (PSB) are another widely used type of biofertilisers. Phosphate solubilising microorganisms play an important role in supplementing phosphorus to the plants and thus enhance plant growth and crop yield. Phosphorus (P) is an important plant nutrient, essential for plant development and growth making up about 0.2 % of plant dry weight. Phosphorous is associated with many vital functions and is responsible for *several physiological and biochemical plant activities such as* Utilization of sugar and starch, Photosynthesis and transporting of genetic traits. It promotes early root formation, plant growth and it improves the quality



Sponsored by the Indian Institute of Geomagnetism, Navi Mumbai-410218 (DST, Govt. of India)

of fruits, vegetables and grains and is vital to seed formation [2].

A majority of agricultural soils contain large reserves of phosphorus. Organic phosphorus compounds such as Inositol phosphate (soil phytate), phosphomonoesters, phosphodiesters including phospholipids and nucleic acids constitute a large proportion of the total phosphorus in many soils. However, plants can only utilize P in soluble inorganic form. Also, a large portion of the soluble inorganic phosphate is accumulated as a consequence of regular applications of P fertilizers, but is rendered insoluble [3, 4]. Phosphate anions are extremely reactive and may be precipitated with highly reactive $Al^{3+}$ and $Fe^{3+}$ in acidic, and with $Ca^{2+}$ in calcareous or normal soils [5, 6]. In these forms, P is highly insoluble and unavailable to plants. Thus, a greater part of soil phosphorus, approximately 95–99% is present in the form of insoluble phosphates and hence cannot be utilized by the plants [7].

Soil Microorganisms are capable of transforming soil P to the forms available to plant. They enhance the P availability to plants by mineralizing organic P in soil and by solubilising precipitated phosphates [8-12]. This group of beneficial bacteria capable of hydrolyzing organic and inorganic phosphorus from insoluble compounds and converting to the soluble form are called as Phosphate solubilizing Bacteria (PSB). Some of the PSB are *Bacillus brevis*, *Bacillus licheniformis*, *Pseudomonas cepacia*, *Serratia marcescens*, *Xanthomonas* spp., *Flavobacterium* spp. etc. [13, 14].

Diverse groups of organisms in soil employ variety of solubilization reactions to release soluble phosphorus from insoluble phosphates [15-17]. Thus the principal mechanism of mineral phosphate solubilization is the production of organic acids and acid phosphatases which play a major role in the mineralization of phosphorous in the soil [18-22]. Organic acids most frequently Gluconic acid and 2-ketogluconic acid synthesized by the microorganisms are associated with phosphate solubilizing ability [23-25]. Other organic acids such as glycolic, oxalic, malonic and succinic acid have also been identified among phosphate solubilizers. Chelating substances and inorganic acids such as sulphuric, nitric and carbonic acid are considered as other mechanisms for phosphate solubilization. However the effectiveness and their contribution to P release in soils seems to be less than organic acid production. PSB have been reported to have the ability to solubilize insoluble inorganic phosphate compounds, such as tricalcium phosphate, dicalcium phosphate, hydroxyapatite and rock phosphate [26].

The PSB are ubiquitous with variation in forms and population in different soils. Population of PSB depends on different soil properties (physical and chemical properties, organic matter, and P content) and cultural activities [27].Larger populations of PSB are found in agricultural and rangeland soils [28]. High proportion of PSB is concentrated in the rhizosphere, and they are metabolically more active than from other sources [29].

Although a number of bacteria have been isolated with phosphate solubilising properties, there is still a need to search for and characterize new effective microbial inoculants. They can be isolated from various soil samples by dilution plating method on different media. Various media employed were GL (glucose and yeast extract), GELP (glucose, soilextract, yeast extract, peptone, $CaCl_2$, $MgSO_4$ and NaCl), Pikovskaya media (PVK), National Botanical Research Institute's phosphate growth medium (NBRIP), National Botanical Research Institute's phosphate growth Bromophenol blue medium (NBRIP-BPB) [30, 31]. The media plates were incubated at 20˚C, 37˚C, and 45˚C. PSB colonies were isolated based on phosphate solubilization on media plates as indicated by the formation of a clear zone around them. Solubilization efficiency (SE %) was then calculated and the phosphorous solubilization potential of selected strains of phosphate solubilizing bacteria was tested *in vitro* by estimating available phosphorous in broth media [32]. These isolates can be tested for their plant growth-promoting activity by measuring the effect of the bacteria *in vivo* on the agronomical parameters like root and shoot elongation, fresh and dry weight of the developed plants. The potential isolates could be developed as inoculants and applied as biofertilisers, to improve phosphorus nutrition in plants and thus promote plant growth and productivity.

**REFERENCES CITED**

1. Subba Rao, N.S., *Biofertilisers in agriculture and forestry*, 1995, Oxford and IBM Publ.Co., New Delhi.
2. Kadiri, D.D., Varada Raju Peetala, N.G.K., and Peela, S., *International Journal of Advanced Biotechnology and Research*, 2004, v. 4(4), p. 518-526.
3. Rodríguez, H., and Fraga, R., *Biotechnol. Adv*., 2004, v. 17, p. 319-339.
4. Katiyar, V. and Goel, R., *J. Microbiol. and Biotechnol*., 2004, v. 14 (4), p. 653-657.
5. Gyaneshwar, P., Kumar, G.N., Parekh, L.J., and Poole, P.S., *Plant Soil*, 2002, v. 245, p. 83-93.
6. Hao, X., Cho, C.M., Racz, G.J. and Chang, C., *Nutr. Cycl. Agroecosys.*, 2002, v. 64, p. 213-224.



Sponsored by the Indian Institute of Geomagnetism, Navi Mumbai-410218 (DST, Govt. of India)

7. Vassileva, M., Vassilev, N., and Azcon, R**.,** *World J. Microbiol. Biotech.*, 1998, v. 14, p. 281–284.
8. Kang, S.C., Hat, C.G., Lee, T.G., and Maheshwari, D.K., *Curr. Sci*., 2002, v. 82, p. 439-442.
9. Das, K., Katiyar, V., and Goel, R.**,** *Microbio. Res.*, 2003, v. 158, p. 359-362.
10. Pradhan, N., and Sukla, L.B., *African J. Biotechnol*., 2005, v. 5, p. 850-854.
11. Chen, Y.P., Rekha, P.D., Arunshen, A.B., Lai, W.A., and Young, C.C., *Appl. Soil Ecol*., 2006, v. 34, p. 33-41.
12. Gupta, G.N., Khan, M.K., and Prakash, V., *International Journal of Recent Scientific Research*, 2013, v. 4(4), p. 353 -356.
13. Satyanarayana, T., and Johri, B.N., *Microbial Diversity: Current Perspectives and Potential Applications*, 2005, 377p., I. K. International Pvt. Ltd.
14. Hameeda, B., Harini, G., Rupela, O.P., and Reddy, G., *Microbiol. Res*., 2008, v. 163, p. 234-242.
15. Illmer, P., and Schinner, F., *Soil Biol. Biochem.*, 1995, v. 24, p. 389-395.
16. Singh, S., and Kapoor, K.K., *Mycorrhiza*, 1998, v. 7, p. 249.
17. Khan, A.A., Jilani , G., Akhtar , M.S., Naqvi, S.M.S., and Rasheed, **M.,** *J. Agric. Biol. Sci*., 2009, v. 1(1), p. 48-58.
18. Surange, S., Wollum, A.G., Kumar, N., and Nautiyal, C.S**.,** *Can. J. Microbiol*., 1995, v. 43, p. 891- 894.
19. Dutton, V.M., and Evans, C.S**.,** *Can. J. Microbiol*., 1996, v. 42, p. 881-895.
20. Nahas, E., *World J. Microb. Biotechnol*., 1996, v. 12, p. 18-23.
21. Hilda, R., and Fraga R., *Biotech. Adv*., 2000, v. 17, p. 319-359.
22. Shankar, T., Sivakumar, T., Asha, G., Sankaralingam, S., and Meenakshi Sundaram V., *World Appl. Sci. J*., 2013, v. 26(5), p. 610-617.
23. Bagyaraj, D.J., and Varma, A., *Adv. Microbiol. Ecol*., 1995, v. 14, p. 119-142.
24. Deubel, A., Gransee and Merbach, W., *J. Plant Nutr. Soil Sci*., 2000, v. 163, p. 387-392.
25. Maliha, R., Samina, K., Nazma, A., Sadia, A., and Farooq, L., *Pak. J. Biol. Sci*., 2004), v. 7, p. 187-196.
26. Vassilev, N., Franco, I., Vassileva, M., and Azcon, R., *Bioresource Technol*., 1996, v. 55, p. 237-241.
27. Kim, K.Y., Jordan, D., and McDonald, G.A., *Biol. Fert. Soils*, 1998, v. 26, p. 79-87.
28. Yahya, A., and Azawi, S K.A., *Plant Soil*, 1998, v. 117, p. 135- 141.
29. Vazquez, P., Holguin, G., Puente, M., Cortes, A.E., and Bashan, Y., *Biol. Fert. Soils*, 2000, v. 30, p. 460-468.
30. Nautiyal, C.S., *FEMS Microbiol. Lett*., 1999, v. 170(1), p. 265-270.
31. Pikovskaya, R.I., *Microbiologia*, 1948, v. 17, p. 319-339
32. Fiske, C.H., and Subbarow, Y., *Journal of Biological Chemistry*, 1925, v. 66, p. 375-400.

Proceedings of the National Seminar on
"Impact of Scientific Advances on Society", August 18-19, 2015, p.83-85
St. Pious X Degree & PG College for Women, Hyderabad-500076.

# Leveraging mobile cloud computing through unwanted desktop-pc resources

**Sujanavan Tiruvayipati [*] and Ravi Thubati[#]**

*Dept. of Computer Science & Engineering, MVSR Engineering College, Hyderabad, India*
[*]*tsujanavan@gmail.com, sujanavan_cse@mvsrec.edu.in*
[#]*thubatiravi999@gmail.com*

## ABSTRACT

The latest developments in mobile computing technology have enabled intensive applications on the modern Smart phones. However, such applications are still constrained by limitations in processing potentials, storage capacity and battery lifetime of the Smart Mobile Devices (SMDs). Therefore, Mobile Cloud Computing (MCC) leverages the application processing services of computational clouds for mitigating resources limitations in SMDs. Currently, a number of computational offloading frameworks are proposed for MCC wherein the intensive components of the application are outsourced to computational clouds. Nevertheless, such frameworks focus on runtime partitioning of the application for computational offloading, which is time consuming and resources intensive. The resource constraint nature of SMDs requires lightweight procedures for leveraging computational clouds. Therefore, this research proposal presents a lightweight framework which focuses on minimizing additional resource utilization in computational offloading for MCC.

*Keywords*: MCC, SMD, cloud computing, LAMP, micro data-centre, virtualization framework

## 1. INTRODUCTION

In the cloud technology gold rush, as organizations of all stripes discover the increased flexibility and speed to market [1] that self-service cloud and Infrastructure-as-a-Service (IaaS) provides, in order to reap those benefits, the cloud must be designed and architected properly. A well-architected cloud does not magically build itself. It requires careful consideration of a multitude of factors both technical and non-technical.There is no single architecture that is "right" for a cloud deployment as it can be used for any number of different purposes [2], each with its own particular requirements and architectural peculiarities.

This research scheme will help an organization design and build a well-architected cloud(IaaS) to fit its unique requirements for supporting SMDs' (Smart Mobile Devices) limitations utilizing existing resources (unwanted resources of desktop users). A reference design of a micro-data-center is presented and a light-weight virtualization framework which is specifically tailored to the requirements of SMDs is also discussed.

## 2. CURRENT MOBILE COMPUTING ISSUES

Mobile technology is growing every day. Mobile users are increasing rapidly but they are bound by a series of problems and limitations.

### *2.1 Scarcity of bandwidth*

If a mobile user needs access to a network such as the internet on the move, he has to resort to slow WAN wireless systems [3], primarily intended for the use of telephone.

### *2.2 Security issues*

When working with a mobile system you are hooked to public networks, requiring careful use of VPN. Security weaknesses in Smartphone allow attackers to gain access to compromising data which they use for criminal purposes. Counter-measures are being introduced [4], but the level of ignorance by users is still too high.

### *2.3 Interference with transmission*

The weather conditions can lead to problems of reception and transmission, especially in confined spaces such as tunnels and buildings.

### *2.4 Central processing unit*

Mobile phones have central processing units (CPUs), similar to those in computers, but optimized to operate in low power environments [5]. Mobile CPU performance [6] depends not only on the clock rate (generally given in multiples of hertz) but also the memory hierarchy also greatly affects overall performance [7]. Because of these problems, the performance of mobile phone CPUs is often more appropriately given by scores derived from various standardized tests [8] to measure the real effective performance in commonly used applications [9, 10].

### *2.5 Vulnerability to viruses*

As more complex features are added to phones, they become more vulnerable to viruses which exploit weaknesses in these features. Even text messages can be used in attacks by worms and viruses. Advanced phones capable of e-mail can be susceptible to viruses that can multiply by sending messages through a phone's address book.



Sponsored by the Indian Institute of Geomagnetism, Navi Mumbai-410218 (DST, Govt. of India)

### *2.6 Storage capacity*

Mobile phones not only are limited on storage but also bigger Data Storage Cripples Mobile Apps. The latest smart phones and tablets at the Consumer Electronics Show in Las Vegas during January, 2015 came with an emphasis on faster processors and compatibility with faster wireless networks. The results suggest that without changing how mobile gadgets store data [11], the benefits of new networks and processors will be limited.

## 3. ARCHITECTURE

Cloud computing fulfilled a long-held dream of turning computing as a utility. MIL (Minimalist IaaS LAMP-stack) extends this usability by grabbing power from unwanted resources of desktop users building a bridge between computation and resource availability (Fig. 1).

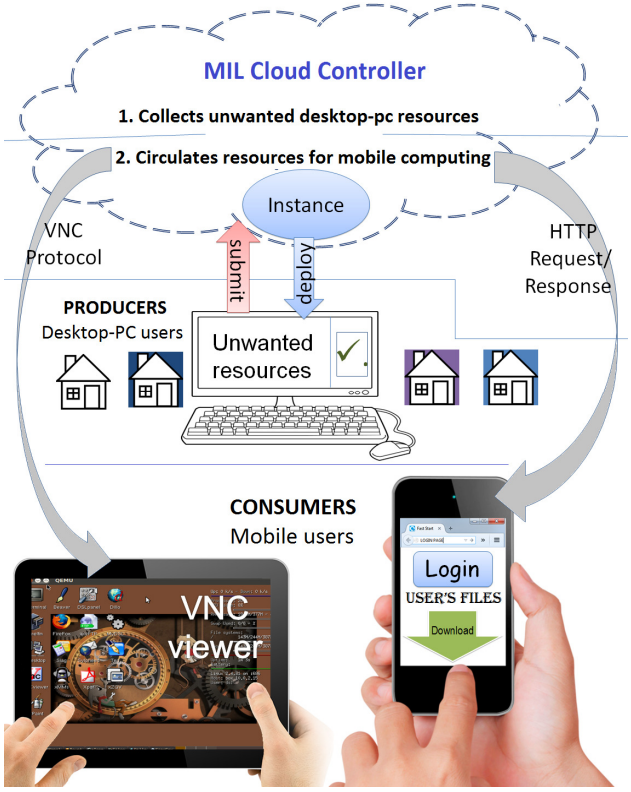



**Figure 1.** *Conceptual architecture of the MIL cloud controller.*

### *3.1 Producers of resources*

Desktop users do not utilize complete resources available within their machines, hence we link the unwanted resources from such desktop users using MIL package and allocate it when necessary through the MIL cloud controller.

Producers first register using IP addresses at which the MIL package is installed. They can share unwanted resources to MIL Cloud controller from anywhere, as it is location independent.

### *3.2 Consumers of resources*

SMD users who require immediate computing power request the MIL cloud controller to arrange resources. These kinds of users are called consumers. The consumers access resources allocated by the MIL Cloud controller through an operating system instance. To view the instance as a DaaS (desktop as a service) clients can use a simple VNC viewer (client application).

## 4. ACCESSING REMOTE RESOURCES USING LAMP STACK

In LAMP stack PHP is higher level programming language using which we can't access the lower level hardware details of its local system, the only way of accessing hardware resources by PHP is via SSH i.e. by establishing a PHP-SSH bridge.

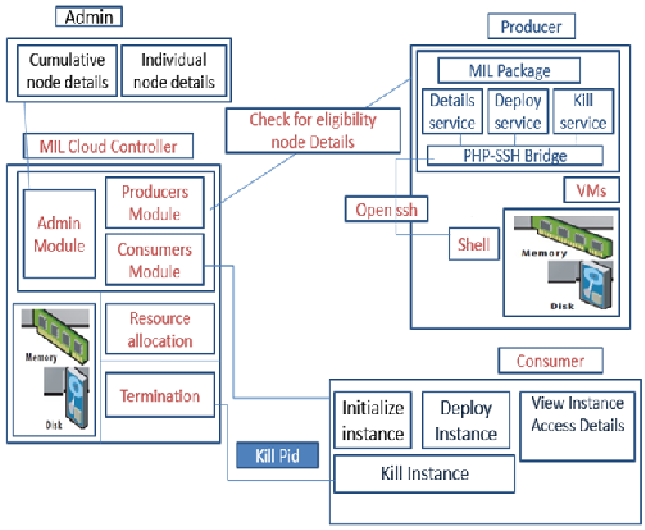



**Figure 2.** *Logical architecture of the MIL packages.*

A computer's PHP-SSH bridge can't capture the hardware details of another remote computer. Hence, a MIL package is required to be hosted on the producer's machine (which contains a PHP-SSH bridge) and MIL cloud controller's PHP pages can make a SOAP request for the PHP-SSH Bridge running on the remote machine to access the producer's resources. The proposed MIL package contains the following services:

### *4.1 Details service*

Details service retrieves the available main memory



Sponsored by the Indian Institute of Geomagnetism, Navi Mumbai-410218 (DST, Govt. of India)

and free hard disk space details form producers to MIL Cloud controller (Fig. 3).

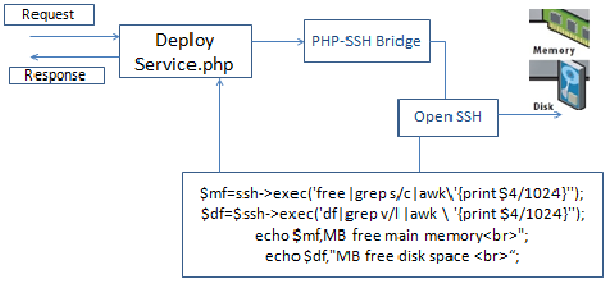



**Figure 3.** *Scheme & code snippet of Details Service.*

### *4.2 Deploy service*

Once the deployment of instance is completed consumer can view their Instance and Access Details (Fig. 4). The accessing of consumers account is done two ways either using VNC Viewer or using Browser.

The viewing of consumer instance is done through VNC Viewer using Ip address and port number otherwise it is done using browser URL.

"DISPLAY=:0"; Represents server default display.

"nohup Qemu >>/ null 2/dev/null &"; Returns Process Id.

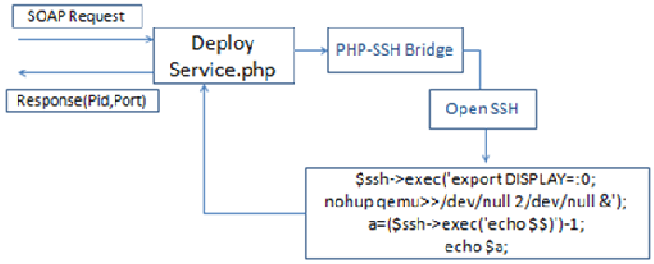



**Figure 4.** *Scheme & code snippet of Deploy Service*

### *4.3 Terminate service*

Termination of an instance is done either by administrator or consumer by sending the "kill" command along with the process ID to the instance and if it is successful a return signal with ID "1" is received else on failure signal with ID "0" is received (Fig. 5).

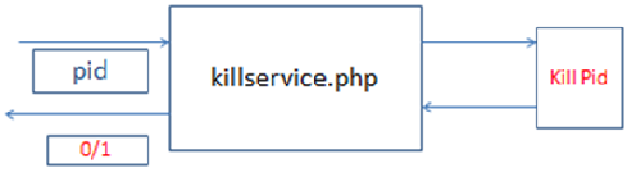



**Figure 5.** *Scheme & code snippet of Terminate Service*

## 5. CONCLUSION

MIL has the Cloud benefits for applications on an individual basis. The application's nature towards load variations and scalability requirements were not tested.

As a general formula it is an application considering the load is always steady-state, cloud elasticity will not be as efficient when compared with dedicated server hosting. However, if an application has non-peak load variation, then it could dramatically reduce the running costs compared to paying for a fully dedicated desktop all the time. In this scenario MIL offers the flexibility of elastic scalability as the application load grows overtime.

### REFERENCES CITED

1. Yu Wu, Zhizhong Zhang, Wu C., Zongpeng Li and Lau F., *IEEE Transactions*, 2013 , v.15(4), p.821-832.
2. Hyun-suk Roh, Hyun-Woo Lee and Sang-Ho Lee, *Advanced Communication Technology (ICACT)*, 16th International Conference, 2014, p.593-596.
3. Tao Ban, Shanqing Guo, Zonghua Zhang, Ando, R. and Kadobayashi, Y., *7th International Wireless Communications and Mobile Computing Conference (IWCMC)*, 2011, p.1801-1807.
4. Xiaolei Li, Guangdong Bai, Thian B, Zhenkai Liang and Heng Yin, *IEEE Eighth International Conference on Software Security and Reliability-Companion (SERE-C)*, 2014, p.158-167.
5. Volkan Rodoplul and Teresa H. Meng, *IEEE Journal on selected areas in communications*, 1999, v. 17(8), p. 1333-1340.
6. Baskarane R., Archana P., Priyadharshini A. and Hemalatha P., *International Conference on Information Communication and Embedded Systems (ICICES)*, 2014, p.1-6.
7. Xing Liu, Chaowei Yuan, Zhen Yang, and Zhongwei Hu, *IEEE 78th Vehicular Technology Conference (VTC Fall),* 2013, p.1-5.
8. Gupta, P. and Kumar, P.R., *IEEE Transactions on Information Theory*, 2000, v. 46(2).
9. Satyanarayanan, M., *IEEE Personal Communications*, 2001.
10. Axelrod, R. and Hamilton, W.D., *Science, New Series*, 1981, v. 211(4489), p. 1390-1396.
11. Hyojung Kang, Junseok Park and Hyokyung Bahn, *IEEE Transactions on Consumer Electronics*, 2010, v.56(4), p.2387-2392.
12. Jararweh, Y., Tawalbeh, L., Ababneh, F. And Dosari F., *IEEE Ninth International Conference on Mobile Adhoc and Sensor Networks (MSN)*, 2013, p.373-377.



Sponsored by the Indian Institute of Geomagnetism, Navi Mumbai-410218 (DST, Govt. of India)

Proceedings of the National Seminar on
"Impact of Scientific Advances on Society", August 18-19, 2015, p.86-88
St. Pious X Degree & PG College for Women, Hyderabad-500076.

# Antibacterial effect of *Coleus amboinicus* leaf extract

**Vasavi Dathar*, Revathi Desai and Pavan Kumar Pindi**

*Department of Microbiology, Palamuru University, Mahabubnagar-509001, Telangana State, India.*
*vasavidathar@gmail.com*

## ABSTRACT

Medicinal plants are the prime source of drugs in both developing and developed nations as drugs or herbal extracts for various chemotherapeutic purposes. A methanolic extract from the leaves of the medicinal plant *Coleus amboinicus* was prepared and tested for antibacterial activity against 11 clinical isolates by disc diffusion method. The bacteria included the Gram positive *Staphylococcus aureus,* Methicillin resistant *Staphylococcus aureus* and Enterococci and Gram negative *E.coli*, *Klebsiella pneumoniae, Citrobacter divergens, Shigella flexneri, Salmonella paratyphi* A, *Salmonella paratyphi* B, *Proteus mirabilis* and *Pseudomonas aeruginosa.* Chloramphenicol and tetracycline were set up as control antibiotics. The extract showed activity against all the isolates with a maximum zone of inhibition of diameter 9.33 ± 0.58 mm and 7.33 ± 0.58 mm against *E.coli* at concentrations 2.5 mg/disc and 1.25 mg/disc respectively. A minimum zone of inhibition of diameter 7.0 mm was shown against *Salmonella paratyphi* B with a concentration of 2.5 mg/disc; but it was resistant at a concentration of 1.25 mg/disc. A minimum inhibitory zone of 6.67± 0.58 mm at this concentration was shown against *Staphylococcus aureus*. Remaining bacteria have shown intermediate results. The leaf extract was also active against Methicillin resistant *staphylococcus aureus. Pseudomonas aeruginosa* which was resistant to both the control antibiotics chloramphenicol and tetracycline and *Proteus mirabilis* resistant to tetracycline were inhibited by the leaf extract. This indicates that *Coleus amboinicus* can be efficiently used as a natural medicine for the control of infections caused by these bacteria as well as other clinical isolates tested.

*Keywords*: *Coleus amboinicus*, leaf extract, clinical isolates, antibacterial effect, disc diffusion

## 1. INTRODUCTION

There are about 2000+ plant species known to possess medicinal value in the traditional Asian system of medicine [1]. Herbal medicines are used for successful management of various diseases like malaria, epilepsy, infertility, convulsion, diarrhoea, dysentery, gonorrhoea, flatulence, tonsillitis, bacterial and fungal infections, mental illness and worm infections [2]. *Coleus amboinicus* or *Plectranthus amboinicus* is a medicinal and ornamental plant belonging to the family Lamiaceae. It is known as 'Vamaku' in Telugu [3]. The leaves are strongly flavored and make an excellent addition to stuffing for meat and poultry. It is also used for making snacks which are very tasty.The leaves are traditionally used for the treatment of coughs, sore throats and nasal congestion and other problems such as infections, rheumatism and flatulence, malarial fever, hepatopathy, renal calculi, asthma, hiccoughs, bronchitis, helminthiasis, colic, convulsions and epilepsy [4, 5]. The plant is also used for its essential oils. It is considered nourishing for lactating mothers which enhances breast milk production and also acts as a uterine cleansing agent [6]. Besides these medicinal uses, the leaf extract of this plant is also used for the biosynthesis of gold nanoparticles by a simple, non-toxic, efficient and green chemistry approach [7]. In the present work, the antibacterial effect of leaf extract of this plant against eleven bacteria isolated from clinical samples is studied.

## 2. MATERIALS AND METHOD

### *2.1 Preparation of leaf extract*

Twenty to thirty healthy leaves of *Coleus amboinicus* (Fig. 1) were taken, dried in the shade for 15 days and powdered in a mechanical grinder. The powder was stored at 4°C. Samples were extracted using methanol as a solvent as described by Crozier et al. [8]. Two grams of dried leaf powder are weighed, placed into a 100 ml conical flask and treated with 40 ml of 80% (v/v) aqueous methanol followed by an addition of 10 ml of 6 M HCl. The mixture was refluxed for 2 hours at 90 °C and filtered using Whatman No. 1 filter paper, followed by evaporation of the filtrate using a vacuumed Rotary Evaporator. The extract was further dried using sodium sulphate, filtered and evaporated on the water bath. The crude extracts were re-dissolved in methanol for antimicrobial analysis.

**Figure 1.** *Coleus amboinicus* plant.



Sponsored by the Indian Institute of Geomagnetism, Navi Mumbai-410218 (DST, Govt. of India)

*2.2 Preparation of antimicrobial discs*

Whatman No.1 filter paper was taken and cut into 6 mm discs. These discs were sterilized in a hot air oven at a temperature of $160^0$C for 1 hour. Two different concentrations of the leaf extract (2.5 mg/ disc and 1.25 mg/ disc) are added to each disc and the discs were used for testing antimicrobial activity [9]. Chloramphenicol and tetracycline were set up as control antibiotics.

*2.3 Preparation of the bacterial culture*

Eleven bacterial isolates from clinical samples are obtained from SVS Medical College, Mahabubnagar, which include *Staphylococcus aureus,* Methicillin resistant *Staphylococcus aureus,* Enterococci, *Escherichia coli, Klebsiella* species, *Citrobacter divergens, Shigella flexneri, Salmonella paratyphi* A, *Salmonella paratyphi* B, *Proteus mirabilis* and *Pseudomonas aeruginosa.* Conventional bacteriological methods such as colony morphology, gram stain and biochemical tests were used for identification of isolates [10]. All the test organisms were inoculated in Mueller Hinton broth (pH 7.4.) for 8 hours. The concentration of the suspensions was adjusted to 0.5 Mc Farland standard [11] to reach an optical density of 0.08 – 0.10 at 625 nm by adding sterile distilled water. This gives a bacterial suspension containing 1.5 x $10^8$ CFU/ml [12]. Isolates were seeded on Mueller Hinton agar plates by using sterilized cotton swabs.The values of antimicrobial activity of the leaf extract of *Coleus amboinicus* were expressed as mean ± standard deviation (n= 3) for each sample.

## 3. RESULTS AND DISCUSSION

As shown in the Table-1, with disc diffusion method, the inhibition zones with concentration of the leaf extract 2.5 mg/disc were found to be 7.0 mm for *Salmonella paratyphi B;* 7.33 ± 0.58 mm for *Shigella flexneri*, 8.0 mm for *Staphylococcus aureus, Klebsiella* species, *Proteus mirabilis* and *Pseudomonas aeruginosa*; 8.33 ± 0.58 mm for Enterococci and Methicillin resistant *Staphylococcus aureus;* 8.5 ± 0.5 mm for C*itrobacter divergens*; 8.67 ± 0.58 mm for *Salmonella paratyphi* A and 9.33 ± 0.58 mm for *Escherichia coli*.

With a concentration of 1.25 mg/disc of leaf extract, the inhibitory zones were found to be 6.67 ± 0.58 mm for *Staphylococcus aureus;* 7.0 mm for Methicillin resistant *Staphylococcus aureus,* Enterococci, *Klebsiella* species, C*itrobacter divergens, Salmonella paratyphi* A, *Proteus mirabilis* and *Pseudomonas aeruginosa;* 7.11 ± 0.29 mm for *Shigella flexneri* and 7.33 ± 0.58 mm for *Escherichia coli*. *Salmonella paratyphi* B is resistant to the leaf extract at this concentration.

**Table 1.** Inhibition zones (in mm) for various bacteria with leaf extract of *Coleus amboinicus*

| S.No | Organism | Zone diameters in millimetres | | | |
|---|---|---|---|---|---|
| | | Leaf extract 2.5mg /disc | Leaf extract 1.25mg/disc | Chloram-phenicol | Tetracyline |
| | Gram Positive bacteria | | | | |
| 1 | *Staphylo-coccus aureus* | 8.0 ± 0.0 | 6.67 ± 0.58 | 26 ± 0.0 | 30 ± 0.0 |
| 2 | Methicil-lin resis-tant *Sta-phylococ-cus au-reus* | 8.33 ± 0.58 | 7.0 ± 0.0 | 34.33 ± 0.58 | 34.67 ± 0.58 |
| 3 | Entero-cocci | 8.33 ± 0.58 | 7.0 ± 0.0 | 20.0 ± 0.0 | 24.0 ± 0.0 |
| | Gram Negative bacteria | | | | |
| 1. | *Escheri-chia coli* | 9.33 ± 0.58 | 7.33 ± 0.58 | 28.67 ± 1.53 | 19.33 ± 0.58 |
| 2. | *Klebsiella* species | 8.0 ± 0.0 | 7.0 ± 0.0 | 27.67 ± 0.58 | 23.33 ± 0.58 |
| 3. | *Citrobac-ter diver-gens* | 8.5 ± 0.5 | 7.0 ± 1.0 | 20.0 ± 0.0 | 25.0 ± 0.0 |
| 4. | *Shigella flexneri* | 7.33 ± 0.58 | 7.17 ± 0.29 | 34.0 ± 0.0 | 25.0 ± 0.0 |
| 5. | *Salmonel-la paraty-phi* A | 8.67 ± 0.58 | 7.0 ± 0.0 | 32.0 ± 0.0 | 24.0 ± 0.0 |
| 6. | *Salmonel-la paraty-phi* B | 7.0 ± 0.0 | Resis-tant | 30.0 ± 0.0 | 22.67 ± 0.58 |
| 7. | *Proteus mirabilis* | 8.0 ± 0.0 | 7.0 ± 0.0 | 20.0 ± 0.0 | Resistant |
| 8. | *Pseudo-monas aerugino-sa* | 8.0 ± 0.0 | 7.0 ± 0.0 | Resistant | Resistant |

The values are mean of triplicate measurements ± standard deviation.

Chloramphenicol and tetracycline were used as control antibiotics which have shown inhibition zones of 20 mm to 34 ± 33 mm and 19.33 ± 0.58 to 34.67 ± 0.58 respectively for various bacteria tested. Similar inhibitory effect against Gram positive and Gram negative bacteria was shown by methanolic extracts of leaf, stem and root of *Labisia pumila* Benth. [13], methanolic extracts of cranberry [14] and ethanol extract of leaf and flower of *Spathodea campanulata* [15].



Sponsored by the Indian Institute of Geomagnetism, Navi Mumbai-410218 (DST, Govt. of India)

## 4. CONCLUSION

Leaf extract of *Coleus amboinicus* exhibited antibacterial effect on both Gram positive and Gram negative bacteria. *Proteus mirabilis* which is resistant to tetracycline is sensitive to the leaf extract. Similarly, *Pseudomonas aeruginosa* is also resistant to both chloramphenicol and tetracycline but sensitive to the leaf extract. The extract is also active against Methicilln resistant *Staphylococcus aureus.* This leaf extract can be used as a natural medicine against some pathogenic bacteria and can also have pharmaceutical applications.

### REFERENCES CITED

1. Agnese, A.M., Perez, C., and Carbrera, *Phtyomed.*, 2001, v. 7(5), p. 389-394.
2. Sofowora, A., *J. Altern. Complement Med.*, 1996, v. 2, p. 365-372.
3. Subrahmanyam, N., and Venugopal Rao, T., *Ayurveda Mokkalu Oushadha Gunalu,* 2010, Published by Amrutham Health Care Series. Dilsukhnagar, Hyderabad, p. 34.
4. Kaliappan, Nirmala Devi and Periyanayagam Kasi Viswanathan, *International Journal of Green Pharmacy*, 2008, v. 2(3), p. 182-184.
5. Shenoy and Smita, *International Journal of Pharmacology and Clinical Sciences,* 2012, v. 1(2), p. 32-38.
6. Damanik, R., *Journal of Human Lactation*, 2009**,** v. 25(1), p. 64-72**.**
7. Narayanan, K.B., and Sakthivel, N., *Materials Characterization,* 2010, v. 61(11), p. 1232–1238.
8. Crozier, A., Lean, M.E.J., McDonald, M.S., and Black, C., *J. Agric. Food Chem.,* 1997, v. 45, p. 590-595.
9. Lalitha, M.K., *Manual on Antimicrobial Susceptibility Testing* (Under the auspices of Indian Association of Medical Microbiologists), 2004, p. 8.
10. Mahon, C., and Manuselis, G., *Textbook of Diagnostic Microbiology*, 3rd ed., 2006, Philadelphia, WB Saunders, USA.
11. Joseph Mc Farland, M.D., *The Journal of American Medical Association,* 1907, v. XLIX (14), p. 1176-1178.
12. Hindler, J.A., and Jorgensen, J.H., *Textbook of Diagnostic Microbiology* edited by Mahon, C.R., and Manuselis, G., 2nd Edition, 2000, p. 62–95. ISBN: 0-7216-7917-X.
13. Karimi, E., Jaafar, H.Z.E., and Ahmad, S., *Molecules,* 2011, v. 16, p. 4438-4450, ISSN 1420-3049.
14. Rahbar, M., and Diba, K., *African Journal of Pharmacy and Pharmacology,* 2010, v. 4(5), p. 286-288.
15. Kowti, R., Harsha, R., Ahmed, M.G., Hareesh A.R., Thammanna Gowda S.S., Dinesha, R., Satish Kumar, B.P., and Irfan Ali M., *Research Journal of Pharmaceutical, Biological and Chemical Sciences,* 2010, v. 1(3), p. 691–699. ISSN: 0975 – 8585.

### ACKNOWLEDGEMENTS

Authors are thankful to Sri P. Srinivas Rao, Correspondent, Adarsh Degree and P.G. College, Mahabubnagar, Telangana State, for his support and encouragement and providing the facilities.

## About St. Pious X Degree & PG College for Women Nacharam, Hyderabad

St. Pious X Degree & PG College for Women is a self financed institution established in 1993with a mission of training the young women to achieve high academic and ethical standards with scientific aptitude and social consciousness through value based quality education. It believes in creating and disseminating knowledge and integrated values in core and frontier areas through innovative practices and develops high level of competence along with deep sense of social responsibilities, environmental consciousness and leadership qualities.

The college is affiliated to Osmania university and administered by the society of Catechist sisters of St. Ann, Hyderabad. It has been accredited with 'A' grade by NAAC and is included under section 2(f) and (12b) of UGC act.

The college offers 15 undergraduate courses in BA,B.Com and B.Sc streams and 6 post graduate programs in the subjects; Physics, Chemistry, Microbiology, Biochemistry Mathematics and Management. It has the reputation of maintaining high academic standard and infrastructural facilities. It has achieved 25 university gold medals and more than 100 university ranks since it's inception.

The college takes pride in it's dynamic and innovative Physical & Life science departments which strive to impart rich and quality education. Socially useful innovative research work and regular publication in peer reviewed journals are the glorious achievements of the departments. The highlights of the departments are 3 UGC funded minor research projects(1 completed and 2 ongoing) and St. Pious Under Graduate Environmental Research group(SPUGER). Members of this group are actively involved in research on environmental sciences and promoting awareness in protection of environment among the people.