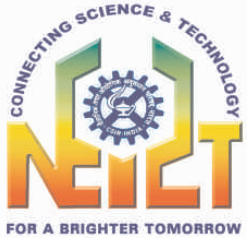
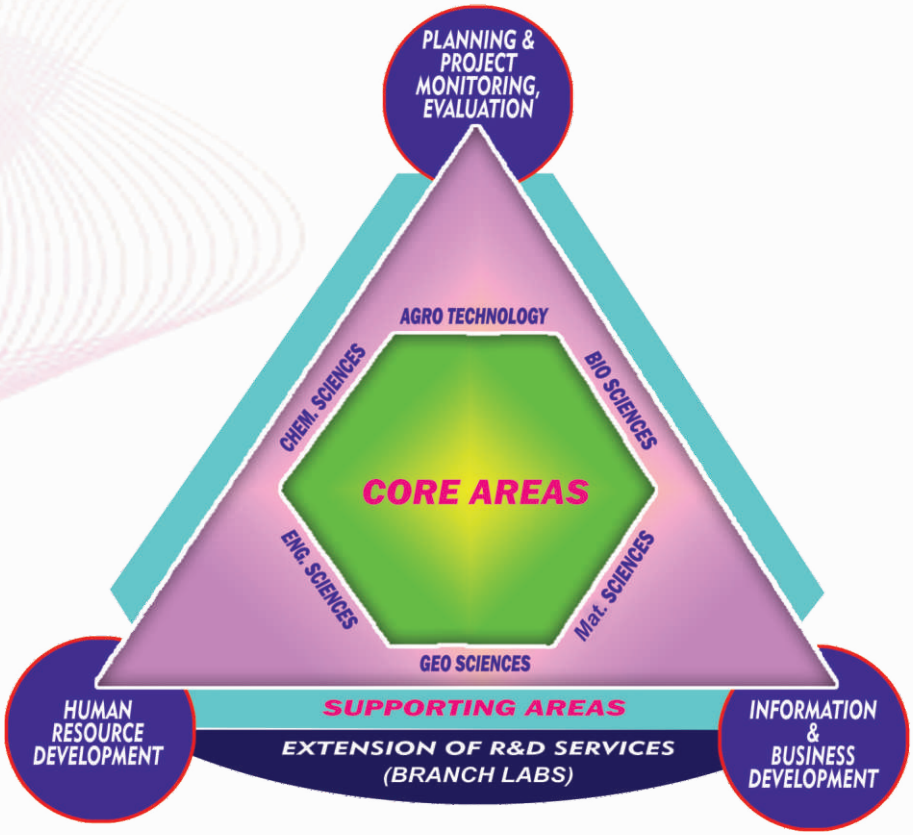
Annual Report

2013-2014





CSIR-North East Institute of Science & Technology,
Jorhat



QUALITY POLICY OF CSIR-NEIST

CSIR-North East Institute of Science & Technology, Jorhat is committed to achieve excellence with quality outputs in R&D in frontier areas, professional consultancy and contract services in Chemical, Biological and Allied Sciences to be offered to customers in public and private domains at national and international levels.

Contents

From Director's Desk		5-8
CSIR-NEIST at a Glance		9
R&D Performance		10
Performance Indicator		11
Research Council		13
Management Council		13
Organization Chart		14
R&D Activities		15
	Agro Technology	15
	Biological Sciences	26
	Chemical Sciences	30
	Engineering Sciences	53
	Geo Sciences	64
	Materials Sciences	69
	Management Sciences	89
S&T Facilities Installed		99
Seminar/workshop organized		102
Events Organized		105
Exhibitions Attended		107
Societal Activities		108
PhD Awarded		110
Visit Abroad		111
Rajbhasa Hindi Activities		112
Awards		117
Achievements		118
Projects		119
	Project Undertaken	119
	Project Completed	120
	Project Ongoing	123
Process Developed		128
Process Released to Industry		128
Marketing rights of products transferred		128
Patents		129
Papers Published		131
Visitors		140
Personnel		141
Retired staff		149

About CSIR-NEIST Jorhat



The governing body of CSIR in its 168th meeting held on 8 December, 2006 decided renaming of five Regional Research Laboratories (RRLs) of CSIR located at five different regions including the one at Jorhat commensurating with their direction, orientation of expertise and excellence developed over the years. Accordingly, the RRL's name was formally changed to North East Institute of Science & Technology (NEIST) with effect from 18 March, 2007, the 46th Foundation Day of the Institute. The NEIST (erstwhile RRL) at Jorhat (Assam) was established in the year 1961 as one of the multidisciplinary CSIR laboratories. It is worth mentioning here that the constituent laboratories of CSIR have been grouped into five broad areas such as physical sciences, chemical sciences, biological sciences, engineering sciences and information sciences depending upon the type of work, objective and the nature of responsibilities vested on these laboratories. On this basis the NEIST is one among the seven other laboratories under the Chemical Science group. The major thrust of R&D activities of NEIST Jorhat has been to develop indigenous technologies and knowledgebase by utilizing the immense natural wealth of the North Eastern region of India. The North Eastern region of the country being bestowed with an abundance of material resources like petroleum, natural gas, minerals, tea and aromatic & medicinal plants and hence the laboratory was assigned to undertake research for development of expertise and know-how for a wide range of industries and extension works. Over the years, the institute has generated more than 120 technologies in the areas of Agrotechnology, Biotechnology, Chemical Sciences, Engineering Sciences, Environmental Sciences and Petroleum and Oil Field Chemicals of which about 60% were commercial successes culminating in setting up of various industries throughout the country. The Institute also developed expertise in the areas like natural products chemistry, drugs and drug intermediates, VSK cement technology, agro-technologies, petrochemicals, crude-oil transportations, paper and paper products, beneficiation chemicals, ecology and environment studies, geotechnical investigations, foundation design engineering, soil investigation and building materials.

These tasks of the Institute have to be focussed and tuned-up differently at different points of time in accordance with the national commitments and priorities. The Institute also has tie-up with other research and academic institutions for functional and other coordinations for HRD and S&T developments of the region in particular and the country as a whole. Effects have also been made to further evolve the Institute as a lead S&T player in the present global scenario.



From the Director's Desk

It gives me immense pleasure to present before you the Annual Report of CSIR-NEIST for the year 2013-2014 highlighting achievements & contributions of the institute. Like previous years this year had also registered lots of notable changes and progress in almost every front, right from the change in the leadership of the institute. I took over the charge as Director on 9 October 2013 from Dr R C Boruah, Acting Director & Outstanding Scientist. Overall the laboratory registered all-round progresses and achievements.

During the year three new know-how namely 'TP-16 biofertilizer for sustainable crop yield', 'Herbal Anti-Asthmatic formulation (as is where is basis)' and 'a Domestic Stove-cum Charcoal making unit' were developed. Besides, four knowhow were released to four parties in the states of Assam, West Bengal and Tripura. In addition to these the marketing rights of two recently developed affordable herbal formulations namely 'Anti-Arthritis' and 'Fungi-Destruct' was transferred to four parties from Assam, Gujarat and West Bengal.

On the publication side, the laboratory published a total of 115 research papers in reputed national and international journals with an average impact factor of 2.4 and highest impact factor of 8.65. On the IPR side, two patents were granted in India and four abroad whereas four patents were filed each in India and abroad. The institute added 21 new projects (grant-in-aid and consultancy) to its already ongoing projects. In the area of human resource development 9 research scholars were awarded PhDs in various disciplines of science by Gauhati, Dibrugarh and Assam University.

CSIR-NEIST has made best endeavour towards national and regional commitments. During the period the laboratory organized important events like Multi-State Mega Mock Exercise for Preparedness on Repeat of M 8.7 Shillong Earthquake, Workshop on Urban Climate Change Resilience, Seminar on Popularization of Coir Technologies, Workshop on Technologies for North East Region and Implementation Framework, National Workshop on Medicinal & Aromatic Plants, Workshop on Vehicular Emission and Control, Short term course on Computational methods for source characterization and stress field, Training on Natural

Dye, Training on Mushroom Cultivation, Science Motivation Programme, holding conference on society of Biological Chemists (India) North-East Chapter etc. During the year eminent personalities like the Hon'ble Chief Minister of Assam, Shri Taun Gogoi and His Excellency Governor of Meghalaya Shri Ranjit Shekhar Mooshahary visited the institute and acquainted themselves with the ongoing activities.

It is indeed a proud privilege for me to mention that like previous three financial years, this year also, the Institute received the 'CSIR Technology Award 2013' in the category of Life Sciences for its recently developed low cost herbal formulation 'Anti-Arthritis', which is highly effective against arthritis, inflammation and associated problems of arthritis. The dedication and hard work of institute has been rewarded in the form of various other awards and recognition bestowed on individual scientists as well as the institute.

I sincerely congratulate all members of CSIR-NEIST and other associated with the institute for their hard work and commitment to the progress of science and societal development and for bringing laurels to the institute.

Dr D Ramaiah
22 September, 2014



निदेशक की कलम से

निदेशक की कलम से

मुझे वर्ष 2013-14 के लिए सीएसआईआर-निस्ट के वार्षिक प्रतिवेदन को प्रस्तुत करते हुए अपार हर्ष हो रहा है। इस प्रतिवेदन में संस्थान की उपलब्धियों और अवदानों का उल्लेख किया गया है। पूर्ववर्ती वर्षों की तरह इस वर्ष भी हरेक क्षेत्र में अनेक बदलाव और प्रगति हुई है। इसमें संस्थान के नेतृत्व में परिवर्तन भी शामिल है। मैंने निदेशक के तौर पर प्रभारी निदेशक और जाने-माने वैज्ञानिक डॉ. आर सी बरूवा से 9 अक्तूबर, 2013 को कार्यभार संभाला। कुल मिलाकर प्रयोगशाला ने सभी क्षेत्र में प्रगति और उपलब्धियां हासिल की।

वर्ष के दौरान तिन नई तकनीकों 'टीपी-16 बायोफर्टिलाइजर फॉर सस्टेनेबल क्राप यील्ड', 'हर्बल एंटी-एस्थेमेटिक फार्मूलेशन (जैसा जहां है के आधार पर)' और 'ए स्तभ-काम-चर्काकुल मेकिङ युनिट' को विकसित किया गया। इसके अलावा चार नई तकनीकों को असम, पश्चिम बंगाल और त्रिपुरा राज्य की चार पार्टियों को जारी किया गया। इसके साथ ही हाल ही में विकसित किये गये वहन करने योग्य जड़ीबूटीय समिश्रण से संबधित दो तकनीकों 'एंटी-आर्थिरिटीस' और 'फुंगी डेस्ट्रक्ट' के विपणन अधिकारों को असम, गुजरात और पश्चिम बंगाल के चार पार्टियों को हस्तांतरित किया गया।

प्रकाशन के क्षेत्र में प्रयोगशाला ने नामचीन राष्ट्रीय और अंतर्राष्ट्रीय पत्रिकाओं में कुल 115 शोध पत्रों को प्रकाशित किया। इसका औसत प्रभाव 2.4 और अधिकतम प्रभाव 8.65 रहा। आईपीआर के क्षेत्र में दो पेटेंट भारत में और चार पेटेंट विदेश में प्रदान किए गए, जबकि भारत और विदेश में चार पेटेंट के लिए आवेदन किए गए। संस्थान ने अपनी वर्तमान में चल रही परियोजनाओं में 21 नई परियोजनाओं (अनुदान और सलाहकार) को शामिल किया। मानव संसाधन विकास के क्षेत्र में 9 शोध दार्शनिकों को विज्ञान की विभिन्न विधाओं में गौहाटी, डिब्रुगढ़ और असम विश्वविद्यालय ने पीएचडी की डिग्रियां प्रदान की।

सीएसआईआर-निस्ट ने राष्ट्रीय और क्षेत्रीय प्रतिबद्धताओं के क्षेत्र में अपनी तरफ से श्रेष्ठ प्रदर्शन करने की कोशिश की है। इस अवधि के दौरान प्रयोगशाला ने कई महत्वपूर्ण आयोजन किए। इनमें 8.7 तीव्रता वाले शिलांग भूकंप की पुनरावृत्ति की तैयारी पर बहु-स्तरीय व्यापक पूर्वाभ्यास, शहरी मौसम के बदलाव पर कार्यशाला, कॉयर तकनीकों को लोकप्रिय बनाने पर कार्यशाला, उत्तर पूर्व क्षेत्र के लिए तकनीक और क्रियान्वयन ढांचा पर कार्यशाला, औषधीय और सुगंधित पौधों पर राष्ट्रीय कार्यशाला, वाहन प्रदूषण और नियंत्रण पर कार्यशाला, श्रोत के वर्गीकरण और तनाव के क्षेत्र का पता लगाने के लिए लघु कार्यक्रम, प्राकृतिक रंग पर प्रशिक्षण, मशरूम खेती पर प्रशिक्षण, वैज्ञानिक प्रोत्साहन कार्यक्रम तथा सोसायटी ऑफ बायोलॉजिकल केमिस्ट्स (इंडिया) की उत्तर-पूर्व इकाई आदि के साथ सम्मेलन आदि शामिल हैं। वर्ष के दौरान गणमान्य

लोगों जैसे असम के माननीय मुख्यमंत्री श्री तरूण गोगोई और मेघालय के माननीय राज्यपाल श्री रंजीत शेखर मुसाहारी ने संस्थान का दौरा किया और वर्तमान में चल रही विभिन्न योजनाओं की जानकारी ली।

मुझे यह बताते हुए काफी गर्व हो रहा है कि पिछले तीन वित्तीय वर्षों की तरह इस वर्ष भी संस्थान ने जीव विज्ञान के क्षेत्र में अपने हाल ही में विकसित कम कीमत वाले जड़ी-बूटीय समिश्रण 'एंटी आर्थिरिटीस' के लिए 'सीएसआईआर तकनीक अवार्ड 2013' को प्राप्त किया। यह समिश्रण गठिया, जलना और गठिया से संबंधित अन्य सहायक समस्याओं को कम करने के मामले में काफी असरदार है। संस्थान की प्रतिबद्धता और कठिन परिश्रम का नतीजा है कि विभिन्न क्षेत्रों में संस्थान को तथा व्यक्तिगत तौर पर वैज्ञानिकों को अन्य कई अवार्ड मिले।

मैं सीएसआईआर-निस्ट के सभी सदस्यों और संस्थान से जुड़े अन्य लोगों को उनके कठिन परिश्रम और विज्ञान के साथ ही समाज की प्रगति के प्रति प्रतिबद्धता के लिए तथा संस्थान का नाम ऊंचा करने के लिए तहे दिल से बधाई देता हूं।

- डॉ. डी रमैया

22 सितंबर, 2014

CSIR-NEIST AT A GLANCE: 2013-2014

RESOURCE BASE

Infrastructural	
R&D Department	13
Branch laboratory	02
Seismic stations	13

HUMAN RESOURCES

Total S&T Staff	**281**
Scientist(Gr IV)	83
Technical (Gr III)	67
Technical (Gr II)	52
Technical (Gr I)	79
Total Administrative Staff	**95**

FINANCIAL

	(₹ in lakhs)
Government Allocation	4620.562
From Contract R&D and Consultancy	770.993
Testing/Analytical services	17.265
Miscelleanous	1.26
Royalty/Premia	6.816

BUDGET

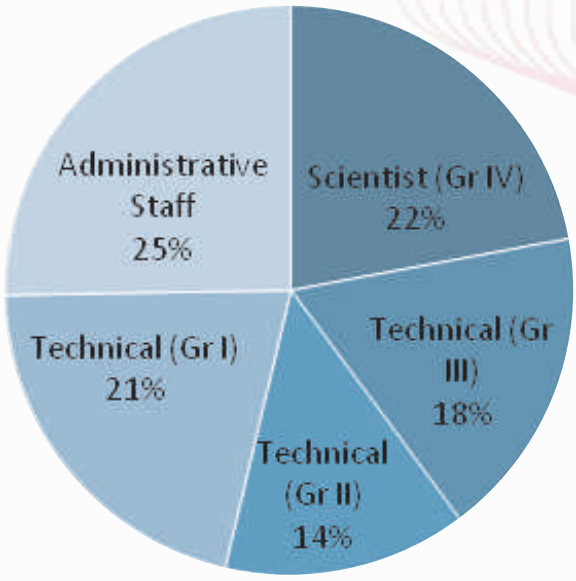
	Sanctioned (₹ in lakh)	Expenditure (₹ in lakh)
Recurring	2904.137	2903.904
Capital	3050.57	3050.337
Network Project	870.885	870.885
Non Recurring	498.2	498.2
Recurring	699.107	699.3

R&D PERFORMANCE: 2013-2014

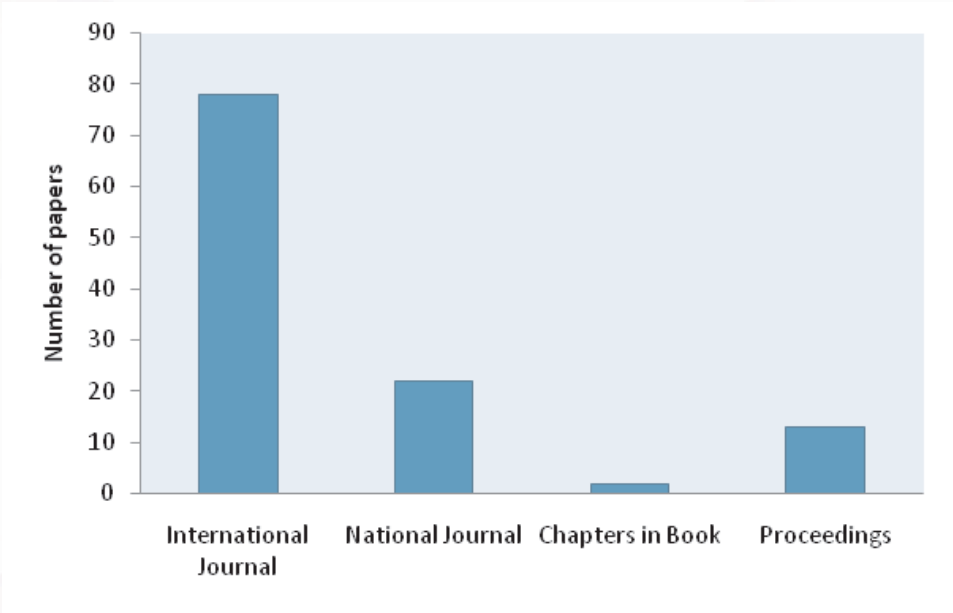
	₹ in crore (Aprox.)
Contribution to Economy	
Industrial production based on NEIST-Jorhat know-how	>100
Science Output	
Total published	115
International Journal	78
National Journal	22
Chapters in Book	02
Proceedings	13
In peer reviewed Journal	74
Average IF	2.4
Highest IF	**08.65**
Technological Output	
Process developed	03
Processes released to industry	04
Extramural & Human Resource Development	
Quick Hire Fellow	02
PI, DST Woman Scientist Scheme	02
Research Associates	02
Sr Research Fellow	19
Jr Research Fellow	15
CSIR-TWAS Fellow	02
DST Inspire Fellow	07
Young Scientist Scheme	01
Teachers Fellow	01
CICS-Research Training Fellowships for Developing Country Scientists (RTFDCS)	01
Project Assistant	153
Patent Filed	
In India	04
Abroad	04
Patent Granted	
In India	02
Abroad	04

PERFORMANCE INDICATOR

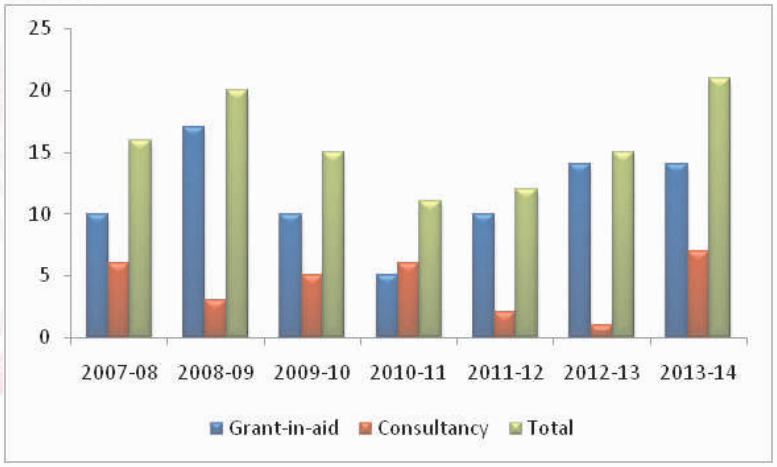
Human Resource: 2013-2014



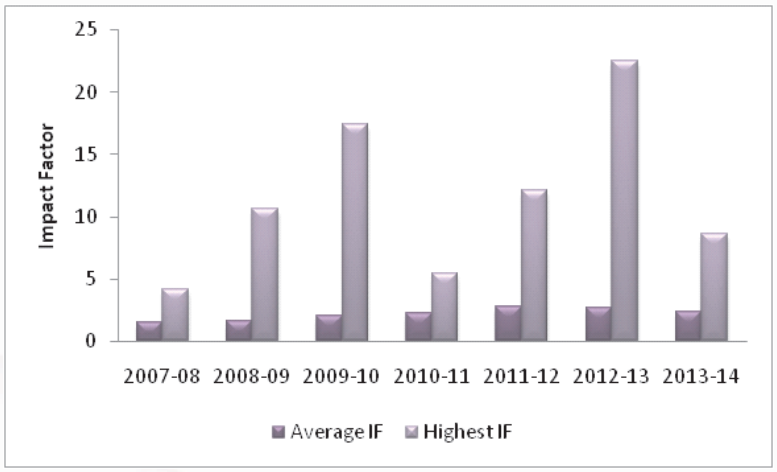
Paper Published: 2013-2014



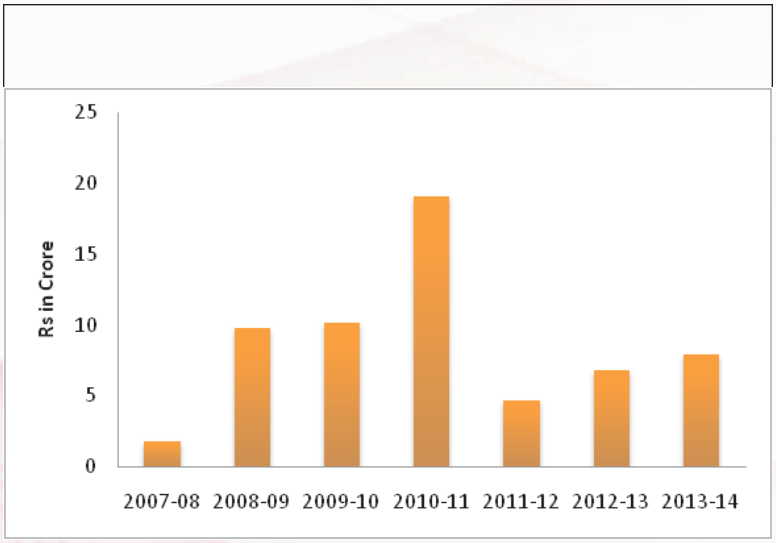
Funded Projects Completed



External Cash Flow



Impact Factor



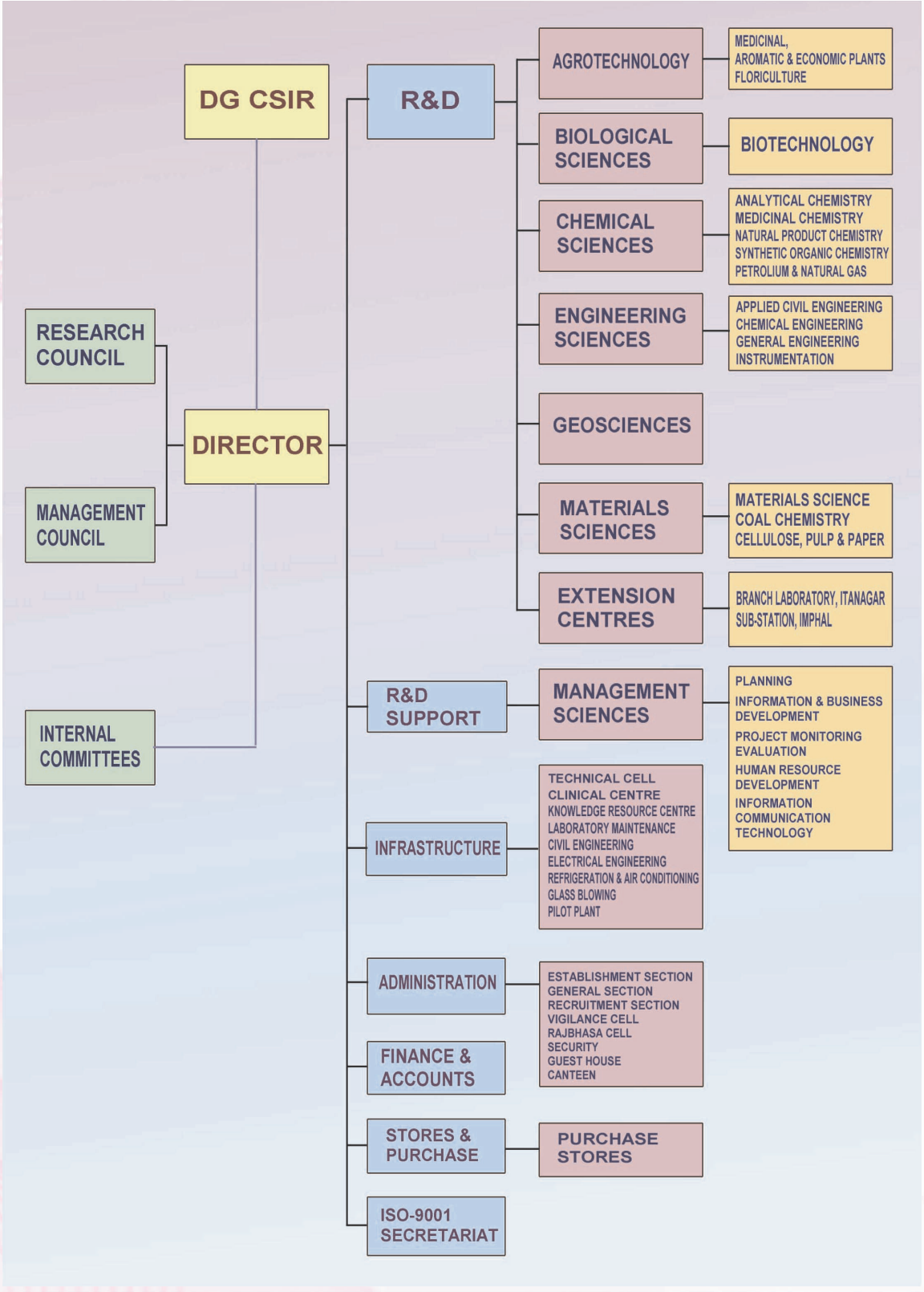
RESEARCH COUNCIL

Prof Harsh K Gupta, Member, NDMA, New Delhi	Chairman
Prof B K Konwar, VC, Nagaland University, Lumami	External Member
Prof H R Wason, Emeritus Fellow, IIT, Roorkee	External Member
Prof Kankan Bhattacharyya, IACS, kolkata	External Member
Prof Samir Bhattacharyya, Former Director, CSIR-IICB, Kolkata	External Member
Prof K S Rangappa, VC, University of Mysore, Mysore	External Member
Prof B B Dhar, Former Director, CSIR-CIMFR	External Member
Dr P K Biswas, Former Advisor (S&T), Planning Commission	External Member
Shri Asoke K Dutta, North East Council	Member
Dr A Ajayaghosh, Outstanding Scientist, CSIR-NIIST, Thiruvanathapuram	DG's Nominee
Dr K C Gupta, Director, CSIR-IITR, Lucknow	Sister Laboratory
Dr Suresh Das, Director, CSIR-NIIST, Thiruvanathapuram	Cluster Director
Dr D Ramaiah, Director, CSIR-NEIST, Jorhat	Director
Head or his nominee, PPD, CSIR, New Delhi	Permanent Invitee

MANAGEMENT COUNCIL

Dr D Ramaiah, Director, CSIR-NEIST	Chairman
Dr M Lakshmi Kantam, Director, CSIR-IICT, Hyderabad	Member
Dr Dipak Prajapati, Chief Scientist, CSIR-NEIST	Member
Dr R L Bezbaruah, Sr Principal Scientist, CSIR-NEIST	Member
Dr Tridip Goswami, Principal Scientist, CSIR-NEIST	Member
Dr Mantu Bhuyan, Scientist, CSIR-NEIST	Member
Dr (Mrs) A M Das, Scientist, CSIR-NEIST	Member
Shri O P Sahu, Principal Technical Officer, CSIR-NEIST	Member
Shri Parag Patar, Finance and Accounts Officer, CSIR-NEIST	Member
Shri Vikram Singh, Administrative Officer, CSIR-NEIST	Member-Secretary
Dr R C Boruah, Outstanding Scientist, CSIR-NEIST	Special Invitee

ORGANIZATION CHART



R&D ACTIVITIES

AGRO TECHNOLOGY

The main objective of the Division are Exploration of the Plant Resources of North-East India and identification of Potential Medicinal, Aromatic and Industrial value up to Development of Technology for mass Multiplication of commercially prospective species and their Conservation. The value addition of the Germplasm through development of different product and dissemination of proven technologies to indigenous people, Govt. organizations, entrepreneurs for overall economic development is another main objective of the Division.

The achievement during the year 2013-14

The division is involved in one In-house project, 8 Network projects (BSC & CSC), 8 Nos. of GPP projects, 1 Cons. Project, 3 International projects and a Herbal Drug Processing facility. The following were important finding of the period:-

a. In-vitro multiplication of *Clausena heptaphylla,* an important medicinal plant.
b. Identification of chemo-type species of *Vativara zizanoides* with 0.5-0.7% essential oil containing Valaneral.
c. Experimental agronomical trails on *Thysanonaleana maxima* establish commercial prospects in three harvest.
d. Genetic studies with 163 accessions of *Aquilaria malacansis* of NE India revealed 4 clusters, GS similarity over 20.6-75% and 19% variation among population.
e. Establishment of *Cassia tora* (as butterfly food plant) as indicator of oil field pollution through pollen viability studies.
f. New source of tree born edible oils identified from Gibbon Reserve.
g. Genetic variation established for Lemongrass accessions collected from different parts of NE India through morphological marker and breeding experiments initiated through Selfing, hybridization trials.
h. Multi-locational trials established for CSIR Lab accession of Cymbopogon through experimental field design.
i. DPR prepared for M/S Highland of Tirap, Arunachal Pradesh for 100 ha. Cultivication of Aromatic plants.

The Division also involve in conducting training programme as a social activities. This year 20 Nos of training conducted in different party of NE India on Mushroom Cultivation involving Govt. agencies, private parties, NGOs, Self help Groups and Industries. A total 350 people were exposed to hands on training in the state and in the Institute.

The division received CSIR-Technology award in life science for "Herbal formulation for control of Authorities in 2013. Besides these 2 Nos of students/staff received Ph D and 1 Fellow worker (Association for advertisement in Bio diversity science) in working.

One patent has been filed and one process were developed during the year and Rs. 50.3lakhs earned by the Division as ECF is another credit to the Division during the year.

A) International Collaboration

Project Title : Comparative studies on the Physiological and Biochemical aspects of adaptation and productivity in *Camelina sativa* L. in different biogeographic regions

Funding Agency : CSIR, India / CNR, Italy

PI & Members : Dr SP Saikia

Objectives:

- To study the physiological parameters in *C. sativa* for adaptation at different biogeography/ecosystems.
- To study the genotype expression of *C. sativa* in two different ecological area in relation of seed and oil yield and quality.

Significant Achievements:

Two consecutive agronomic trials, using three *Camelina* genotypes, were carried out in north-east India (Assam and Manipur). The two localities are

characterized by a sub-tropical climate condition. Comparison of agronomical, physiological and biochemical levels have been carried out in both Indian regions. Our results have demonstrated that in these climatic areas *Camelina* was able to grow and produce seeds only during winter season (from November to March) when the precipitation are absent giving a dry condition season and the temperature is comparable to that of spring-summer temperate European belt. At morphological level the most evident effect between the two localities was on the plant height and number of branches of the *Camelina* genotypes analyzed. Regarding the seed productivity in the two years of trials, the seed yield was lower (0.3 ton/ha max) in comparison to the potential of the species (1.0-2.5 ton /ha) and accompanied by small and light seeds, smaller in Manipur (< 1.0 g/1000 seeds) than in Assam (1.2 g/1000 seeds). Furthermore the seeds harvested in north-east India showed lower oil content, about 25%, in comparison to the same genotypes, approximately 35% of oil, grown in Italy. The different percentage in oil, detected in the seeds grown in north-east India, was accompanied by a minor difference in the oil compositions. However, the smaller seeds showed a higher content in tocopherols, which gives a greater oxidative stability and shelf life to the seeds. In conclusion, it is possible to infer that *C. sativa* has a high ability to adapt in area outside of its original one, probably due to a high plasticity of some morphology traits and biochemical characteristics of seeds.

Project No : GPP-0289

Project Title : Screen Printed Electrodes (SPEs) Functionalized with Organic-Inorganic Hybrid Nano-Composites for Bio-sensing Applications

Funding Agency : Department of Science & Technology and Indo-Russian bilateral

PI & Members : Dr Raju Khan PI, Dr BS Bhau Co-PI

Objectives :

- Synthesis and characterization of metal oxide nanoparticles.
- Fabrication of organic-inorganic nanocomposites materials on to the Screen Printed Electrodes (SPEs) and its characterization using CV, EIS, SEM, X-ray diffraction, DPV.
- Biofunctionalization of organic-inorganic nanocomposites modified SPEs by surface Modifcation's using immobilization of hemoproteins.
- Application of electro catalytic activity of hemoproteins (cytochrome c and myoglobin).

Significant Achievements:

Biosensors are one group of analytical devices that has attracted considerable attention in recent times. At the same time stricter requirements regarding human health have led to a rising number of clinical and medical diagnosis tests. Therefore, there is a need in developing highly sensitive, fast and economic methods of analysis. The elaboration of biosensors is probably one of the most promising ways to solve some problems concerning sensitive, fast, repetitive and cheap measurements. In order to investigate the bioactivity of the adsorbed protein, the fabricated electrode will be employed as a biosensor based on hemoprotein activity. Myocardial infarction or acute myocardial infarction (AMI) is the medical term for an event commonly known as a heart attack. It happens when blood stops flowing properly to part of the heart and the heart muscle is injured due to not receiving enough oxygen. Usually this is because one of the coronary arteries that supplies blood to the heart develops a blockage due to an unstable build up of white blood cells, cholesterol and fat. The event is called "acute" if it is sudden and serious. Acute myocardial infarction (AMI) is the result of a sudden occlusion that decreases blood flow to a portion of the myocardium, causing cell death. The definition and diagnosis of AMI have been based on the WHO criteria, whereby patients must meet at least two of three conditions: characteristic chest pain, diagnostic electrocardiogram (ECG) changes, and elevation of the biochemical markers in their blood samples.

Under Indo-RFBR bilateral project, Indian collaborator of Dr Raju Khan (Principal Investigator) and DR BS Bhau (Co-PI) of the project visited Institute of Biomedical Chemistry, Moscow Russia, during 10th March 2014 to 23rd March 2014. During the visit to prepare the MWCNT-modified screen-printed electrodes. The morphology of the screen printed electrode (SPEs) modified with MWCNTs was examined by SEM

showed in figure 1. The negatively charged functional groups on the surfaces of myglobin interact with the positively charged free amino groups of myoglobin resulting in myoglobin to be easily adsorbed onto the surface through the electrostatic interactions. Moreover, myoglobin adsorbed at the surface was further confirmed by CV studies.

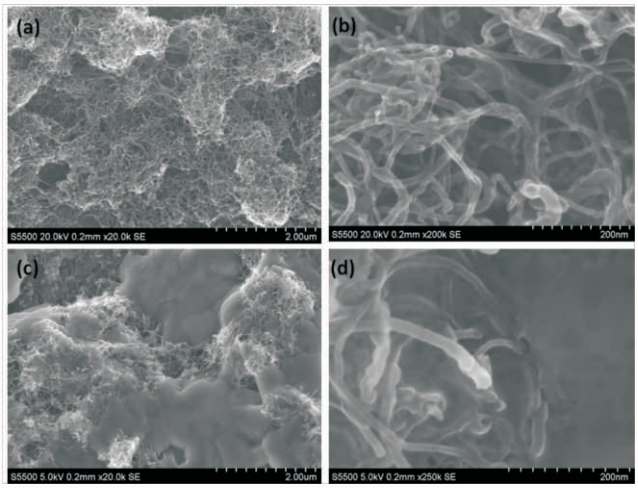


Figure-1 SEM images of on SPEs-MWCNT (a) and at higher magnification (b) myoglobin immobilized at SPEs-MWCNT (c), at higher magnification (d)

Project Title : **Eco-friendly management of plant pathogens using natural plant extract from North-East India by inducing resistance in plants**

Funding Agency : ASCR, Czech Republic / CSIR, India

PI & Members : Dr B S Bhau PI, Dr A M Das Co-PI, Dr R Khan Co- PI

Objectives:

- Works involves the extraction of selected medicinal plants of Northeast India using different solvents and the extracts has been sent to foreign collaborator for bio-evaluation against various diseases. Moreover, on the activity report, chemical investigation of some of the plants taken-up for chemical investigation based on their innovativeness activity and the Phytochemical investigation.

Significant Achievements:

In the work, collection of some selected plants from North-East India (nearby Jorhat Town and Karbi Anglong District) and carried out on extraction of value added products from natural plant using various solvents for potential bioactive molecules.

(a) Fractionation of the ethanol extract [code no. STL-1]-5g
(b) Fractionation of the 50% ethanol extract [code no. STL-2]-6g
(c) Fractionation of the ethanol extract [code no. A-1]-5g

The above fractions had been sent for bioevaluation to Prof. Lenka Burketova, Institute of Experimental Botany AS CR, Prague, Czech Republic

B) National Collaboration

(i) Network Projects

Project No : **BSC-0105**

Project Title : **New initiatives to boost agriculture productivity through maximizing pre and post harvest yields**

Nodal Laboratory : CSIR-CFTRI

Funding Agency : CSIR New Delhi

PI & Members : Dr P K Chowdhuri,PI, Dr P R Bhattarcharyya, Co PI, Dr S C Nath, Dr Mrs A Goswami Dr J Kalita, Dr Mantu Bhuyan, Mr T Hussain, Dr Ms D Banik

Objectives:

- Development of Plant based Formulations for control of Insect-pest of stored pulses & cereals
- Development of Economically & Environmentally sustainable strategies for the conversion of cereal & fruit processing by-products into new foods with ambitious market opportunities
- Development of protocols for high value molecules for preparation of Nutraceuticals & Functional foods having antioxidant, anti-inflammatory and other organoleptic properties

Significant Achievements:

Development of Plant based Formulations for control of Insect-pest of stored pulses & cereals

- Identification of potential insect pest of stored grain of this region has been done based on the extensive survey works and collection of stored grains samples. A total of six insect species has been isolated and recorded

infesting stored pulse & cereal grains. Following are the major insect species recorded in stored grains in Assam:

1. *Callosobruchus chinensis* (Bruchidae : Coleoptera)
2. *Callosobruchus maculates* (Bruchidae : Coleoptera)
3. *Callosobruchus analis* (Bruchidae : Coleoptera)
4. *Sitophilus oryzae* (Dryophthoridae : Coleoptera)
5. *Rhizopertha dominica* (Bostricidae : Coleoptera)
6. *Triboleum castaneum* (Tenebrionidae : Coleoptera)

The frequency of occurrence of various insect pests in collected samples is found to be highest (29.51%) for *C. chinensis* in case of stored pulse grains & *S. oryzae* (35.67%) for stored cereal grains. Therefore, it can be interpreted from the observations that the major insect pest associated with stored pulses is *C. chinensis* & *S. oryzae* in case of cereals in Assam.



Major insect pest of Stored Pulses have identified as C. Chinensis

- *Callosobruchus chinensis* (L.) (Coleoptera : Bruchidae) is one of the major insect pest infesting stored pulses in India. Recourse of synthetic insecticides to protect stored pulses often lead to dangers of the development of resistant strains, toxic residue and users safety. Locally available and less toxic pest management alternatives such as the use of effective botanicals are important. Essential oils of two variants of *Cinnamomum verum* Presl. Syn. *C. zelanicum* Blume from North East India (RRL J 1620 and RRL J 1622) were characterized and tested for their biological activity in vapour form against *Callosobruchus chinensis* (L.). Choice and no-choice tests showed that leaf and bark oil of two variants of *C. verum* Presl. had significant repellent action and reduced the fecundity and decreased egg hatchability of *C. chinenisis* (L.). However, leaf oil with higher percentage of eugenol exhibited better activity than the bark oil in both the tests. Hence, the volatile essential oils of both the variants of *C. verum* Presl. can be used safely as fumigants (*Kalita et al, 2014, Int J Appl Biol Pharma, 5(3) : 190-194*).

Development of Economically & Environmentally sustainable strategies for the conversion of cereal & fruit processing by-products into new foods with ambitious market opportunities & Development of protocols for high value molecules for preparation of Nutraceuticals & Functional foods having antioxidant, anti-inflammatory and other organoleptic properties

Following work have been already initiated:

- Extraction of Rice Bran Oii from a traditional rice cultivar of NE Region, viz., *Musuri* Variety
- Extraction of □-Orizanol from RBO
- Synthesis of analogues of □ -Orizanol using readily available Steroid molecules & determination of their Antioxidant activity.
- Development of Natural Pigments cum Antioxidants from some indigenous fruits of North East India

Work on Traditional Rice Cultivars of North East India:
Seven traditional rice cultivars of North-East India, grown in three different ecosystems, and exhibiting distinct genotypic variations, were investigated for phenolic acids in free, alkali- and acid hydrolyzed rice bran extracts using the Folin-Ciocalteu reagent and HPLC. The extracts were also

analyzed for their antioxidant activities using the DPPH radical scavenging and CUPRAC assays. The percentage of Total Phenolic Content (TPC) of the different rice bran extracts were determined. Most of the phenolic acids were present as esterlinkages (~ 61 %) to cell-wall substituents, while a small portion was bound by ether-linkages (~ 3 %).

HPLC studies showed the presence of ferulic, p-coumaric, sinapic, caffeic, chlorogenic and vanillic acids in the extracts. Hydrolyzed extracts exhibited better EC50 values than the free extracts. The free phenolic extracts contributed 91.1-99.2 % to the total TEAC values as determined by CUPRAC assay. Besides, a comparative study with other rice cultivars grown in different parts of the world indicated the superiority of

these cultivars, which is largely attributable to the genotypic differences among the cultivars. The study thus reveals the potential of these rice cultivars towards the development of nutraceuticals and functional foods.

The proximate and elemental compositions in bran of five varieties of rice of North-East India (A-E) were investigated. The varieties were found to contain appreciable quantities of nutrients. They could, therefore, be used in food fortification and as nutraceutical.

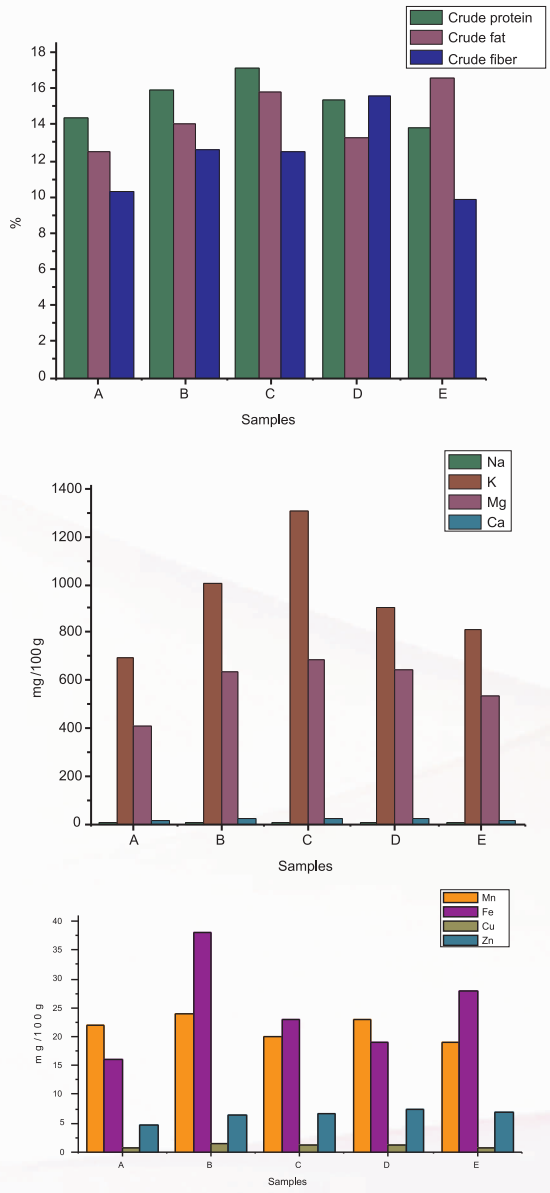


Fig. 1. Proximate composition (a) and elemental composition [(b) &(c)] in bran of five varieties of rice.

Development of Natural Pigments cum Antioxidants from some indigenous fruits of North East India

The present study investigates Anthocyanins content and Antioxidant Activity in extracts from various indigenous fruits like Assam Mulberry(*Morus alba*), *kola Jamu* (*Syzygiumcumini*) and Banana bracts (*Musa balbisiana*) etc.



Assam Mulberry (Morus alba)

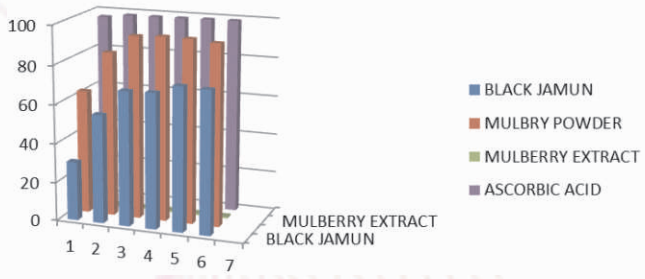


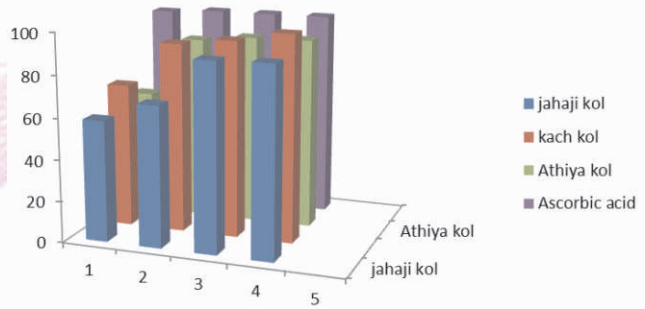
Kola Jamun (Syzygiumcumini)



Kol Dil (Banana bracts)

Determination of Antioxidant Activity by DPPH Method and its comparisition with that of Ascorbic acid (Standard).





Project No : **BSC-0106**

Project Title : **Bioprospection of Plant Resources and Other Natural Products**

Funding Agency : **CSIR, New Delhi**

PI & Members : Dr SC Nath, Dr BS Bhau, Dr Mohan Lal

Objectives : Taxonomy & Molecular biology (Plant DNA Barcoding)

Significant Achievements:

- Second phase of field trips to Gibbon Wild Life Sanctuary has been completed with the collection of 60 plant specimens
- Botanical identities of Gibbon's collections have been confirmed for 35 species of folklore and 50 species of other medicinal (codified) and aromatic values including the *Litsea cubeba* citronellal type fruit essential oil
- DNA samples of 3 species have been isolated followed by the standardization of their primer and PCR amplification
- A new DNA extraction protocol has been standardized for *Cinnamomum Tamala*.
- DNA extraction of 2 different plant species (*Cinnamomum Tamala and Nepenthis khasiana*) has been done for total 15 accession of each (Fig. 5A & 5B).
- DNA amplification of all the accessions using 4 different primers (ITS5a-ITS4, rbcL1F-rbcL1F, rbcl724-rbcL724 & trnH-psbA) for both the extracted plant species.
- Amplified DNA samples are preceded for DNA sequencing.

Project No : **BSC-0110**

Project Title : **Introduction, domestication, improvement and cultivation of economically important plants**

Funding Agency : **CSIR, New Delhi**

PI & Members : Dr P R Bhattacharyya PI, Dr S C Nath, Dr M P Borthakur, Dr P Baruahj, Dr M Lal Dr M Bhuyan, Dr B S Bhau, Dr B Baruah, Dr S P Saikia

Objectives :

- Selection and characterization of diversity (Morphological, Chemical and molecular) among aromatic grass *Cymbopogon* spp. and *Cinnamomum* germplasm.
- Performance and evaluation of elite clones through multi-location coordinated trials
- Introduction of Novel horticultural crops for hills and plains.
- Introduction of Swertia chirata from Eastern Himalaya.
- Evaluation of Bixa germplasm for plant improvement.
- Evaluation of Biopesticide from indigenous sources.

Significant Achievements:

- 15 accessions of *Cinnamomum* species represented by the following 4 species and 9 infra-specific categories have been collected based on their uses by the local people for spice and culinary values *C. tamala*: 3 accessions – Leaves as Tejpat spice *C, zeylanicum*: 2 accessions – St. bark as Cinnamon spice *C. sulphuratum*: 2 accessions – St. bark as Cinnamon spice *C. bejolghota*: 2 accessions - St.bark as Cinnamon & Leaves as Tejpat spice
- Eight accessions of the following East Indian (*Cymbopogon flexuosus*) and West Indian

Lemon grass (*C. citratus*) germ-plasms growing under wild and cultivated stands have been collected and introduced in NEIST germplasm bank. C. flexuosus: 5 accessions C. citratus: 3 accessions.

- Collection of plant materials for DNA isolation protocols and PCR standarization and optimization- Among different methods of DNA isolation Rapid Isolation of DNA Protocol (KHANUJA *et*. al 1999) was found to be the most efficient. A total of 25 random RAPD primers (RPI) have been selected for genetic diversity analysis after preliminary primer screening and PCR standardization and optimization process for these primers is still in progress. (Fig.4A)
- DNA Quantification and Quality testing- The quality and quantity of the DNA samples were also checked using nano-spectrophotometer.
- Tagging and numbering of *Cymbopogon* Collections in NEIST Campus- 47 numbers of unknown *Cymbopogon* collections found in NEIST Campus were tagged with the help of silicon pad and numbering has done serially 01 to 47.
- Morphological Study of the tagged 47 collections of *Cymbopogon* has been done.
- Oil extraction from the *Cymbopogon* collections has been done and their analysis process is in progress.
- RAPD PCR Standardization and Optimization- RAPD PCR conditions for *Cymbopogon collections have* been standardized. A series of different conditions using the different PCR parameters (DNA, primer, dNTPs, Taq DNA polymerase, and 10 X buffer concentrations) was carried out to get an optimized condition for a proper setting up of standard PCR. A set of 25 random PCR primers (RPI, Bangalore Genei) were arbitrarily chosen after the preliminary screening.
- Electrophoresis of the PCR products- Amplified PCR products were electrophoresed in 1.5% agarose gel under submerged condition. Amplified bands were viewed under UV light with the help of UV transilluminator. (Fig. 4B).
- Germplasm Mutation Study of *Cymbopogon* Collections- 8 collections of *Cymbopogon* were selected for mutation study and different concentrations of chemical treatment have been done. The treated germplasms have been planted in the farm.

(ii). Inhouse Grant in aid, Consultancy Projects

Project No : **MLP-1000/1**

Project Title : **Bioprospection and Assessment of Genetic Diversity of Medicinal Aromatic and Economic Plants of North-East Indian for Industrial and Socioeconomic Development**

Funding Agency : CSIR, New Delhi

PI & Members : Dr PR Bhattacharyya**,PI,** Dr SC Nath**,** Dr P Baruah, Dr M Borthakur, Dr BS Bhau, Dr SP Saikia, Dr M Bhuyan, Dr M Lal, Dr AK Bordoloi

Objectives:

- Agrotechnology Development

Significant Achievements:

1. Achieved *in vitro* optimal shoot multiplication of *Asparagus racemosus* in BAP fortified MS basal medium.
2. Rooted plantlets of *Clausena heptaphyla* were acclimatized properly at polyhouse.
3. An experimental agronomic trial on an important economic crop growing wild in North-East India – the *Thysanolaena maxima* (Broom Grass), flowering tops (inflorescence) of which are used commercially for making fine broom to polish floor, has been conducted at a zero technology condition in the Experimental Farm of NEIST, Jorhat. Based on three spacing and three harvests, per hectare per annum yield potentiality of the flowering tops (inflorescence) of the grass has been evaluated. The experiment resulted 10375, 8632 and 5478 numbers of standard brooms (40 nos of inflorescence per broom) at the spacing of 2.5x 2.0 m, 2x2m and 2.5x2.5 m. with the economic returns estimated at Rs.2,48,425.00, Rs.2,04,850.00 and Rs.1,26,000.00 per hectare per annum (Rs.25.00/ broom) respectively.

4. Essential oil and aroma-chemicals of *Ocimum viride,* an aromatic medicinal plant species of North -East India with perennial growth habit the aerial of which are being used by the local people for the control of insect pest have been studied.. A pale yellow coloured essential oil in .8-9% yield (FWB) obtained by hydro-distillation of the aerial parts of the plant growing wild in upper Brahmaputra valley region of Assam has been analyzed by GC and GC/MS. Forty components representing about 99.4% of the total oil have been identified. Thymol (41.9%), followed by γ-terpinene (20.9%) and p-cymene (6.0%), was the major component of the oil.

Project No : **GAP - 0250**

Project Title : **Development of molecular markers for evaluation of population genetic structure of the *Aquilaria malaccencis* in North East India: Implication for its use and conservation**

Funding Agency : DBT

PI & Members : Dr BS Bhau, Dr SC Nath

Significant Achievements:

156 genotypes of *Aquilaria malaccensis* were collected from NEIST campus, Jorhat and various parts of North East India (Assam, Arunachal Pradesh, Meghalaya and Tripura). DNA was extracted using modified CTAB method from these genotypes. RAPD and ISSR PCR were done with 84 random genotypes of *A. malaccensis* representing the various geographical locations to study the genetic diversity of the plant. RAPD PCR showed 71.3 % while ISSR PCR showed an average of 58.35 % genetic diversity respectively .

Project No : **GPP-0256**

Project Title : **Biotech Intervention on Selected Medicinal and Aromatic Plants (MAP) of NER for their Effective Utilization**

Funding Agency : **DBT**

PI & Members : Dr PR Bhattacharyya

Objectives:

Bio-formulation Development

Significant Achievements:

- Screening of RAPD, ISSR primers and PCR standardization. ISSR primer selection was successfully performed and PCR protocol was standardized. From 13 primers around 100 RAPD markers of *Acorus calamus* have been developed. 16 positive primers for ISSR have been screened till date and PCR optimization process was done. 6 random primers of RAPD have been used for *Clerodendrum indicum* RAPD-PCR amplification.
- Bud proliferation initiated at the base of explants implanted in all the treatments supplemented with different concentrations of auxins viz. IAA (Indole-3-acetic acid), NAA (α-naphthalene acetic acid) and cytokinins viz. Kinetin & BAP (6-Benzylaminopurine) alone or in combinations. Among the various treatments, the difference lies in the time period for induction of bud break followed by shoot elongation.5 mg/l BAP showed, best shoot regeneration along with simultaneous rooting within 25-28 days. It implies that single step regeneration of whole plants may considered as for both time and cost effective method of regeneration of *Homolomena aromatica.* Presently more than two hundred regenerated plantlets were transferred to the soil conditions.
- For initial establishment of aseptic culture, different explants viz. rhizome segments, axillary buds and apical meristematic collected from 6 different sources of germplasms were established at NEIST Experimental Garden. After bud initiation, the explants were cultured separately on media with different cytokinins and auxins formulation. For multiplication of shoots, proliferated shoot clumps were sectored into small propagules of 3-6 shoot buds/ clump and transferred onto various combinations of media viz. BAP, Kin, NAA and IAA. Among the various treatments, highest efficiency of micropropagated shoot formation (6-7) was recorded on the media supplemented with (1.0 mg/l) BAP and IAA with (0.5 mg/l) Kinetin The newly emerged shoots when transferred to IBA (Indole-3-

butyric acid) and IAA (1.0 mg/l each) showed root induction along with shoot initiation. Results recorded so far agree with earlier various workers, that morphogenetic effects of different plant growth regulators were found to be different varieties/stocks. This reflected differences between clones in their sensitivity to various auxins and cytokinins and also to the altered morphogenetic reaction.

Project No : **GPP-0268**

Project Title : **Self-empowerment by the women community of rural areas of west Jorhat (SC populated) through Organic Vegetable Gardening as well as production of popular food viz. Mushroom Cultivation**

Funding Agency : Department of Scientific & Industrial research, Govt of India

PI & Members : Dr MP Borthakur, Dr AK Bordoloi

Objectives:

Societal Development

Significant Achievements:

Under this project awareness programme was held on misconception about mushroom consumption, it's nutritional benefit specially for women and children , it's cultivation by NEIST based low cost easy cultivation technology at four different villages under two different Gaon Panchayat in presence of respective Panchayat presidents, secretaries and members and also other dignitaries associated with the village for the first time.

In-Campus training was given to 105 women from different S.H.G. selected from 3 different Gaon Panchayat. Batches of 10 women were invited to obtain training at NEIST per day. During demonstration cum practical training works, each trained lady became sufficiently skilled to train up at least 10-12 women under them and as such during the 1st year about 1050 lady was trained up.

As selling of Mushroom in small quantity and collecting in different period is somehow difficult, so a meeting was organised in presence of Panchayat members to encourage women for doing co-operative basis of cultivation in a low cost cropping house and harvest at a fixed period in large amount.

One day training programme was also conducted for trained women on value addition of Mushroom by demonstrating of different delicious food dish preparation by mushroom by a resource person from Faculty of Home Science, Dept. of Food & Nutrition, Assam Agri. University, by assuming another source of earning by making hotel /restaurant business by the women community.

Overall, performance of the whole training period was found to be very good and trained women showed their satisfaction by learning and implementing this new technology and touching and consuming mushroom for the first time in their life

Project No : **GPP-0272**

Project Title : **Studies on drought resistance strategy in seedlings of Teak (*Tectona grandis* L.) species and selection of improved genotype for forest management**

Funding Agency : DBT

PI & Members : Dr SP Saikia

Objectives:

- To screen the drought tolerance and drought sensitive teak germplasm based on various physiological parameters.
- To study the global gene expression in drought tolerance and sensitive genotypes in teak
- To validate the candidate genes by Real-time PCR.

Significant Achievements:

The present study primarily aims to understand the drought tolerance strategies adopted by teak seedlings by studying the various physiological processes *vis-a-vis* differential gene expression in two selected genotypes. The germplasms of North East region are screened for drought tolerant and drought sensitive. Individual components that contribute to water stress tolerance are estimated.

Project No : **GPP-0280**

Project Title : **Economic and Biogeographic evaluation of the Cinnamomum**

Species in some selected parts of India through Morphological, Chemical and MolecularBiology study.

Funding Agency : DBT

PI & Members : Dr SC Nath ,PI, Dr BS Bhau

Objectives:

Study of genetic diversity of Cinnamomum species in NE India.

Significant Achievements:

- Collection of eight different varieties of Cinnamomum species found in NE India (*C. tamala, C. impressinervium, C. sulphuratum, C. zeylanicum, C. bejolghota, C. asomicum, C. camphora, C. pauciflorum).*
- Standardization of protocol for DNA extraction from the tender leaves of Cinnamomum species.
- Extraction of DNA from three species of Cinnamomum such as, *Cinnamomum tamala, Cinnamomum impressinervium, Cinnamomum zeylanicum.*
- Primer testing for RAPD amplification with RPi primer from 1 to 25.

Project No : CNP-0458

Project Title : Techno Economical studies of six technologies under Coir Board in North Eastern States and organization of two seminars

Funding Agency : Central Coir Research Institute, Coir Board, Alleppy, Kerala

PI & Members : Dr Jatin Kalita, PI, Dr T Goswami Member, Dr Dipul Kalita, Member, Mr JJ Bora Member

Objectives:

- Technical evalution of the know-how/technology developed by an R&D Institution.
- To broadly specify a the plan and machinery and other facilities required.
- Assessment of demand of the product to be produced.
- The likely invesment required.
- Financial analysis of the proposed technology/venture to broadly determine weather the project is economically viable.
- Commercial analysis of the project to evolve sound marketing plan and organizational structure for the proposed venture.
- To make projected financial analysis for submission to the financial institutions and bank seeking long term borrowings respectively.

Significant Achievements:

The project work involve techno-economical studies of six technologies under Coir Board in North Eastern Region of India. Techno-economical studies of the six technologies viz(i) Mobile fibre extraction unit. (ii) Cocolawn™ (iii) Anugraha (iv) Anupam (v) C-Pom, Coir Pith Organic Manure & (vi) Coir Polymer Composit Board Has been completed and the final report of recomendations Have been submitted to Coir Board, Govt of India. There is a good scope for setting up coir industries in order to bring awareness for the use of coir fibre in this part of the country, as observed from the tech-economical feasibility study. It is espected that, socio-economic conditions of this region could be improved through setting up of coir based industries.

Project No : CNP-0446

Project Title : **Butterfly Population Studies in NRL Butterfly Valley**

Funding Agency : Numaligarh Refinery Ltd, Numaligarh, Golaghat

PI & Members : Dr Mantu Bhuyan PI
Dr PR Bhattacharyya Member
Dr SC Nath Member

Objectives:

- Studies on larval and nectar host plant range and preferences of some important butterfly species.
- Studies on biology of few important butterflies.
- Studies on foraging behaviour of butterflies.
- Studies on butterfly and host plant species diversity in adjoining buffer zone.

- Identification of parasitoids and entomo pathogens of eggs, larva and pupa of butterflies

Significant Achievements:

(i) 132 species of butterflies are identified and found available in the NRL Butterfly valley of NRL.

(ii) Several nectar and larval host plants are planted.

(iii) Created congenial atmosphere to attract butterfly in the valley

(iv) Lifecycle of 15 important species of butterflies are studied.

(v) 11 species of parasitoids were collected out of which 2 are egg parasitoids while 9 are larval parasitoids.

Project No : **CNP-0465**

Project Title : **Detailed project report for the proposed composite forest farming at Tirap, Arunachal Pradesh**

Funding Agency : Highland East Pvt. Ltd.

PI & Members : Dr SP Saikia

Objectives:

- To prepare a detailed project report for setting up a Citronella plantation and distillation project at Malisa Tea Garden Area, Tirap, Arunachal Pradesh

Significant Achievements:

The abundant natural resource of Arunachal Pradesh can be tapped to generate a healthy self-perpetuating economy for the underprivileged masses which in turn will support our Country's economy. Detailed report was prepared after field survey.

BIOLOGICAL SCIENCES

The Division is actively engaged in bio-prospecting and bio-profiling microbial diversity, plants and insects from North East Gene pool. In the area of microbial diversity, the division is maintaining a huge collection of more than 4000 microbial strains as stock cultures, collected and isolated from specific niches of this biodiversity hot-spot. These strains have been utilized in various on-going R&D projects of this institute. In the field of bio-prospecting, we have developed efficient bacterial consortia as a part of bioremediation package with field tested proven track record which were extensively applied in ONGC oil fields with impressive success. Selected PGPR strains have been used in bio-formulation packages and the technology has been released and successfully commissioned in the last few years. Metagenomics on cold adapted microbial strains from Tawang, Arunachal Pradesh and crude oil degrading strains from Oil field area of Digboi are in progress. Whole Genomic Sequencing of certain hydrocarbon degrading and antibiotic producing microbial strains and their analysis have been completed to understand their potentialities in molecular level. Bio control potentialities of certain short-listed strains have been evaluated for their field applications. Screening microbial enzymes having targeted activities such as biotransformation and industrial catalysts are regular activity of the group. Screening anti-infective against *Mycrobacterium tuberculosis* and related pathogens is in progress. Isolation, structure elucidation, bioassay and mode of action of the bioactive molecule isolated from endophytic fungi endowed with anti-prostate cancer activity was completed. Study on the impact of environmental pollution on human health especially COPD have been extensively studied in molecular and genetic level. The group is supplementing novel bacterial genus & species into world microbial taxonomy from NE Gene pool in collaboration with IMTECH Chandigarh. Extensive study on silk worm biochemistry and productivity has resulted in developing technology packages. Induction of systemic resistance through root associated bacteria in Patchouli is another interesting ongoing program. DBT-sponsored Bioinformatics facility is catering to the needs of both scientists and students immensely.

Major ongoing programmes in 12th FYP are: Photobiological approach to produce bio energy through carbon sequestration, adaptive biology in medicinal plants, integrated Next Gen approach in health, diseases and environment, nanomaterials and its impact on safety, health & environment, enhancing agriculture production by optimizing pre- & Post-harvest yield, therapeutics of COPD and related respiratory disorders, role of ACC-deaminase producing PGPR on water stress affects, biocatalysts for industrial applications, bio-pulping and bio-bleaching.

International Collaboration

Project No. : **GPP-0277**

Title of Project : **Comparative antimicrobial activity and molecular characterization of *Clerodendrum* species of Thailand and India**

Funding Agency : **DST, New Delhi**

PI & members : **Dr. S. B. Wann, Dr. B. S. Bhau, Dr. T. C. Bora**

Objectives :

i) The systematic bioresource mapping of *Clerodendrum* species from different regions of both the countries are so far not available and thus there is a lot of scope to map the diversity and utilize it for prospection. *Clerodendrum* germplasm collection and systematic documentation will be done individually in both the countries.

ii) *Clerodendrum* is a large genus containing species that are important both ecologically and commercially. Some species are early successional colonisers of degraded land and could be used for habitat restoration, but, others can become pernicious weeds, that accurate identification and careful consideration must go hand-in-hand before

implementing restoration work. To overcome this bottle neck evaluation of genetic diversity within species and among species using ISSR and AFLP based molecular markers will be done for Indian species.

iii) *Clerodendrum* species have been used medicinally in their countries of origin for centuries. More rigorous scientific trials are now underway to evaluate the potential of compounds extracted from them, especially antipyretic and anti-inflammatory properties, as well as antibacterial activity. Evaluation of antimicrobial activity of the plant extract(s) and its various fractions will be done from Indian and Thailand species by individual PIs in their country.

Significant Achievements:

Molecular characterization of *Clerodendrum indicum*

Thirty different leaf samples of *Clerodendrum indicum* were collected and analyzed to study the genetic diversity using arbitrary DNA primer (10 mer). The genomic DNA extraction was carried out using modified CTAB method in which PVP was added to overcome the ***problem*** of phenolic compound in the leaf tissue that interfere with the isolation of genomic DNA and this method also yielded a colorless, high quality and quantity of genomic DNA.

RAPD profile of 20 genotypes of *Clerodendrum indicum* using primer BG12, BG9 and BG10 was performed which gives some of the polymorphic bands (Fig. 1, 2, 3). The DNA fingerprint pattern of all 20 samples was analyzed using NTSYSpc -2.02h software and the comparison in the dendogram (Fig. 4). The cluster was divided into two major groups, i.e., group 'a' and group 'b'. Again group 'a' was divided into two subgroups namely 'c' and'd'. Subgroup 'c' includes 8 samples (3, 4, 14, 5, 11, 18, 12 and 17) among which highest similarity was obtained between genotype of sample 3, 4 and 14. Subgroup 'd', 'f', 'e' includes 6 samples (2, 6, 9, 10, 13, 16) where all the sample are not similar and the highest similarity in this subgroup was found in between sample 3 and 17 along with 4, 14, 5, 11, 18 and 12. Group 2 was divided into subgroups 'e' and 'f'. Samples (9 and 10) belong to subgroup 'f' and samples (13 and 16) belong to subgroups 'e'. Sample 15, 8, 20 and 19 showed highest diversity from the other samples.

A total of 20 arbitrary decamer primers were screened for the study. These primers showed different range of amplification (Fig. 1, 2). Only those primers showing clear and maximum number of bands amplified were selected for this study. Out of these primers, 12 primers that amplified across all the individual samples were taken.

A total of forty bands (64%) were polymorphic and twenty two (13.64%) were monomorphic. The average number of bands was 5.22 per primer. Maximum polymorphism (i.e., 100% polymorphism) was observed with primer BG 12. Maximum number of monomorphic bands (5 bands) was observed with primer BG17 out of 6 bands (71.42%). The average percentage of polymorphic bands for all samples per primer was 64%.

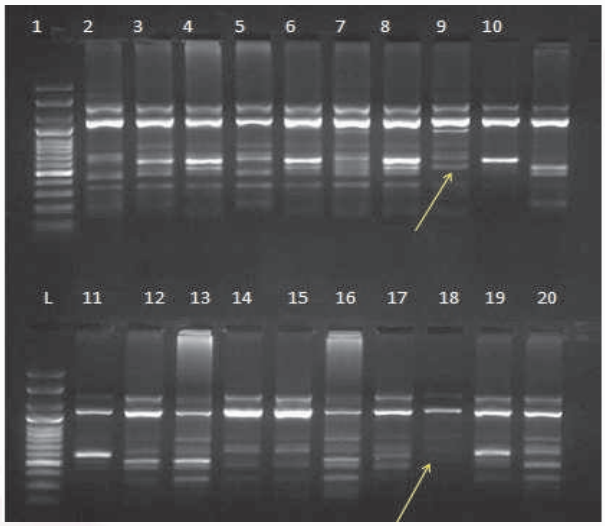


Fig. 1: Amplification of genomic DNA with primer BG 12.

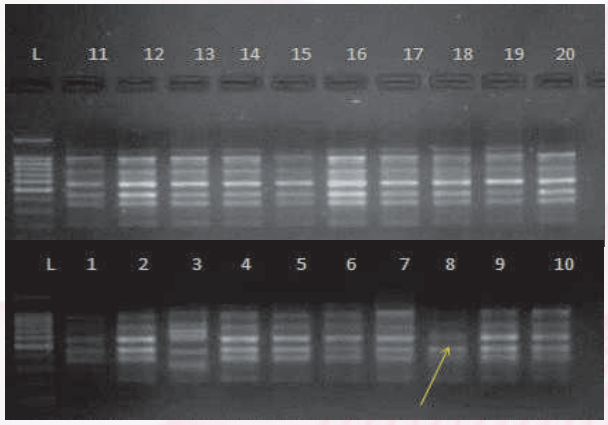


Fig. 2: Amplification of genomic DNA with primer BG9.

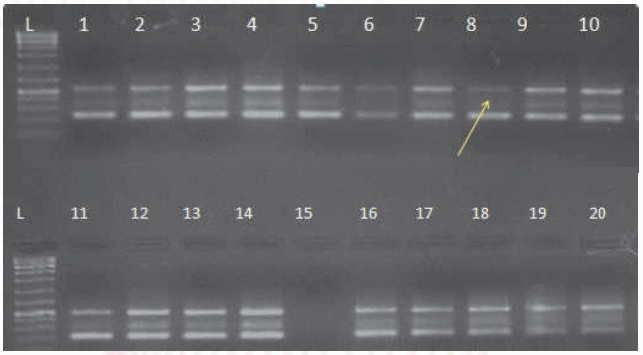


Fig. 3: Amplification of genomic DNA with primer BG10.

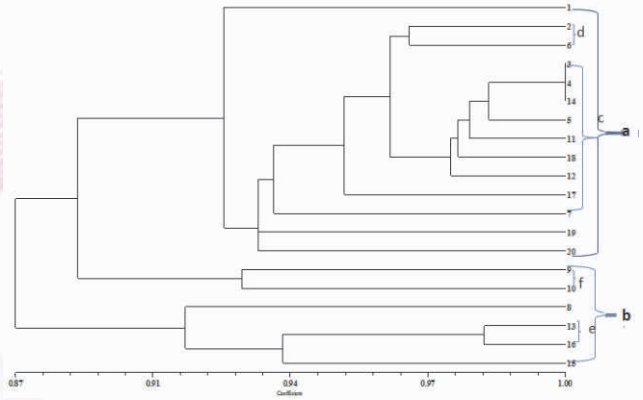


Fig. 4: Dendogram of the genetic relationship between 20 Clerodendrum indicum plants collected from different parts of North-East India.

Antimicrobial activity

The extract of *Clerodendrum indicum* of dried leaves powder was extracted in different organic solvents-methanol, ethanol, hexane and toluene and antimicrobial activity performed. The results obtained from the antimicrobial screening shows that the ethanolic crude extract of *Clerodendrum indicum* exhibit a significant activity against one bacterial strain; *Bacillus subtillus* MTCC 2453, and two fungal strains; *Candida albicans* NEIST and *Fusarium auxisporum* NEIST.

2. National Collaboration

(i) Network Project

Project No : **BSC-0109**

Project Title : **Studying adaptation biology and understanding/exploiting medicinally important plants for useful bioactives**

Funding Agency : CSIR, New Delhi

PI & Members : Dr H P Deka Boruah, PI , Dr T C Borah Dr R Saikia, Dr Jatin Kalita, Dr M Khongsai

Objectives:

- Characterization of population dynamics and phenology in plant species in different ecosystems under natural and with respect of adaptation of species complexes under field condition.
- Establishment of relationship of microbial dynamics to the environment and adaptation of plants.
- Exploring plant diversity in different ecosystems of Assam and amplitude of adaptation to abiotic stresses in plant species across and within ecological niche(s).
- Studies on interaction/association among the species in relation to biotic (microbes) and abiotic components
- Dynamics of nutrients recycling in relation to plant performance at different ecological niches
- Identification of common and distinct eco-physiological response of plants in various ecological niches.

Project No : **BSC-0111**

Project Title : **Integrated NextGen Approaches in Health, Disease and Environmental Toxicity**

NEIST Title : **Studies on the Useful and Functional Properties of Some Proteins/ Peptides of Microbial Origin**

Funding Agency : CSIR, New Delhi

PI & Members : *Dr BG Unni, Nodal Scientist*, Dr R Saikia, Co Nodal Scientist, Dr M Bhuyan,*Co Nodal Scientist, Dr PR Bhattacharya, Dr TC Bora Dr HP Deka Baruah, Dr PK Baruah , Dr T Borah,, Dr.Jatin Kalita,, Mr D Ozah,*

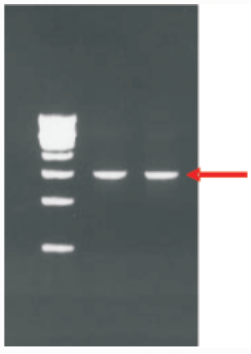
Objectives:

- Genetic diversity of bacteria isolated from environmentally degraded land of Assam **(ii)**To conduct surveys to identify different level of pollutants in industrial and non-industrial areas and correlate with aerial pollutants for documenting the impact of pollutants on butterflies. **(iii)** Isolation, characterization and purification of

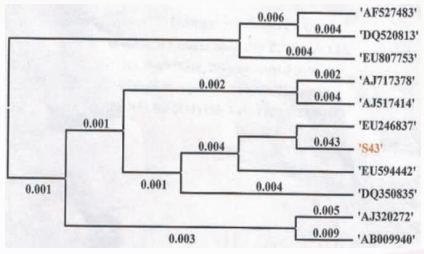
coagulase, extracellular protein produced by *Staphylococcus basabrani* and further application studies.

Significant Achievements:

(i) A novel strain - NEIST 1 was isolated from places around the Brahmaputra River of Assam and identified using 16S rDNA primers. The sequenced 1.5 Kb 16S rDNA was clustered hierarchically with reported 16S rDNA sequences available at the NCBI database using the neighbour joining methods. The purification by different precipitation methods and chromatographic methods are under progress to have specific extracellular protein which has coagulase properties. Homology modelling related to the structure as well as the cavities/active sites of the protein is under progress. (ii)Sampling from different sites of Digboi Oil Refinery's nearby was done. (iii) Screening of 180 nos. of bacteria for the degradation of biosurfactants and Genotyping of these bacteria is in progress (iv)Isolation of bacteria and screening them for naphthalene degradation are under progress.(iv) Air quality data like CO_2, CO, SO_2, Temperature and Relative humidity were recorded from three selected polluted sites in Assam i.e. Gas Gathering Station, Rudrasagar, Coal Field of Ledo (Margherita) and Nagaon Paper mill, Jagiroad. Sites were selected on the basis of nature of industries and nature of pollutants. To study the impact of pollutants on plants, plant samples common to all three sites were collected from the sites and analyzed. During analysis plant characters like total chlorophyll contents, specific leaf area (SLA), leaf dry matter content (LDMC), leaf stomatal index and leaf thickness were studied. Along with plant samples Butterflies population at all the three sites were surveyed and recorded.



Agarose gel (1%)



Phylogenetic tree in MEGA 3.1 software using neighbour joining method.

Project No : **BSC-0116**

Project Title : **Therapeutics of Chronic Obstructive Pulmonary Disease (COPD) and related respiratory disorders**

NEIST Title : **Chronic obstructive pulmonary disease: Study of differential immune responses through gene environment interaction**

Funding Agency : CSIR, New Delhi

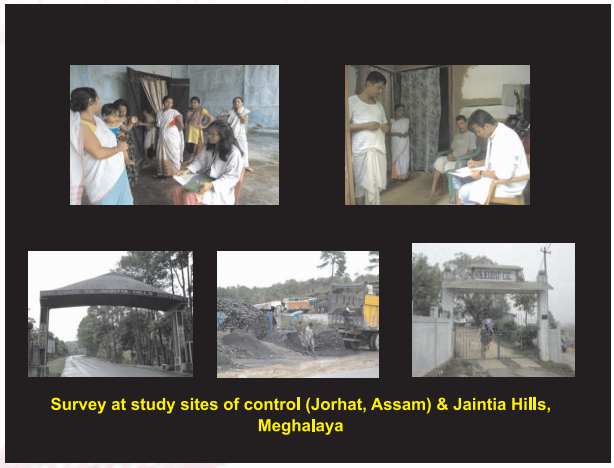
PI & Members : Dr B G Unni, Nodal Scientist, Dr H P Dekabaruah, Co- Nodal Scientist, Dr P K Baruah,, Dr T Bora, Dr Jatin Kalita, Mr R C Bharali, Mr D Ozah,

Objectives:

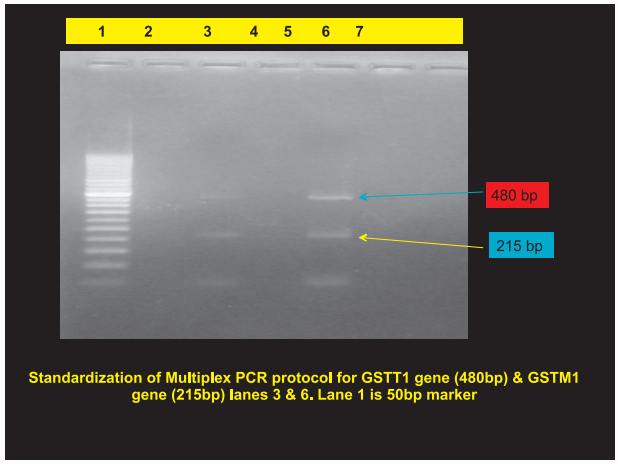
- To study the impact of environmental factors and genes (GSTT1, GSTM1, α_1 Antitrypsin and HMOX1) interactions in Chronic Obstructive and Pulmonary Disease (COPD)

Significant Achievements:

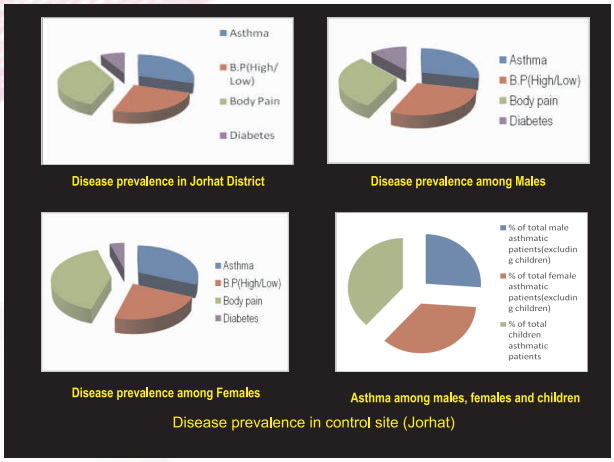
Health camps and survey were conducted in Jorhat district and in Ledo (Tirap colliery) in Assam. Experimental sites, survey and health camps near coal mine at Jaintia hills Meghalaya for examining the COPD patients and permissions to hold such health camps were also obtained. Air analysis were also carried out at Jorhat as the control and near Coal mine at Ledo as experimental site. In the coal mining site, most of the diseased populations are found to be suffering from respiratory problem (29%) which includes cough and sputum, chest pain, asthma, blood in sputum and T.B. Among the control and experimental sites (open cast coal mine site) at Ledo is found to be most polluted with the highest amount of suspended particulate matter, nitrogen dioxide, sulphur dioxide levels .Analysis of respirable/non respirable particulate matters is under progress. Standardization for multiplex PCR protocol for GSTT1 & GSTM1 genes are being completed.

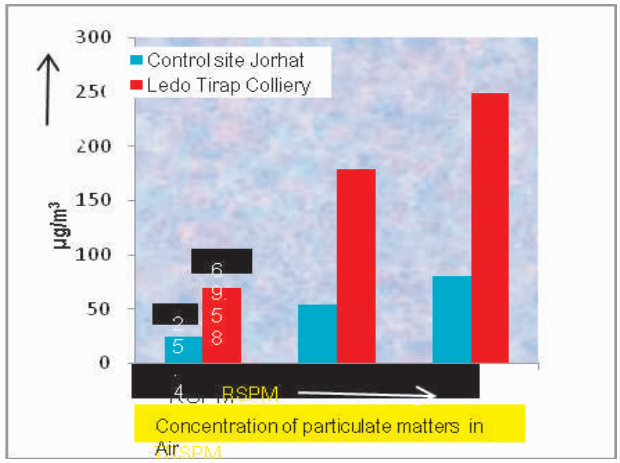


Survey at study sites of control (Jorhat, Assam) & Jaintia Hills, Meghalaya



Standardization of Multiplex PCR protocol for GSTT1 gene (480bp) & GSTM1 gene (215bp) lanes 3 & 6. Lane 1 is 50bp marker





Project No : **BSC 0117**

Project Title : **Plant microbe and soil interaction**

Funding Agency : CSIR, New Delhi

PI & Members : Dr BS Bhau,**PI,** Dr SB Wann, Dr Mohan Lal ,Mr Bitupon Borah

Objectives:

- Isolation and identification of bacterial strains from the various areas of Indo-Burma mega biodiversity hot spot. An emphasis will be given for bacillus and pseudomonas strains from the Indian region.
- Selection of potential strains for growth promotion and nematode control studies. The strains isolated by NEIST Jorhat from this region will also been screen for the same.
- Bacterization of patchouli saplings with selected strains in gnotobiotic and nursery condition.
- Physiological changes in bacterized host plants grown in soil infested with nematodes under gnotobiotic and nursery conditions.
- Development of a bacterial formulation of potential strains and their efficacy evaluation in patchouli cultivation under different agro-climatic conditions.
- Large-scale host gene-expression profiling study of a interaction between a root-knot nematode and a plant carried out by a microarray strategy after PGPR treatment.
- Quantitative RT-PCR (qPCR) to validate the microarray data.

Significant Achievements:

Soil samples were collected from various part of North-Eastern region and screened for their PGPR activity both qualitatively and quantitatively. Forty bacterial samples showed positive PGPR activity of which P3, P9, P13, R9 and H1 showed the highest PGPR activity like siderophore production, phosphate solubilization, HCN production,

IAA production and calase activity. The nematode diseases on patchouli plant planted in NEIST campus were studied and nematodes isolated from infected patchouli plant were identified as *meloidogyne incognita)* and maintained them in tomato plant in earthern pots under greenhouse conditions. Twenty selected bacterial strains were tested in *in vitro* conditions against *meloidogyne incognita* and found H1 strains effectively killed J2 stage *meloidogyne incognita.* Biochemical identification of the forty isolated strains were investigated according to Bergies manual of systematic bacteriology. Hi strains in combination with or without P3, P9 and P13 and this work is still in progress. Different defense related enzymes were screened for their activity upon infection with *meloidogyne incognita* and found that peroxidase and chitinase showed more activity as compared to polyphenol oxidase. Molecular identification of *meloidogyne incognita* and the bacterial strains were still in progress.

Project No. : **BSC-0117 (PMSI)**

Type of Project : **CSIR-Network**

Title of Project : **Role of ACC-deaminase Producing Bacteria on Alleviation of Water Stress Affect in Pulse Crops (RAWS)**

PI & Members : Dr. Ratul Saikia, PI, Dr. Tarun C. Bora, Co-PI, Dr. H. P. Deka Baruah, Co-PI, Mrs. Archana Yadav, Ms. Juthika Saikia & Ms. Rajashree Dhandia.

Sponsoring Agency : CSIR, New Delhi

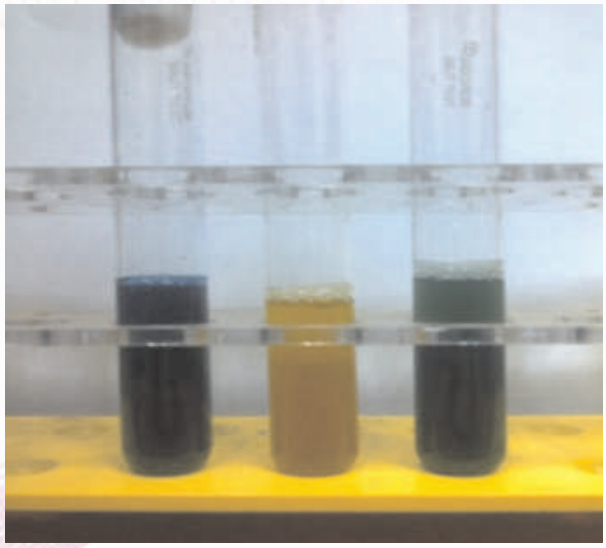
Duration of Project : 5-years

Objective : ***Isolation and screening of rhizobacteria for plant growth promotion with special reference to black gram. Genotyping and assessment of growth promoting traits in PGPR. Expression analysis of ACC-deaminase genes from PGPR.***

Role of ACC-deaminase producing bacteria for plant growth promotion under water stress condition.

Significant Achievements

- **Isolation of ACC-deaminase producing rhizobacteria with multiple growth promoting traits** A total of 80 nos. of ACC-deaminase producing bacteria have been isolated from pulse rhizosphere collected from different areas of Jorhat, Assam. Out of these 60%, 90%, 30% and 40% of the isolates showed positive for production of IAA (indole acetic-acid), NH_3, siderophore and HCN respectively while 70% of them are found to be phosphate-solubilizers (Fig.1). In addition, few of the isolates also exhibited antifungal activity against Rhizoctonia solani and Fusarium oxysporum.
- **16S rRNA gene sequencing and identification** Sequencing of 16S rRNA gene for 30 promising bacterial strains were done and sequence alignment revealed that most of strains were affiliated to genera of Pseudomonas, Burkholderia, Bacillus, Ochrobactrum, Serratia, Comamonas, Staphylococcus, Klebsiella and Cupriavidus. The sequences were submitted to the NCBI-GenBank and accession nos. are KJ784475, KJ784476, KJ784477, KJ801950, KJ784478, KJ801951, KJ801952, KJ801953, KJ784479, KJ784480, KJ818119, KJ831073, KJ831074, KJ831075 etc.
- **Effect on seed germination and plant growth-promotion under drought conditions** ACC- deaminase producing rhizobacterial strains exhibiting multiple growth promoting attributes in vitro tests were selected and used as inoculants for the seed germination assay. It was observed that the inoculated black gram seeds had a greater root length than the uninoculated (control) seeds. The root length of the seeds treated with the strains Ochrobactrum pseudogrignonense RJ12, Pseudomonas sp. RJ15 and Bacillus subtilis RJ46 was significantly higher than the others, with a seed germination percentage of 80%, 90% and 100%, respectively. When these 3 strains were used for pot experiments it was found that the plant response to the consortia of the 3 strains was remarkably high as revealed in root length, shoot length, fresh weight and dry weight even under drought stress condition.





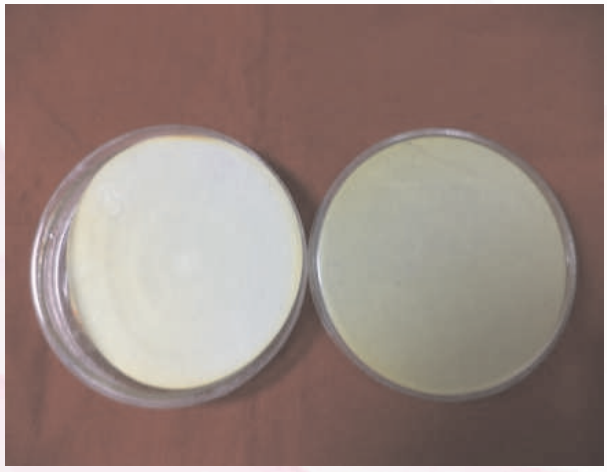


Fig. 1. Plant growth promoting traits of rhizobacteria, ***A.*** siderophore production
B. phosphate solubilization and C. HCN production test



Positive control (watered) *Consortium in water deficit condition* *Negative control (water deficit condition)*

Fig. 2. Experiment conducted in plastic and earthen pots (data not shown) to determine the growth promoting activity of the consortium of three ACC- deaminase producing PGPR strains under water stress (deficit) condition- *Ochrobactrum pseudogrignonense* RJ12+ *Pseudomonas* sp. RJ 15 + *Bacillus subtilis* RJ46.

Project No : **CSC-0106**
Project Title : **Biocatalysis for industrial application & greener organic synthesis**
CSIR-NEIST Title : **Functionalization, glycosylation and acylation using transferase (AATs) of Artemisinin and related phytochemicals for value addition**
Funding Agency : CSIR, New Delhi
PI & Members : Dr T C Bora, Nodal Scientist, Dr N C Barua, Dr R L Bezbaruah,Dr Ratul Saikia, Mr A C Kakoty, Mrs Archana Yadav.

Objectives:

- Collection and screening of microbial strains from NE gene pool & their maintenance as stock cultures.
- Screening for targeted and desired functionalization of Artemisinin.
- Screening for targeted and desired glycosylation of phytochemicals.
- Screening for Acylation using acyl transferase(AATs) and related catalysts to achieve the desired goal.
- Optimization and improvement of the strains and their molecular characterization. Process parameters will be completed. Patents will be filed. Reports will be submitted to the nodal institute.

Significant Achievements:

- Collected 51 samples from specific niches and isolated 515 strains from NE gene pool.
- Screened for targeted activities/enzymes using SOP for biotransformation using Artemisinin as a substrate.

- Reaction product were run in TLC to detect biotransformation or derivatives formed using ethyl acetate and hexane(1:5) as running solvent.
- Short-listed 20- fungal strains for further experiments.
- Rechecked their activity and finally 4 fungal strains were selected for further study.
- Identification of the transformed products obtained after fractionation/column chromatography are in progress.

Project No : **CSC-0116**
Project Title : **Photobiological process to produce bioenergy through carbon sequestration from atmosphere and wastewater BioEn**
CSIR-NEIST Title : **Screening of efficient algal species from North-East India for biomass culture to be utilized for biofuel/biodiesel production**
Funding Agency : CSIR, New Delhi
PI & Members : Dr H P Deka Boruah, Nodal Scientist, Dr T C Borah, Dr R Saikia, Dr Pinaki Sengupta

Objectives:

- Selection, collection of efficient algal species from North –East India for biofuel production
- Culture of algal species and standardize the parameters for maximum biomass production.
- Mass culture production in photobioreactors and in natural condition
- Mass culture production for biomass and harvesting of cells for the concern laboratory for biofuel / biodiesel production.

(ii) Inhouse, Grant in aid & Consultancy Projects

Project No : **MLP 2000**
Project Title : **Bio-profiling and bio-prospecting microbes, plants and insects from North East gene pool and their application potentials**
Funding Agency : CSIR, New Delhi
PI & Members : Dr B G Unni,PI, Dr TC Bora, Dr R L Bezbaruah, Dr S B Wann, Dr H P Deka Boruah, Mr A C Kakoty, Dr R Saikia, Dr M Khongsai, Dr Anil K Singh, Dr Jatin Kalita, Ms A Yadav,Ms PBordoloi.

Objectives:

- Survey and identification of specific niches/settings, and collection & isolation of samples and strains.
- Screening & short-listing strains /metabolites/ species for potential functionalities
- Molecular characterization of species/metabolites following SOP
- In-vitro, in-vivo asaay of leads/hits and field scale application of consortia.
- Optimization of process parameters & developments of process/technology for gainful utilization.

Significant Achievements:

a) Collected 96 samples from specific niches of N E gene pool of Tawang, Arunachal Pradesh, Gibbon forest, Buroi, Dikrong areas.
b) Isolated 661 strains from 96 samples collected from specific niches of N E Gene pool.
c) Screened for stress tolerance and plant growth.
d) Screened for novel bioactive molecules.
e) Screened for lipase and ACC-deaminase activity.
f) Mode of action of anti-cancer molecule was completed.

Experiments on mode of action of bioactive molecule exhibiting *in-vitro* anti-prostrate cancer activity was completed:

To understand the mode of action of this bioactive molecule, isolated from endophytic fungi, on the test pathogens (*Candida albicans* and *Escherichia coli*), fluorescein isothiocyanate (FITC) and propidium iodide (PI) uptake assay was designed and assayed. For immobilization of microbial cells, poly-L-lysine (PLL) coated slides were prepared. After 5 minutes solution was removed by aspiration and washed with MilliQ water. Slides were allowed to dry for 2 hours before introducing cells. Then *E. coli* and *C. albicans* were grown to attain an OD 0.6 in Luria broth (LB) and potato dextrose broth (PDB) respectively. The cells were washed and suspended (2×10^7cfu/mL) in 10 mM sodium phosphate buffer (pH 7.4) and incubated with targeted molecule at its MIC concentration for 1 h at 30°C.

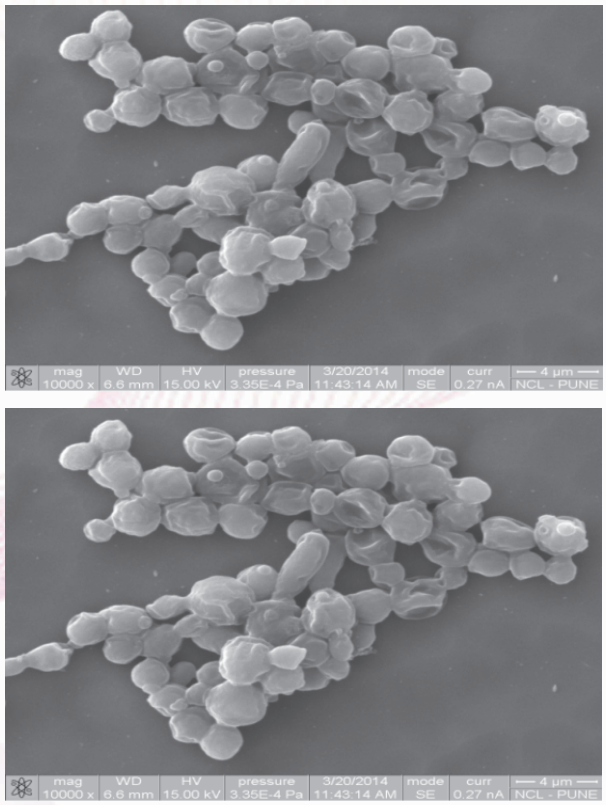


FIG 1: SEM images of C. albicans (A-control/untreated, B- treated)

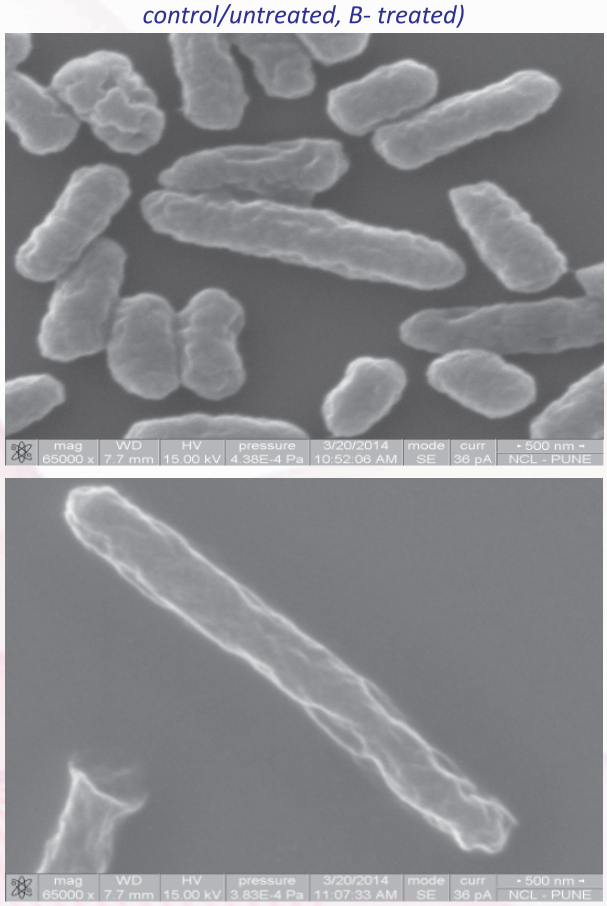


FIG 2: SEM images of E.coli (A-treated, B-control/untreated)

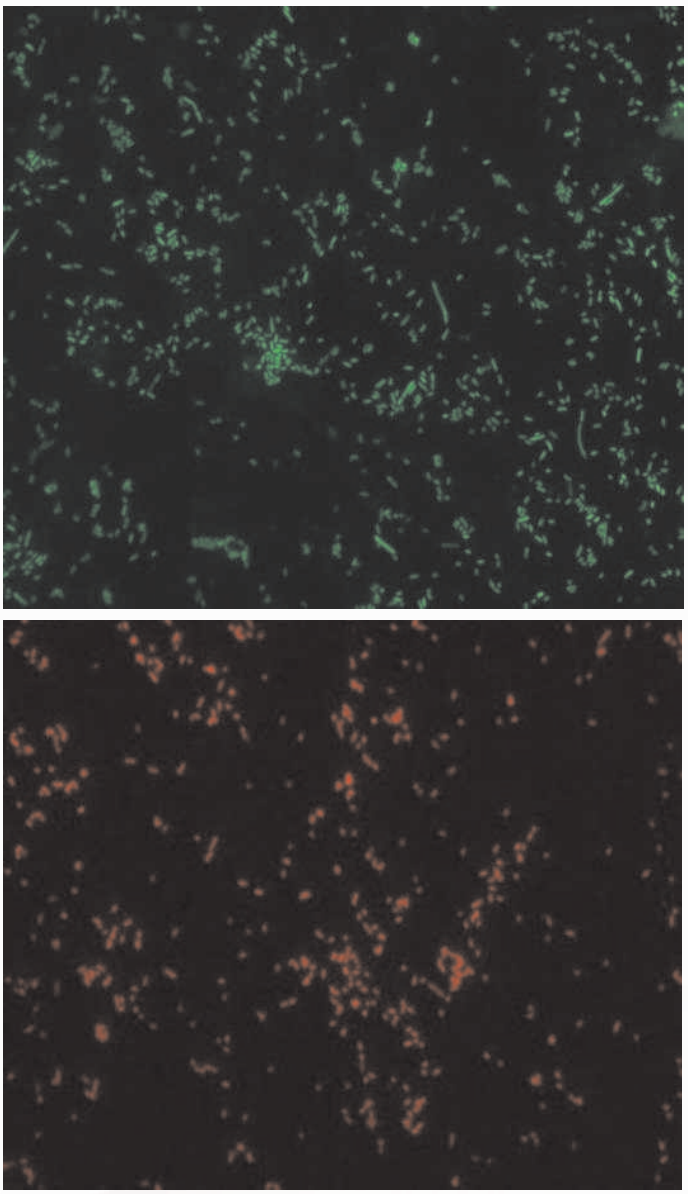


Fig3: Fluorescence images in SEM (FITC) and (PI) of E.coli

The microorganisms were then immobilized on poly-lysine (PLL) coated glass slide for 1 h at 30°C, followed by addition of FITC (10µg/mL) also suspended in the same buffer. Control experiment was performed using buffer solution without compounds. The slides were washed with 10mM sodium phosphate buffer (pH 7.4) and viewed under a Zeiss fluorescent microscope equipped with an AxioCam camera. The same procedure was followed for the assay with PI.

No fluorescence was observed in the cells in the absence of targeted molecule. Because the entry of fluorescein isothiocyanate (FITC) requires significant membrane damage, the observed fluorescence behaviour of the cells suggests that the molecule rendered the cells permeable to FITC. The DNA binding dye PI stains only dead cells.

Scanning electron microscopy (SEM) analysis of treated and untreated cells was also carried out. E. coli and C. albicans cells were grown in LB and PDB respectively until an optical density of 0.6 at 600nm was attained. Cells were washed twice with 10mM sodium phosphate buffer (pH 7.4) to remove media, then resuspended in same buffer. Cells were incubated with inhibitory concentrations of targeted molecule at 37^{0}C (E. coli) and 28^{0}C (C. albicans) for 1hr, then washed twice with buffer and pelleted down at 5000 rpm for 10min. For fixation of cells, the pellet was incubated with 1% glutaraldehyde in phosphate buffered saline for 30min. A drop containing cells was placed on a silicon wafer and dried overnight. Wafers were then gold coated and observed under scanning electron microscope.SEM images showed morphological alterations including deformation and shrinkage in both the cells. The test was carried out at NCL, Pune as joint collaborative R&D by Shruti Talukdar, SRF, Biotechnology Division.

Project No : **MLP-8000/1**

Project Title : Development of agro-technology & chemical investigation of selected medicinal, aromatic and edible plant of Arunachal Pradesh

Funding Agency : CSIR, New Delhi

PI & Members : Mr Chandan Tamuly,PI, Dr BC Baruah, Jayanta Bora, Moushumi Hazarika.

Objectives:

- To introduce various medicinal, aromatic and edible plants.
- To developed new/better strain of medicinal/ aromatic plants.
- Development of agro technology for commercial cultivation.
- Chemical investigation of unexplored medicinal, aromatic and wild edible plant of Arunachal Pradesh.
- Evaluation of antioxidant activities, phenolic content, flavonoids content of selected medicinal/edible plant and parts thereof.
- Evaluation of nutraceuticals and mineral content of selective medicinal/edible plant species.
- To generate knowledge, enhance the value of knowledge and its application for agro based industrial development in the rural sector.
- To generate employment opportunities for socio economic uplift in the rural sector

Significant Achievements:

Photocatalytic activity of Au nanoparticles synthesized by using Piper pedicellatum C.DC fruits Synthesis of Au nanoparticles by using Piper pedicellatum C.DC fruits extract in aqueous medium is reported. Photocatalytic activity of the Au nanoparticles was investigated by degradation of Methyl red (MR) dye under UV light. The rate constant of photocatalytic degradation of MR was investigated. The results show that Au nanoparticles have suitable photocatalytic activity for the degradation of MR dye Biosynthesis of Gold (Au) nanoparticles by using Gymnocladus assamicus and its catalytic activity: Here we first report synthesis of gold (Au) nanoparticles by using Gymnocladus assamicus pod extract in aqueous medium. The Au solution shows potential catalytic activity in reduction of 4-nitrophenol to 4-aminophenol.

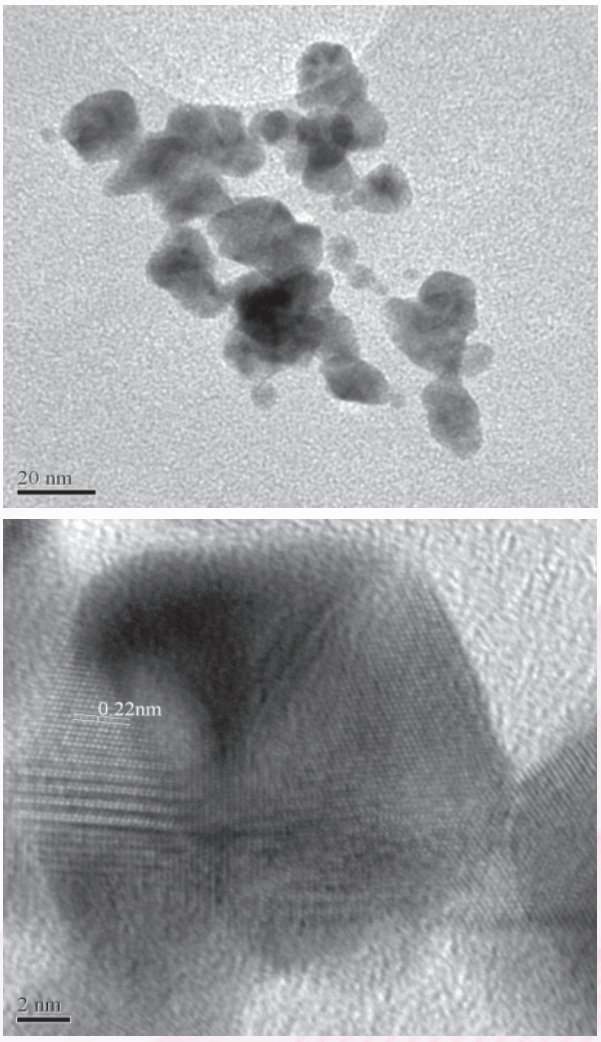


Figure 1: (a) HRTEM images of Au nanoparticles, inset: its lattice fringes formed by using G. assamicus pod extract (b) single Au nanoparticles

Undertook nearly 10 field survey tours in various parts of (Assam: Jorhat, Golaghat, N.C. hills, Dima Haso dist.) Arunachal Pradesh: Papum Pare dist., Meghalaya: Ri Bhoi, E. Khasi Hills, E. & W. Jaintia hills dist., Manipur: Imphal East, Imphal West, Tamenglong dist, Mizoram: Aizwal, Lungleh dist., Nagaland: Nagalnd and Kohima dist., Tripura: North Tripura, Unokoti, Dhalai, Khowai dist.) and collected nearly 90 nos. of accessions including male and female individuals of *Horsfieldia amygdalina* (Wall.) Warb., *H. kingii* (Hook.f.) Warb., *Knema linifolia* (Roxb.) Warb., *K. angustifolia* (Roxb.) Warb., *K. tenuinervia* W.J. de Wilde, fruiting individuals of *Endocomia macrocoma* subsp. *prainii* (King) W.J. de Wilde and individual with initiation of flowering in *K. globularia* (Lour.) Warb.

The phenological, ecological and ethnobotanical primary data were documented (through photography and video) and the data available in the secondary sources were compiled.

All the collected specimens were processed for preparation of herbarium and phytochemical screening. Nearly 25 herbarium sheets were prepared.

The deposited herbarium and freshly collected specimens were studied under stereomicroscope for various phenotypic characters. The various plant parts were dissected and measurements were taken for thorough study.

Prepared a checklist of the family *Myristicaceae* distributed in India and updated nomenclature, delimited circumscriptions, made descriptions for 6 taxa and prepared botanical illustrations.

User-friendly taxonomic key was prepared for these species.

The process of extraction of various dried plant parts viz. leaves, twigs, bark, seeds etc. was standardized in various non polar and polar solvents.

Effect of CTAB in biosynthesis of Au-nanoparticles using *Gymnocladus assamicus and its biological evaluation:* *The shape-controlling role of cetyltrimethylammonium bromide (CTAB) in biosynthesis of Au-nanoparticles is reported by using Gymnocladus assamicus pod extract. The Au-nanoparticles are spherical in presence of CTAB and the shape and size of the Au nanoparticles strongly depend on the concentration of CTAB. The bacterial activity was investigated against the gram negative bacteria Pseudomonas aeruginosa and gram positive bacteria Staphylococcus aureus. The bacterial growth kinetic is monitored in nutrient broth. It was observed Au nanoparticles shows strong antibacterial activity against P. aeruginosa and S. aureus*

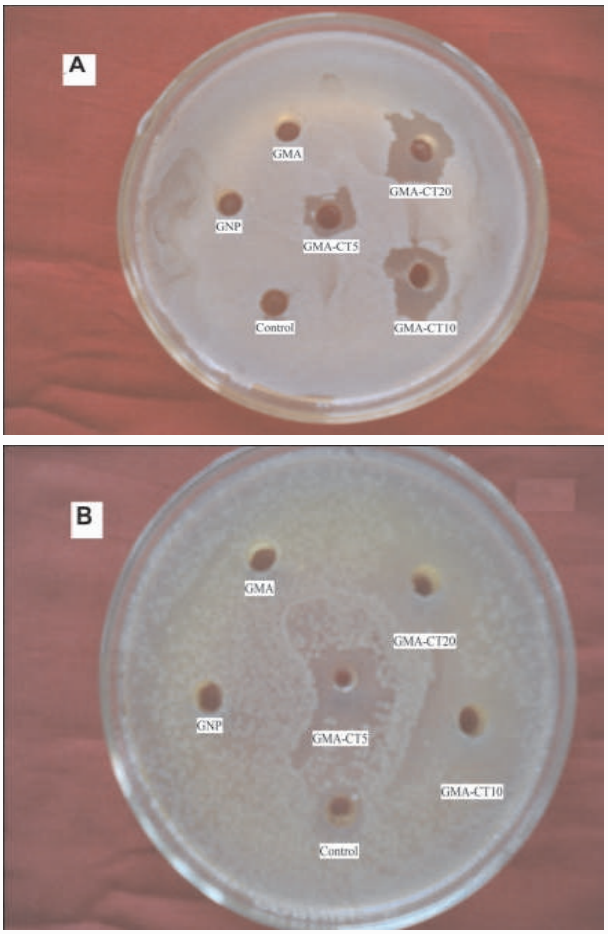


Fig.. Zone of inhibition produced by Au-nanoparticles seeded with varying concentrations of CTAB.

- ***In vitro study on antioxidant activities and phenolic content of three Piper species from North East India:*** *The antioxidant activities of water (W) methanol (ME), water: methanol (1:1), ethanol (ET), chloroform (CH), ethyl acetate (EA) and petroleum ether (PE) extracts of the leaf of three Piper species viz; Piper betle L, Piper betleoides C.DC and Piper wallichii (Miq.) Hand-Mazz was investigated using several in vitro antioxidant assays. The phenolic acid and flavonoids i.e. catechin, quercetin, gallic acid, coumaric acid and protocatechuic acid which may be responsible for antioxidant activities in the fraction of best solvent system were evaluated. The study revealed that Piper species may be used as one of the source of potential antioxidants.*

- ***Ethnobotany and antioxidant determination of Phoebe cooperiana fruit-*** *A highly utilized wild fruit in Arunachal Pradesh, India, and anti-oxidant properties of the fruit were studied.*

Project No : **GPP 262**

Project Title : **A study on Taxonomy and Ethno-botany with an emphasis to biochemical parameters of the family *Myristicaceae* R. Br. in North East India**

Funding Agency: SERB, Department of Science & Technology, GOI, New Delhi

PI & Members : Dr Dipanwita Banik, PI, Mr P P Bora

Objectives:

- A critical Taxonomic study of the family Myristicaceae in North East India based on thorough survey.
- To provide correct identification, correct nomenclature with full citation with all the synonyms and types, assigning the circumscription of different taxa, detailed description, distribution, phenology, ecological notes, vernacular names, economic uses, specimens examined, illustration, photographs and distribution maps.
- To collect and provide data on ethnobotany.
- To screen the content of fixed oil, flavonoids, amino acids etc. from various plant parts of different species to check its correlation with taxonomy.

Significant Achievements:

Consulted relevant literatures and types and other specimens in the following herbaria: CNH, BSI, Kolkata (CAL), Arunachal Pradesh Circle of BSI (ARUN), State Forest Research Institute, Itanagar (SFRI) etc. Undertook nearly 10 field survey in various parts of NE and collected nearly 90nos of accessions of Horsfieldia amygdalina (Wall.) Warb., H.kingii (Hook.f.) Warb.,Knema linifolia (Roxb.) Warb., K.angustifolia (Roxb.) Warb., K. tenuinervia W.J. de Wilde, Endocomia macrocoma subsp. prainii (King) W.J.de Wilde and K.globularia (Lour.) Warb.



Photo 1: Male inflorescence of Knema linifolia (Roxb.) Warb



Photo 2: Infructiscence of Knema angustifolia (Roxb.) Warb.



Photo 3: Male flower of Knema linifolia (Roxb.) Warb.

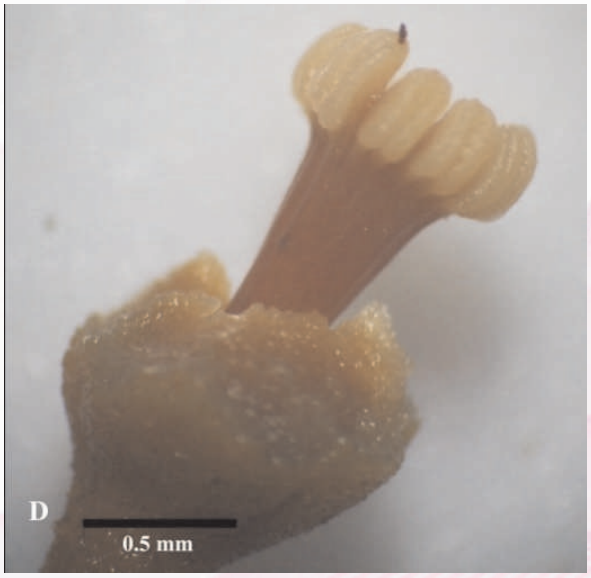


Photo 4: Synandrium of Knema angustifolia (Roxb.) Warb.

Project No : **GPP- 0271**
Project Title : **Detoxification of mustard seed based product through fermentation process based on North East traditional practices and their value addition**
Funding Agency :
PI & Members : Dr T C Bora ,PI, Dr M Khongsai, Co-PI, Ms Kankona Talukdar ,P A

Objectives:

- Microbial detoxification of glucosinolates and their degradation products for improving protein quality and availability, whilst removing the antinutritional compounds. Sinigrin (2-propenyl-glucosinolate) will be used as a model for isolation of microbial degraders of glucosinolates due to availability, solubility and ease of estimation.
- Documentation of the traditional fermented food products.

Significant Achievements:

- Collected 25 samples of traditionally prepared fermented mustard seed cake from various part of north east India.
- Isolated 70 bacterial strains from fermented samples.
- Screened for production of myrosinase enzyme with isolated bacterial strains.
- Myrosinase activity was assayed according to the method of Palmieri **et al. 1982,** where strain KHdss shows more activity.
- Biochemical test of the KHdss strains shows a positive of citrate and ornithine utilization.

Project No : **GAP-0178**
Project Title : **Exploration and Screening of Bacterial Diversity in North-East dia and their Biocontrol Properties**
Funding Agency : ICAR, New Delhi
PI & Members : Dr Ratul Saikia , PI, Dr Tarun C Bora, Co-PI, Mrs Archana Yadav.

Objectives:

- Collection of environmental samples from different habitant of North-East States of India
- Isolation, purification and preservation of bacteria
- Screening of bacterial isolates for antimicrobial activity
- Characterization of potential isolates and diversity analysis

Significant Achievements:

Genotying of fluorescent pseudomonads associated with green gram (Vigna radiata. L) rhizosphere. During this investigation, a total of 120 culturable fluorescent pseudomonads were isolated from vegetative as well as reproductive growth phase of green gram rhizosphere. PCR based techniques, i.e. Rep PCR, amplified ribosomal DNA restriction analysis (ARDRA) and ribosomal intergenic space analysis (RISA) revealed significant intrageneric diversity among the isolates associated with reproductive growth phase of green gram. *16S rRNA* based diversity study was carried out among 85 distantly related fluorescent pseudomonads isolates. *16S rRNA* partial sequencing analysis identified *Pseudomonas aeruginosa* as the dominant group.

Functional diversity of fluorescent pseudomonads. Functional diversity among the 120 isolates associated with green gram rhizosphere were investigated by screening for the production of enzymes/hormones such as phosphatase, indole-3-acetic acid (IAA),1-aminocyclopropane-1-carboxylate (ACC) deaminase, chitinase and antimicrobial metabolites. Real time qPCR based relative expression of the three important bacterial stress responsive genes, i.e. *acdS*, *KatA* and *gbsA* in *P. aeruginosa* GGRJ21 were analyzed due to its stable growth kinetics under osmotic stress conditions. High production efficiency of different plant-growth promoting (PGP) traits as well as consistent up-regulation of bacterial stress responsive genes under osmotic stress condition could promote GGRJ21 as a potent plant growth regulator.

Alleviation of drought stress in green gram by a stress tolerant strain of Pseudomonas aeruginosa. The role of osmotic stress tolerant *Pseudomonas aeruginosa* GGRJ21 on drought stress alleviation in host plants was studied in both the green house and field conditions. An high *production of* reactive oxygen species *(ROS) scavenging enzymes and cellular osmolytes; increased root length, shoot length, weight, relative water content, and a stronger up-regulation of the drought stress responsive genes, i.e.* dehydration-responsive element binding protein (*DREB2A*), catalase (*CAT1*) and dehydrin

(*DHN*) *were recorded in bacterial inoculated plants in comparison with the uninoculated control plants tested under drought conditions (Fig. 1). The f*ield experimental data shows an increase in biomass and better growth and development in inoculated and stressed plants when compared to untreated and stressed plants.

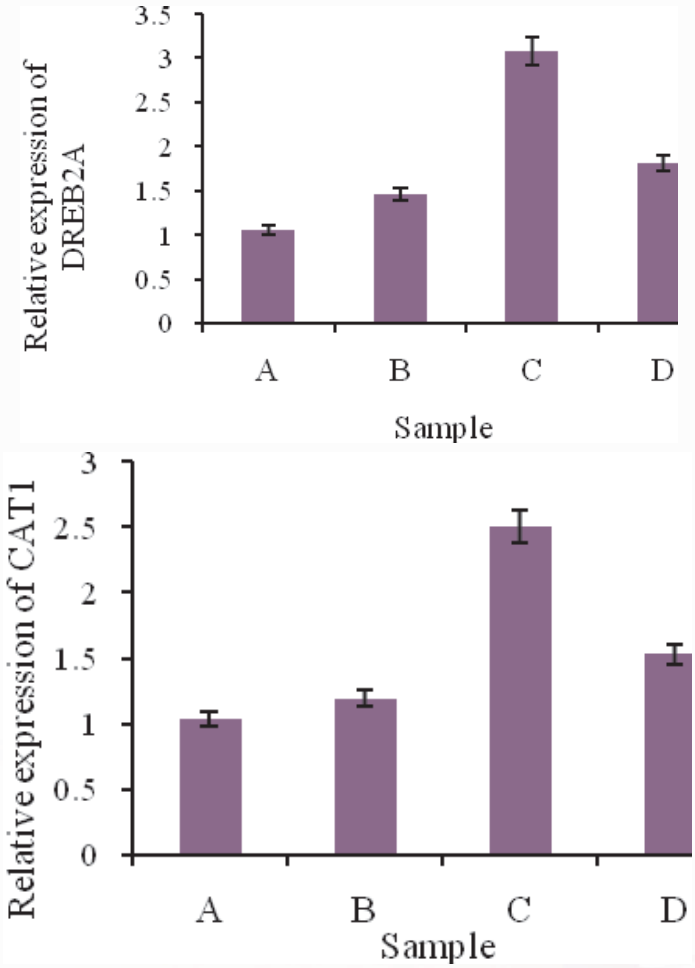
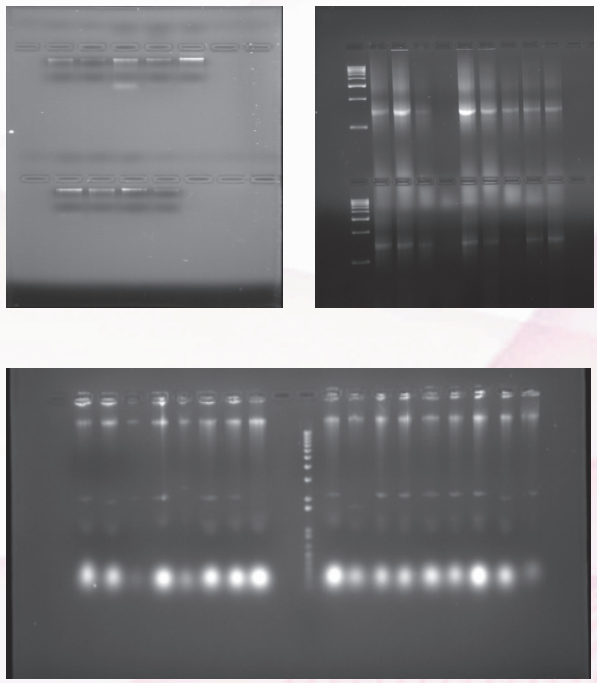
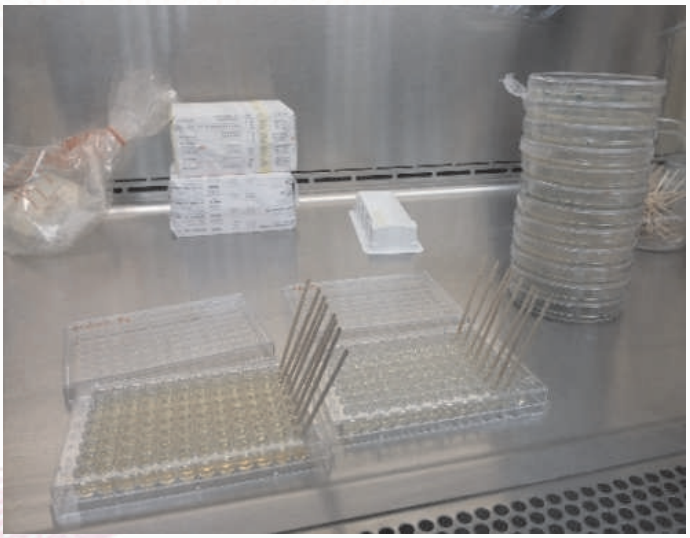


Fig. 1. Relative gene expression level of a. DRAB2A and b. CAT1 in green gram growing on different treatment conditions. A–uninoculated watered plant, B- inoculated plants with sufficient water supply, C–inoculated plants under stress, D-uninoculated plants under stress) (Sarma and Saikia, Plant & Soil, 2014; 377:111–126).

Bacterial community profiling in cold-adapted region of Arunachal Pradesh through metagenomics approach. The bacterial community structures in alpine acidic soils of Arunachal Pradesh are not focused since long and as such the genetic resources are yet to be mined. It is quite evident from published literature of the need for exploring cold climatic geographical niches in order to describe the architecture of microbial flora/fauna prevalent in such environments. A few sites in West Kameng district which experience frequent freeze thaw cycle throughout the year, microaerophilic tension at high altitudes were taken into evaluation for bacterial diversity. Environmental DNA (eDNA) was isolated from the soil/water samples. The full length 1.5 kb 16S rRNA gene amplified from the metagenomes were subjected to vector ligation using T4 DNA ligase and subsequent transformation into *E. coli* JM109 hosts bearing lacZΔM15 mutation. The generated colonies on Ampicillin/X gal/ IPTG plates were picked for clone library generation. The generated library was screened for desired vector + insert by cracking gel method and processed for plasmid purification from positive clones. T7/SP6 promoter primer was used for sequencing of insert (Fig. 2). A few accession numbers obtained from GenBank are KF312276 - KF312299.

Bacterial diversity is also addressed using the Illumina MiSeq Paired end (151 bp x 2) Next Gen Sequencing approach. Amplicon sequencing of V3 variable region is done from different barcoded samples. The fastq reads after quality checking will undergo adapter/singleton removal. The BAM/SAM alignment libraries will undergo downstream analysis against Greengenes database. MG-Rast, MeGAN, Qiime will be deployed for phylogenetic inferences.





OTU clustering and sequencing of insert

Fig.2.*Bacterialdiversitystudythroughmetagenomicsapproach,a. eDNA isolation; b. 16S rRNA gene amplified; c. 16S rRNA gene cloned in TA vector and screened by cracking method; d. positive clonesselectedandlibrarygenerated;e.OUTclustering*

Project No : **GAP-0255**

Project Title : **Genetic diversity of antimicrobial agents producing Streptomyces isolated from protected forest area of Assam and Arunachal Pradesh**

Funding Agency : DBT, New Delhi

PI & Members : Dr Ratul Saikia, PI, Dr Tarun C Bora, Co-PI, Dr Manab J Bordoloi, Co-PI, Mrs Archana Yadav, Mr Dharmaraj Deka, Mr Manabjyoti Dutta,

Objectives:

- Genetic diversity of Streptomyces spp.
- Chemical profiling of antimicrobial metabolites.
- Selection of most efficient strain to control phytopathogen

Significant Achievements:

Psychrotolerant antifungal Streptomyces and the shift in chitinase gene family. A total of 210 *Streptomyces* were isolated from the soil samples of Tawang, Arunachal Pradesh where temperature varied from 5°C during day time to – 2°C during the night. Based on antifungal activity, total 33 strains were selected. Optimal growth temperature for the strains was 16°C, with growth occurring down to 6 °C but not above 30°C. Phylogenetic analysis based on 16S rDNA sequences revealed the taxonomic affiliation of the strains with *different species of Streptomyces. Antifungal property was due to the* heat labile proteins. Comparative real-time qPCR study for chitinase expressing ability revealed that out of six promising antifungal strains, the strain *Streptomyces roseochromogenus* TSR12 was the most active producer of family 18 chitinase genes (Fig. 1). It is notable that *Streptomyces* strains with enhanced inhibitory potential is mostly due to family 19 chitinase gene, on the contrary, this study did not show any expression of the particular family in these six strains, however, expressed family 18 chitinase genes.

Purification and partial characterization of antimicrobial metabolit. Antimicrobial metabolite from the antimicrobial strain, *Streptomyces roseochromogenus* TSR12 was extracted and purified by TLC having R_f value 0.14, 0.22, 0.56, 0.67 and 0.85 (Fig. 2). The fraction, R_f 0.14 exhibited maximum antimicrobial activity *in vitro* was further purified. It was further analyzed by FTIR, ^{1}H NMR (300 MHz) and mass spectroscopy indicated that the molecule has CH_2-CH_2-CH_2, ester C=O group $(CH_3)_2C<$, isobutyrate, one end methyl group several OH and CH_3CO-

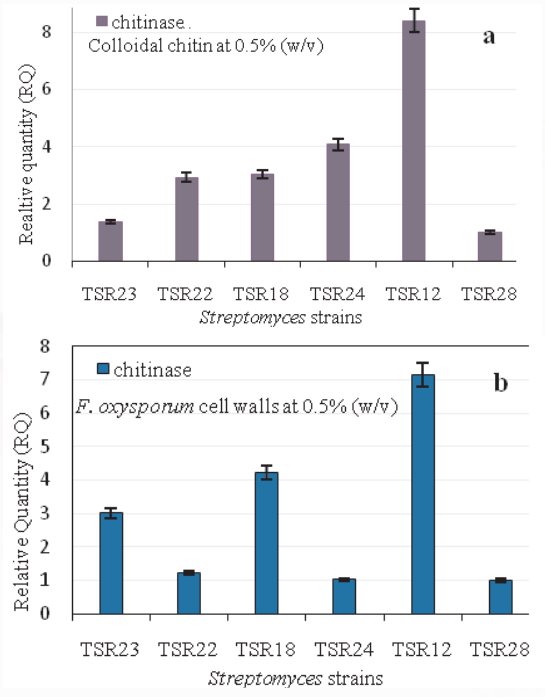


Fig. 1. Quantitative comparative gene expression of family 18 groups A chitinase genes. cDNA prepared from strains TSR23, TSR22, TSR18, TSR24, TSR12 and TSR28 after growth in (a)colloidal chitin (0.5% w/v) and (b) Fusarium oxysporum f. sp. ciceri cell wall (0.5% w/v) amended media were used for regulation of chi gene expression using real- time qPCR. (Debnath et al., Extremophiles, 2013; 17:1045–1059).

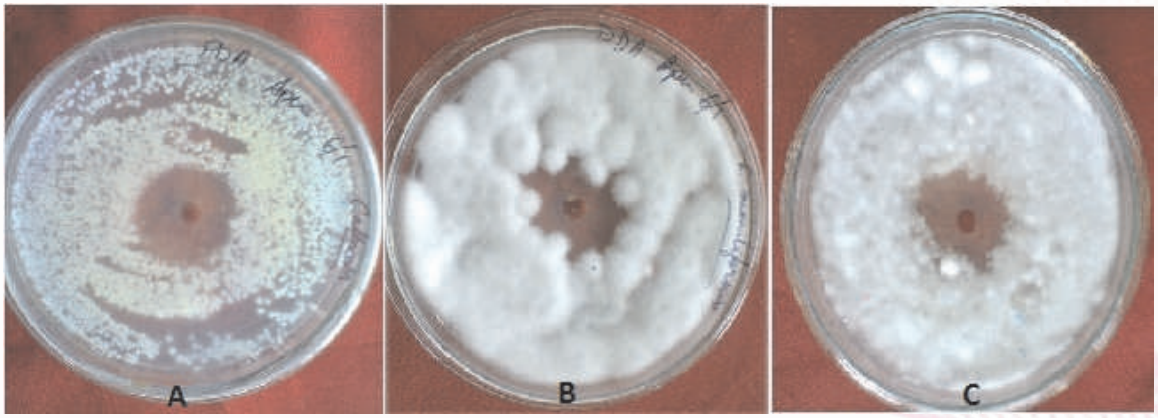


Fig. 2. *Antifungal activity against of Streptomyces roseochromogenus TSR12,* ***A.*** *Candida albicans,* ***B.*** *Fusarium moniliformes,* ***C.*** *Fusarium oxysporum*

Project No. : **GPP-0260**

Title of Project : **Screening and molecular characterization of microbial pathogen diversity of *Staphylococci* and development of diagnostic test for rapid detection.**

Funding Agency : Department of Biotechnology (DBT), Government of India

PI & members of Project : Dr. T. C. Bora, **Dr. B. S. Bhau,** Dr. S. B. Wann

Objectives:

- Survey, screening and isolation of *strains* of *Staphylococcus species from different niches of soil, food sources, hospital and clinical samples and maintain the cultures.*
- Characterization of cell surface proteome of *Staphylococcus* strains and production of high quality antibodies.
- Development of microbial genotyping methods for *strains* of *Staphylococcus species* based upon small sets of polymorphism selected from known genomic diversity on the basis of their optimal combinatorial informative power.
- Develop diagnostic test to identify infections with these virulent *Staphylococcus* strains for clinical isolates of other *Staphylococcus* strains.

Salient Achievements:

Staphylococcus strains were isolated from clinical samples from nearby Tea Estate in Jorhat district collected from wound swabs of patients. The 18 samples were tested for the presence of *Staphylococcus* strains by inoculation in Mannitol agar salt medium. The pure culture of the individual bacterial colony was further characterized and identified by Gram's staining. The studies show that most of the isolated clinical samples are Staphylococcal positive strains and none of the isolated Staphylococcus strains are methicilin resistant. The Staphylococcus strains are catalase positive. The test was used to identify organisms that produce the enzyme, catalase. All the isolated strains were showing negative activity against Phenylalanine deamination, H_2S production, Oxidase, Lysine utilization, Ornithine utilization, and Urease tests (Fig. 1, 2, 3).

PCRs of few of the DNA samples were tested and set up for amplifying a region of the conserved 16S rDNA region of the bacteria. Different sets of forward and reverse primers specific for bacterial 16S rDNA were used in the study in varying concentrations, which are as follows: Bac8f-rP2, fD1-rP2, U1-U2. But, it was observed from the electrophoretogram that no DNA sample got amplified with the sets of primers used. Primer dimer formation occurred which was evident from the band in the gel. Since, these primers did not work for amplifying 16S rDNA of *Staphylococcal* strains, new sets of *Staphylococcus* 16S rDNA specific primers have been designed and ordered.

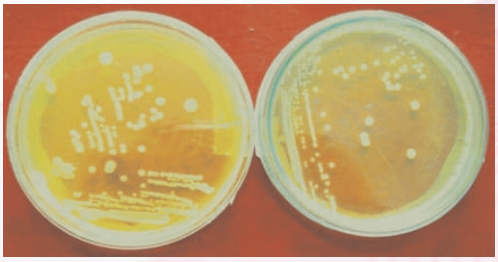


Fig. 1: Colonies of Staphylococcus strain in Mannitol salt agar medium.

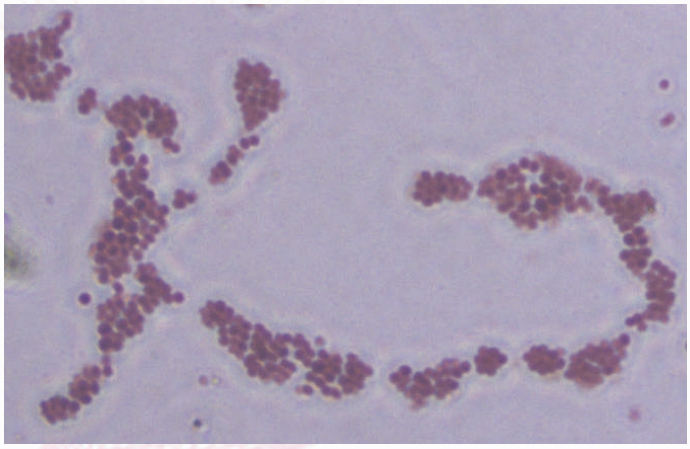
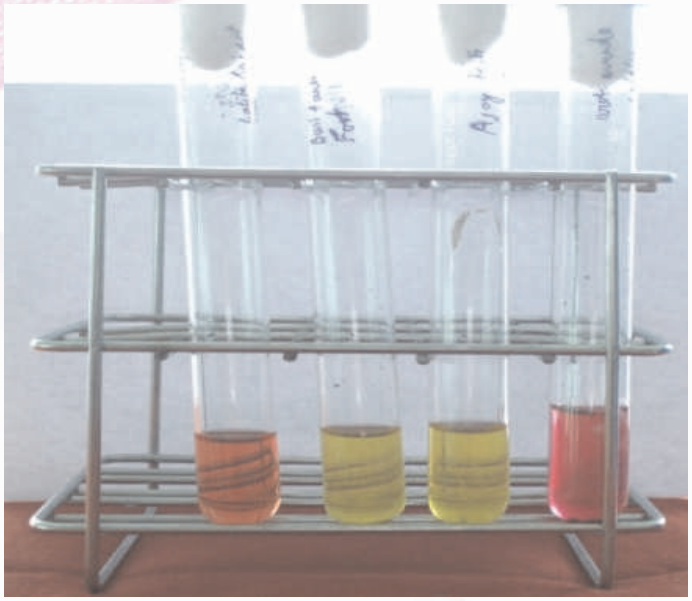


Fig. 2: ***Gram staining of*** *Staphylococcus strain.*



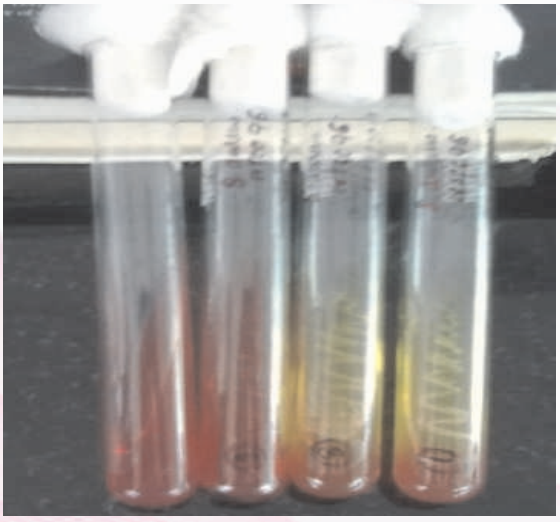


Fig. 3: **Biochemical characterization of** strains- (A) pink colour test tube (Control), (B) slight yellow test tube shows Staphylococcus strain.

Project No : **GPP-0265**

Project Title : **DNA Fingerprinting of Endophytic Actinomycetes Isolated From Protected Forest Areas of Assam and Mizoram.**

Funding Agency: Department of Biotechnology, New Delhi

PI & Members : Dr Ratul Saikia, PI, Dr Tarun C Bora, Co-PI, Mrs. Archana Yadav, Mr Animesh Gogoi, Ms Anwesha Gohain.

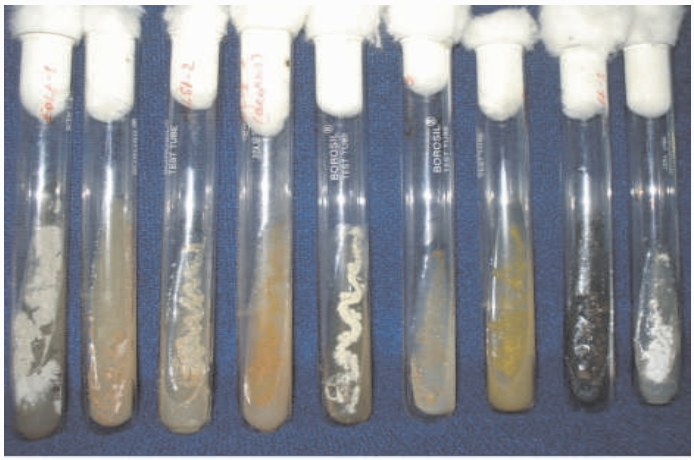
Objectives:

- Genetic diversity of endophytic actinomycetes
- Bioprofiling of endophytic actinomycetes
- DNA *Barcoding of biologically active strain(s)*

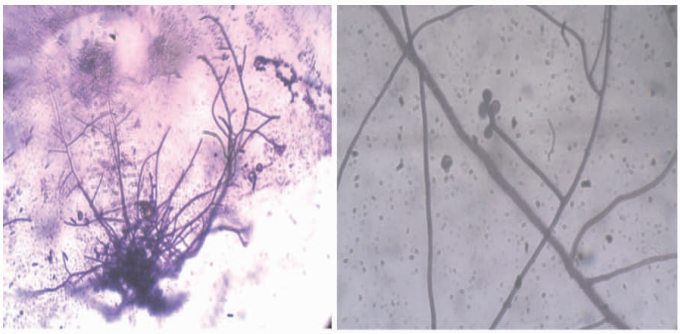
Significant Achievements:

Phylogenetic analysis of endophytic actinomycetes. Till date 100 nos. of *endophytic actinobacterial* strains have been isolated from different plant samples collected from Gibbon Wild Life Sanctuaries, Jorhat and Kaziranga National Park of Assam (Fig. 1). Most of the strains showed positive for secretion of amylase, catalase, proteinase and lipase enzymes. Phylogenetic affiliation has been done based on 16S rDNA sequence (Fig. 2). Fifty numbers of sequences have been submitted to the NCBI GenBank (Gene accession nos. KF011550, KF011551, KF021229, KF703719 etc.).

Antimicrobial property and detection of biosynthetic genes. The strains were screened for antimicrobial activity against fungal pathogens (*viz. Candida albicans*, *Fusarium oxysporum*, *Aspergillus niger* and *Rhizoctonia solani*) and bacterial pathogens (*viz., Staphylococcus aureus Bacillus subtilis*, *Pseudomonas aeruginosa* and *E. coli*). Some of the strains were promising antimicrobial activity against bacterial pathogens as well as fungal pathogens (Fig. 3). These strains were again screened for biosynthetic genes, *viz. PKSI*, *PKS II* and *NRPS* and detected the genes in some of the strains; sequencing and further analysis of these genes are under progress.

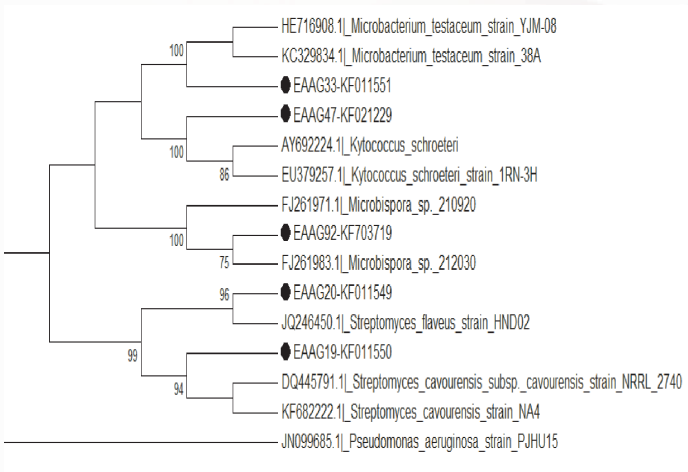


(a)



(b)

Fig. 1. Few endophytic actinomyces strains; a. pure culture in tube; b. microscopic view



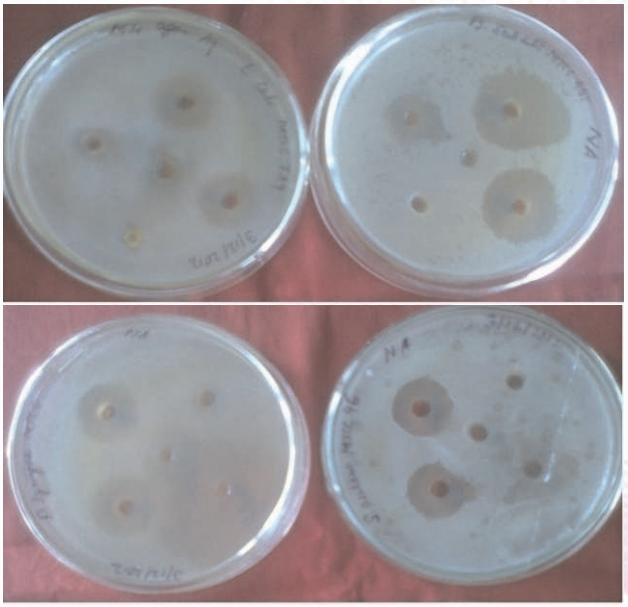


Fig. 3. Antibacterial activity of endophytic actinomyes against bacterial test pathogens.

Project No : **GPP-290**

Project Title : **Isolation and characterization of Antifungal peptides from Mug Silkworm *Antheraea assama* Helfer**

Funding Agency : DBT's Twinning Programme for the NE region in collaboration with Central Muga Eri Research & Training Institute, Central Silk Board & Indian Institute of Technology, Kharagpur, West Bengal.

PI & Members : Dr B G Unni, PI, Dr Jatin Kalita , Co-PI

Objectives:

- Isolation and purification of anti-fungal peptides from the hemolymph of fungal challenged muga silkworm, *Antheraea assamensis* Helfer., Biochemical characterization of isolated anti-fungal peptides and functional properties in health sector

Project No :GPP-291

Project Title :**DNA-Fingerprinting of Lignocellulose Degrading Microbes Isolated from Protected Forest Areas of Assam and Mizoram.**

Funding Agency :DBT, New Delhi

PI & Members :Dr Ratul Saikia, PI & Coordinator, Dr Tarun C. Bora, Co-PI, Dr Praksh J. Saikia, Co-PI, Mrs Archana Yadav, Co-PI, Ms Pallavi Buragohain, Ms Merilin Kakoti.

Objectives:

- Screening of microbes for lignocelluloses degradation
- Identification and genetic diversity of lignocellulolytic microbes
- Evaluation of potential isolates for production of extracellular enzymes
- Enzyme production and biomass conversion (delignification and cellulolysis) *using biomass as a substrate*

Significant Achievements:

Isolation and purification of microbes (bacteria and fungi). **A total of 140 microbes (bacteria and fungi)** were isolated from soil and bark samples which were collected from protected forest area, Nambor Wildlife Sanctuary.

Screening for enzymes activity. Thirty nos. of bacteria and 30 nos. of fungal isolates have been screened for cellulase and laccase activity. Out of these, 2 fungal isolates (LCF- 16 & LCB- 27) were found to be prominent for laccase activity. However, 12 nos. fungal isolates and 3 nos. of bacterial isolates were positive in cellulase activity (Fig. 1). Similarly, 2 bacterial isolates showed positive in xylanase activity.

Project No : GPP-285

Project Title : Induction of systemic resistance through root associated bacteria in Patchouli (*Pogostemon cablin* Benth.) and management of nematode

Funding Agency : DST, New Delhi

PI & Members : Dr S B Wann

Objectives:

- Isolation and screening bacterial strains from different cropping systems of the Indian region of the Indo-Burman mega biodiversity hot spot. An emphasis will be given from the Patchouli (Pogostemon cablin Benth.) plant rhizosphere and phyllosphere. Selection of the strains will be done initially based on their in vitro antagonism against fungus, Synchytrium pogostemonis f. sp. patchouli.
- Induction of systemic resistance in Patchouli plant against fungus, Synchytrium pogostemonis f. sp. patchouli under laboratory and nursery conditions besides enhanced and improved number of leaves production through bacterial dressing of the saplings.
- Evaluation of Cellulase and pectinase enzyme production by the pathogen in presence and absence of the selected bacterial strains.
- Evaluation of the PAL, POX, and POD enzyme in the systemic resistance induced plants at various stages of growth and their role in improved leaf production and disease resistance.
- Development of bacterial formulation based on bacterial strain(s) and/or their bioactive metabolites for the induction of systemic resistance in Patchouli plants against fungus, Synchytrium pogostemonis f. sp. patchouli disease besides production of enhanced and improved number leaf production.

Significant Achievements:

(i) Soil samples collected from rhizospheric region of Patchouli plants and used for isolating bacterial strains. A total of 40 bacteria were isolated from different soil samples were characterized. The isolated bacteria show Gram positive and Gram negative reaction. The morphology were observed to be short rod, rod in chain, small rod, elliptical rod, thin and long rod, rod with prominent endospore, and coccus grape type, coccus in groups, coccus in chains, coccus in tetrads, and small coccus.

(ii) Bacterial strains show different biochemical characteristics i.e., Oxidase activity, Catalase activity, Citrate utilization, Glucose fermentation, Starch hydrolysis, Urease activity, H_2S production, Indole production and Nitrate reduction activity.

(iii) The characterized and biochemical tests performed on the isolated bacterial strains shows that they exhibit PGPR activity. More than 30 bacterial strains gave positive results when tested for antagonism against fungal pathogen, Phosphate solubilizing, production of Siderophore, Hydrogen cyanide Indole-3-acetic acid and Fluorescent pigments.

(iv) A survey conducted for nematode infection (*Meloidogyne incognita*) in Patchouli and isolated eggs/ larvae and maintained in vegetable crops. *In vitro* tests for assessing effectiveness of PGPR against nematode infection in Patchouli saplings were conducted in pot experiments in the green house condition.

CHEMICAL SCIENCES

In Chemical Sciences Area, the thrust of the research has beenfocussed ongreen approaches for development and value addition of bioactiveand biopolymers. This Area consists of five divisions - Natural Products Chemistry, Medicinal Chemistry, Synthetic Organic Chemistry, Petroleum and Natural Gas and Analytical Chemistry with five work packages respectively. In 12th Five Year Plan period, it has been involved in a number of CSIR-Network (15), Grant-in-aid (15), NMITLI (1), Industry Contract (1)and International Collaborative projects (6).

The major emphasis of Natural Products Chemistry Divisionhas been on chemical investigation of selected traditionally reputed medicinal plants of the northeastern region of India for drugs, pest management agents and nutraceuticals.The department played a key role in developing two herbal drugs: one for treatment of rheumatoid arthritis and one for fungal diseases. The division is actively involved in several CSIR Network Projects for the development of herbal drug for lung cancer (NEEP), determination of oil content of lesser known seeds (AGROPATHY) and bioactive molecules from natural resources as affordable healthcare agents (NaPAHA).The Medicinal Chemistry Division has made significant contributions in the emerging areas of organic chemistry particularly for generating library of novel bioactive analogues, new synthetic methodologies and new organic and bio-organic transformation reactions.It participates in CSIRNetwork Projects for the development of affordable cancer therapeutics (ACT), generating innovative and natural scaffolds (ORIGIN),new molecules and their bio-evaluation as anti-tuberculosis agents (OSDD), and also creating CSIR advanced analytical facility for North East (CAAF-NE).The main focus of the Synthetic Organic Chemistry Division is on development of green methodologies for industrially important organic compounds either from natural or from synthetic sources. The division is also working on the synthesis of stable metal nanoparticles on nanoporous biopolymers/cellulose templates and their application in organic synthesis.The division is collaborating inCSIR Network Projects for the studies on the lignin/degraded lignin products from paper mill waste and microbially treated lignocellulosic materials (ERIPP), synthesis and catalytic activity of metal nano particles in cellulose template (CSC), membrane and adsorbent technology platform for effective separation of liquids and gases (MATES).The Petroleum and Natural Gas Division is engaged in both applied and fundamental research in areas that are vital to the polymer and oil industries. Research projects of the division are focused on modification of polymers by introduction of functional groups, grafting, thermal and light stabilization of polymers, on mechanism of high conversion and living radical polymerization systems, preparation of novel polymeric materials based on renewable natural resources. The division is involved in CSIR Network projects for Process development for bio-lubricants based on castor oil (GenLube),pathways for polycaprolactone/PCL-gelatin microspheres by modified emulsion and solvent evaporation methods (M2D),transition metal based catalyst system for copolymerization of olefins (SPIRIT).The Analytical Chemistry Division provides analytical inputs to In-house, CSIR Network as well as Grant-in-aid and R&D projects of the institute. The Division has also been extending its support to different educational institutions, industries, NGO's, Govtand Semi-Govt organizations, individuals of the NE region of India and also involved in R&D activities of severalCSIR Network projects.

International Collaboration

Project No : **P80102**

Project Title : **Stereoselective multi-component organometallic reactions and synthesis of bioactive molecules using green methodology**

Funding Agency : NSFC,China and CSIR New Delhi

PI & Members : Dr Dipak Prajapati, PI
Dr Romesh Ch Boruah, Co-PI

Objectives:

- To study the reactivity, regioselectivity and stereoselectivity of the organometallic reactions.
- To accomplish the synthesis of novel bioactive molecules by a multi-component one-step

process and set the pathway for the construction of basic skeletons of natural products.

- Naturally, as mentioned above the theme is the development of new knowledge of the most finest nature i.e. stereospecificity, regiospecificity and asymmetric synthesis.

Salient Achievements:

An efficient catalyst- and solvent-free pseudo five component one pot methodology has been developed for the synthesis of spirindenopyridine derivatives via a tandem Knoevenagel/aza-Diels-Alder reaction strategy where both diene and dienophile was generated in situ. The actual [4+2] nature of the reaction pathway was established by performing the reaction stepwise. Overall, this is a very simple, clean and green protocol for obtaining complex pyridines in excellent yields within very short period of time.

Project No : **GAP-0234**

Project Title : **New Advances in the integrated Management of food processing waste in India and Europe: use of Sustainable Technologies for the Exploitation of by- products into new foods and feeds (NAMASTE)**

Funding Agency : DBT sponsored Indo-EU International collaborative

PI & Members : Dr PK Chowdhury, PI & WP3 Leader, Dr (Mrs) Aradhana Goswami WP2 Leader, Dr Dipul Kalita, Dr PJ Saikia, Mr Ananta Sharma, Mr OP Sahu, Mr Tobiul hussain Ahmed, Mrs Polakshi Bordoloi

RTD Partners:

1. CSIR- NEIST, Jorhat (Coordinating Institute)
2. UAS-Bangalore

Management Partner:

3. EIRC, Bangalore

Industrial Partners:

4. Nature Fresh Logistic (NFL), Pune
5. Vaigai Industries(VI), Madurai

NAMASTE-EU:

1. University of Bologna, Italy (Coordinating Institute)
2. Instt of Food Research, Norweich, UK
3. AZTI, Spain
4. Campden & Chorleywood, Hungary
5. Agro Technology & Food innovations B.V. Netherlands
6. GLP, Spain
7. J. Rettenmeier & Soehne GmbH &Co.KG, Germany

Objectives:

- NAMASTE is one of the first joint projects under the coordinated call between the European Union (EU) and the Department of Biotechnology (DBT), Government of India, with participants from both EU countries (Italy, United Kingdom, Spain, Hungary, Netherlands, Germany) and India (Assam, Karnataka, Maharashtra, Tamil Nadu). The project is running from spring 2010 to early 2013.
- The main aim of the NAMASTE project is to develop innovative, comprehensive and industry-relevant approaches for the valorization of citrus, mango and pomegranates by-products and wheat and rice bran through environmentally and economically sustainable conversion of these by-products into healthy food ingredients, foods and feeds.
- The strategic objective of the project is to interface the complementary and synergic needs and expertise of EU and India and to exploit common, industrially-driven, innovative and sustainable processes for converting locally abundant common/complementary fruit and cereal processing by-products into new food products and feed products of local and transnational interest.

Significant Achievements:

Protocol has been developed for stabilization and preservation of rice bran, Extraction of natural colour (anthocyanin) from pigmented rice bran, Fermented Rice Bran and Dietary fibre from Rice Bran. The products are shown below





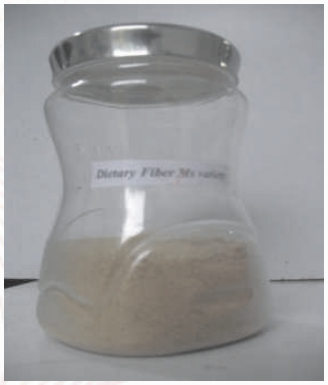


Fig 1: Stabilized Rice Bran obtained from Black Rice variety (Mn)
Fig 2: Fermented Rice Bran from white Rice Variety (Ms)
Fig 3: Fermented Rice Bran from Black Rice Variety (Mn)
Fig 4: Dietary Fiber Component extracted from the white Rice Bran sample (Ms)
Fig 5: Anthocyanins from Pigmented Rice Bran (Mn)

i) With Georgetown University, Washington DC, USA

Objectives:

Investigation of the mechanistic details of the Prostate cancer activity of *Murraya koenigii*, the Indian *curry patta.*

PI & Members: Dr N.C.Barua, PI, Dr G.Baishya

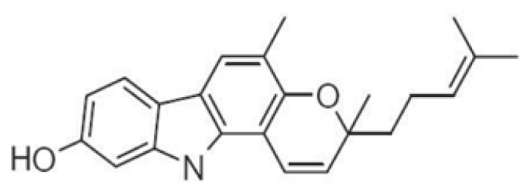
Salient Achievements:

Under this CSIR approved academic collaboration, we are investing the mechanistic details of the Prostate cancer activity of *Murraya koenigii*, the Indian *curry patta.*



Murraya koenigii plant

The activity on the pharmacological aspects is being carried out under the guidance of Prof. Partha Banerjee at Georgetown University, Washington DC, USA and the chemical aspects is being carried out at CSIR-NEIST under the guidance of Dr N.C.Barua



Mahanine

ii)With Institute of Natural Products Chemistry, Hanoi, Vietnam

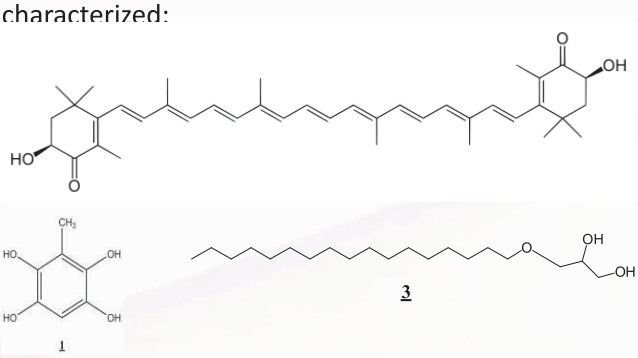
Objectives:

Chemical investigation of species of sea stars (family Asterninidae) from Vietnam waters in search of bioactive molecules (2012-2014) Sponsored by DST, India and Ministry of Science & Technology, Vietnam

PI & Members : Dr M.J.Bordoloi , PI

Salient Achievements:

The following three molecules have been isolated and characterized:



National Collaboration

i). Network Projects

Project No : **BSC-0105**
Project Title : **New initiatives to boost agriculture productivity through maximizing pre and post harvest yields**
Nodal Laboratory : CSIR-CFTRI
Funding Agency : CSIR New Delhi
PI & Members : Dr P K Chowdhuri,PI, Dr P R Bhattarcharyya, Co PI, Dr S C Nath, Dr Mrs A Goswami, Dr J Kalita, Dr Mantu Bhuyan, Mr T Hussain, Dr Ms D Banik

Objectives:

- Development of Plant based Formulations for control of Insect-pest of stored pulses & cereals
- Development of Economically & Environmentally sustainable strategies for the conversion of cereal & fruit processing by-products into new foods with ambitious market opportunities
- Development of protocols for high value molecules for preparation of Nutraceuticals & Functional foods having antioxidant, anti-inflammatory and other organoleptic properties

Significant Achievements:

Development of Plant based Formulations for control of Insect-pest of stored pulses & cereals

Identification of potential insect pest of stored grain of this region has been done based on the extensive survey works and collection of stored grains samples. A total of six insect species has been isolated and recorded infesting stored pulse & cereal grains. Following are the major insect species recorded in stored grains in Assam:

1. *Callosobruchus chinensis* (Bruchidae : Coleoptera)
2. *Callosobruchus maculates* (Bruchidae : Coleoptera)
3. *Callosobruchus analis* (Bruchidae : Coleoptera)
4. *Sitophilus oryzae* (Dryophthoridae : Coleoptera)
5. *Rhizopertha dominica* (Bostricidae : Coleoptera)
6. *Triboleum castaneum* (Tenebrionidae : Coleoptera)

The frequency of occurrence of various insect pests in collected samples is found to be highest (29.51%) for *C. chinensis* in case of stored pulse grains & *S. oryzae* (35.67%) for stored cereal grains. Therefore, it can be interpreted from the observations that the major insect pest associated with stored pulses is *C. chinensis* & *S. oryzae* in case of cereals in Assam.



Major insect pest of Stored Pulses have identified as C. Chinensis

Callosobruchus chinensis (L.) (Coleoptera : Bruchidae) is one of the major insect pest infesting stored pulses in India. Recourse of synthetic insecticides to protect stored pulses often lead to dangers of the development of resistant strains, toxic residue and users safety. Locally available and less toxic pest management alternatives such as the use of effective botanicals are important. Essential oils of two variants of *Cinnamomum verum* Presl. Syn. *C. zelanicum* Blume from North East India (RRL J 1620 and RRL J 1622) were characterized and tested for their biological activity in vapour form against *Callosobruchus chinensis* (L.). Choice and no-choice tests showed that leaf and bark oil of two variants of *C. verum* Presl. had significant repellent action and reduced the fecundity and decreased egg hatchability of *C. chinenisis* (L.). However, leaf oil with higher percentage of eugenol exhibited better activity than the bark oil in both the tests. Hence, the volatile essential oils of both the variants of *C. verum* Presl. can be used safely as fumigants (*Kalita et al, 2014, Int J Appl Biol Pharma, 5(3) : 190-194*).

Development of Economically & Environmentally sustainable strategies for the conversion of cereal & fruit processing by-products into new foods with ambitious market opportunities & Development of protocols for high value molecules for preparation of Nutraceuticals & Functional foods having antioxidant, anti-inflammatory and other organoleptic properties Following work have been already initiated:

- Extraction of Rice Bran Oii from a traditional rice cultivar of NE Region, viz., *Musuri* Variety
- Extraction of □-Orizanol from RBO
- Synthesis of analogues of □ -Orizanol using readily available Steroid molecules & determination of their Antioxidant activity.
- Development of Natural Pigments cum Antioxidants from some indigenous fruits of North East India

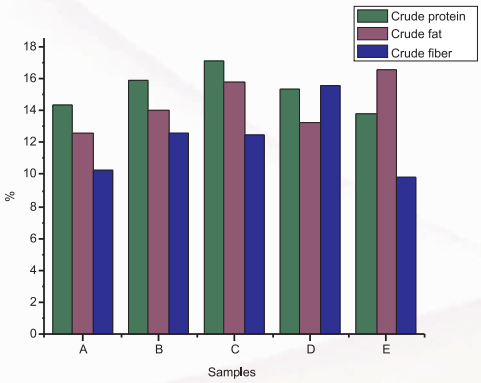
Work on Traditional Rice Cultivars of North East India:

Seven traditional rice cultivars of North-East India, grown in three different ecosystems, and exhibiting distinct genotypic variations, were investigated for phenolic acids in free, alkali- and acid hydrolyzed rice bran extracts using the Folin-Ciocalteu reagent and HPLC. The extracts were also analyzed for their antioxidant activities using the DPPH radical

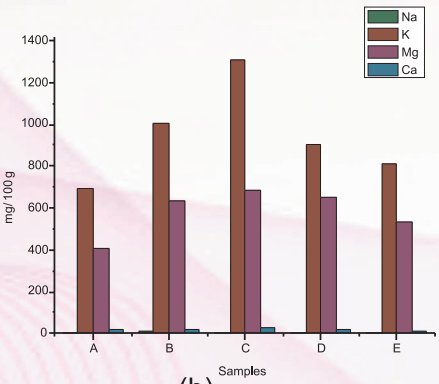
scavenging and CUPRAC assays. The percentage of Total Phenolic Content (TPC) of the different rice bran extracts were determined. Most of the phenolic acids were present as esterlinkages (~ 61 %) to cell-wall substituents, while a small portion was bound by ether-linkages (~ 3 %).

HPLC studies showed the presence of ferulic, p-coumaric, sinapic, caffeic, chlorogenic and vanillic acids in the extracts. Hydrolyzed extracts exhibited better EC50 values than the free extracts. The free phenolic extracts contributed 91.1-99.2 % to the total TEAC values as determined by CUPRAC assay. Besides, a comparative study with other rice cultivars grown in different parts of the world indicated the superiority of these cultivars, which is largely attributable to the genotypic differences among the cultivars. The study thus reveals the potential of these rice cultivars towards the development of nutraceuticals and functional foods.

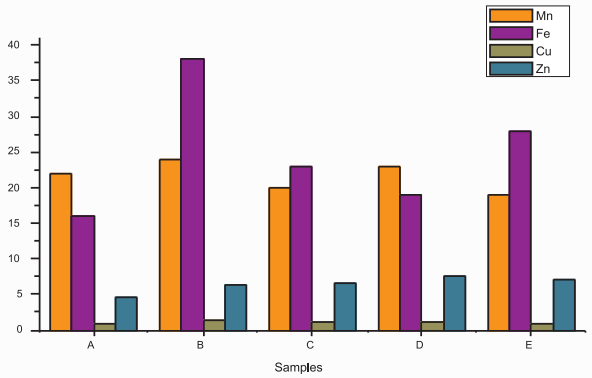
The proximate and elemental compositions in bran of five varieties of rice of North-East India (A-E) were investigated. The varieties were found to contain appreciable quantities of nutrients. They could, therefore, be used in food fortification and as nutraceutical.



(a)



(b)



(c)

Fig. 1. Proximate composition (a) and elemental composition [(b) &(c)] in bran of five varieties of rice.

Development of Natural Pigments cum Antioxidants from some indigenous fruits of North East India

The present study investigates Anthocyanins content and Antioxidant Activity in extracts from various indigenous fruits like Assam Mulberry(*Morus alba*), *kola Jamu* (*Syzygiumcumini*) and Banana bracts (*Musa balbisiana*) etc.



Assam Mulberry (Morus alba)

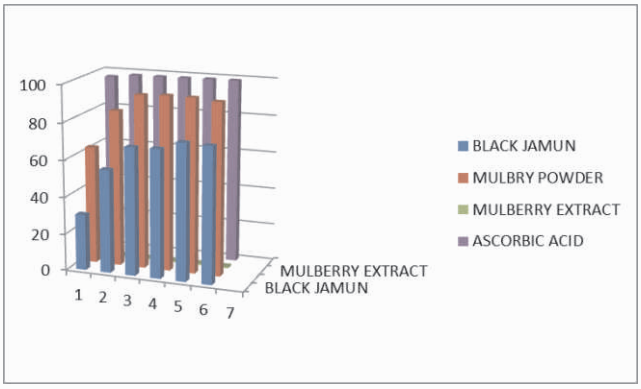


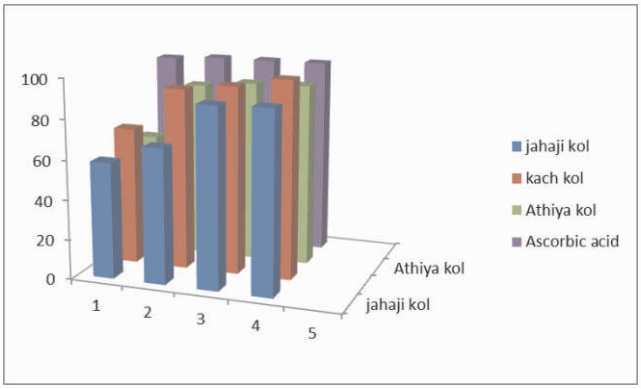
Kola Jamun (Syzygiumcumini)



Kol Dil (Banana bracts)

Determination of Antioxidant Activity by DPPH Method and its comparisition with that of Ascorbic acid (Standard).





Project No : **CSC-107**
Project Title : **Inherently Safer Practices for Industrial Risk Reduction (INSPIRE)**
Funding Agency : CSIR, New Delhi
PI & Members : Mr Bipul Das, PI, Mr Tobiul Hussain Ahmed, Co-PI, Dr (Mrs) Aradhana Goswami, Dr Swapnali Hazarika, Dr Pranjal Gogoi, Dr Pallab Pahari, Dr Sanjeev Gogoi

Objectives:

- Up gradation of Thermo chemical Laboratory.
- To build knowledge-base / expertise for evaluating chemical reactive systems by application of thermo-chemical techniques, towards implementation of inherently safer options.
- To integrate experimental findings on thermal hazard studies and to develop alternate process strategies to prevent runaways.
- To undertake Hazard Study and Risk Analysis of existing chemical and biochemical processes and to provide risk reduction solutions.

Significant Achievements:

Thermo chemical laboratory for studies on reactive hazard evaluation, heat of reaction, adiabatic temperature rise, reactivity and exothermicity data etc. for select runaway reaction systems developed and related works undertaken.

Project No : **CSC-0108**
Project Title : **Organic reactions in generating innovative and natural scaffolds**
Funding Agency : CSIR, New Delhi
PI & Members : Dr Dipak Prajapati, PI, Dr Romesh Ch Boruah, Dr P J Bhuyan, Dr Pranjal Gogoi, Dr Sanjeev Gogoi

Objectives:

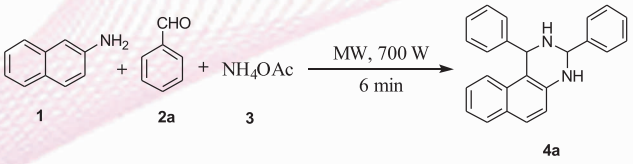
- Design and synthesis of small molecules (Mol.wt <600 Dalton) as potential therapeutic agents in human health care.
- Asymmetric total synthesis of natural products having proven biological activity with special relevance to cancer, CNS, arthritis and cardiovascular disorders.
- Library synthesis around scaffolds identified from natural and synthetic molecules using automation including Fragment based synthesis.
- Development of new methods towards C-C and C-X bond forming reactions and application to scaffold synthesis taking into account the green chemistry principles.

Significant Achievements:

Catalyst- and solvent-free, pot, atom and step economic synthesis of tetrahydroquinazolines by an aza-Diels–Alder reaction strategy

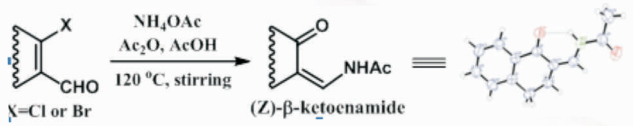
A pot, atom and step economic (PASE) synthesis of tetrahydroquinazolines has been achieved via microwave-assisted four-component catalyst- and solvent-free aza-Diels–Alder reaction strategy. The key step of the methodology is the in situ generation of both the diene and the dienophile and their subsequent reaction to give the desired product. We have developed an efficient aza-Diels – Alder reaction for the construction of 2,4 - diaryltetrahydroquinazoline derivatives. The reaction is feasible under both microwave and thermal conditions and can be tuned by varying the time to obtain dihydroquinazoline derivatives under thermal heating. The cascade nature of the transformation as well as in-situ generation of both

the diene and dienophile and their subsequent cycloaddition makes this methodology pot, atom and step economic. Urea is also shown as a nitrogen source under microwave conditions and can be exploited further for preparation of six membered aza heterocycles. Overall, this one-pot four-component method is simple, rapid and efficient, and provides an alternative for the construction of tetrahydroquinazolines in absence of harmful organic solvent and additives.



Stereoselective Synthesis of (Z)-β-Ketoenamides from β-Halo-, β-Unsaturated Aldehydes

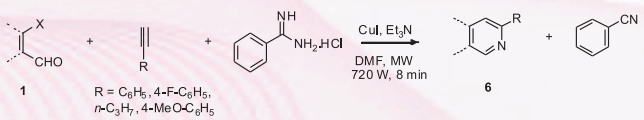
A series of steroidal and non-steroidal β-ketoenamides have been synthesized from their corresponding β-halo-α,β-unsaturated aldehydes. This synthetic methodology provides an efficient access to (Z)-β-ketoenamides. The structures of these products have been unambiguously established by single crystal XRD study. This process is found to be mild and inexpensive. The β-halo-α,β-unsaturated aldehydes are synthesized from corresponding ketones using Vilsmeier formylation reaction.



Microwave assisted catalyst free synthesis of 3-substituted isoquinoline and substituted pyridine derivatives

One catalyst free synthesis of biologically important 3-substituted isoquinoline and substituted pyridine derivatives was developed using multicomponent reaction of *β*-halovinyl/aryl aldehydes, terminal alkynes, benzamidine hydrochloride and triethyl amine as the starting materials under microwave irradiation.

Scheme 3.



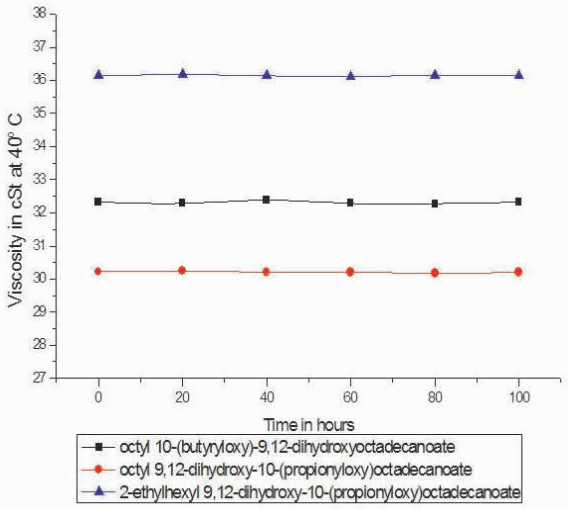
Project No : **CSC-0118**
Project Title : **New Generation Lubricants and Additives**
Funding Agency : CSIR, New Delhi
PI & Members : Dr SD Baruah, PI, Dr A Borthakur, Co-PI, Mr A Gautam, Mr NC Laskar, Mr RC Bohra, Mr L Phukan, Mr IJ Bora

Objectives:

- Development of environmental friendly biodegradable base oils stock from non-edible vegetable oils for industrial use.
- Development of epoxidized vegetable oil based high temperature lubricants.

Significant Achievements:

Vegetable oil with high oleic contain can replace the petroleum based lubricating oil. Castor oil is one such products which contain about 80-90% ricinoleic acid. Lubricating oil is prepared from castor oil by epoxidation and followed by epoxide ring opening reaction with lower molecular fatty acid using mild acid catalyst. Finally the product formed is esterified with fatty alcohols. The efficacy of four developed producst (i) di-hydroxy propionyloxy octyl stearate



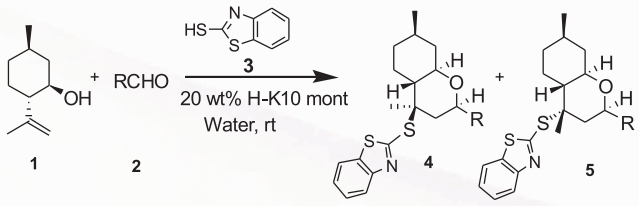
Thermal Stability of developed lubricants

(DPOS), (ii) di-hydroxy butyloxy octyl stearate (DBOS), (iii) di-hydroxy dodecanyloxy octyl stearate (DDOS), (iv) di-hydroxy propionyloxy decyl stearates (DPDS) were evaluated as lubricants. One synthesized product meets the characteristics of commercial lubricants

Project No : **CSC-0130**
Project Title : **Natural products as affordable healthcare agents**
Funding Agency : CSIR, New Delhi
PI & Members : Dr M J Bordoloi, Dr N C Barua, Dr G Baishya, Dr P K Chowdhury, Dr D K Dutta, Dr A M Das, Visva Bharati, Santiniketan

Significant Achievements:

2-Mercaptobenzothiazole derivatives are important class of compounds that show potent antibacterial and antifungal activities. Some of them are also known to exhibit different biological activities like antitubercular, anti-inflamatory, antitumor, amoebic, antiparkinsonian, antthelmintic, amtihypertsensive, antihyperlipidemic, antiulcer, chemoprotective and selective CCR3 receptor antagonist activity. 2-Mercaptobenzothioacetate is also found to be very useful in leather industry. Here we have found that the solid acid catalyst H-K10 mont (acid treated Montmorrilonite K10) efficiently catalyzes the thia-Prins cyclization of (-)-isopulegol **1** with different aldehydes **3** in water to produce a library of some novel mercaptobenzothiazole derivatives **4** & **5** (Scheme 5, unpublished result).



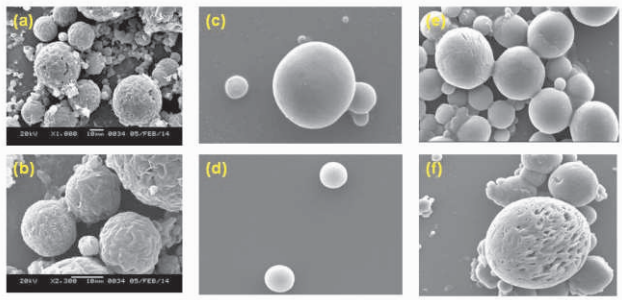
Project No : **CSC-0134**
Project Title : **Molecules to Materials to Devices**
Funding Agency : CSIR, New Delhi
PI & Members : Dr SD Baruah, PI, Dr PJ Saikia, Co-PI, Dr M K Huda, Mr PP Saikia, Ms A Borah

Objectives:

- Development of efficient polymerization method for the preparation of porous polymeric microspheres of polyesters and their copolymers with easy manipulation and control over their properties for tissue engineering.

Significant Achievements:

Aliphatic polyesters with good flexibility in composition, structure, and property are promising candidates for the fabrication of biodegradable microcarriers in which polycaprolactone (PCL) based microspheres paved a versatile role in biomedical application. PCL microspheres were prepared by modified solvent evaporation technique using poly(vinylpyrrolidone) (PVP) and gelatin as stabilizers. In order to form an emulsion of the stable polymer microparticles with the carrier solvent and along with the drug to be delivered, the choice of suitable stabilizer is also necessary. PCL microspheres were also developed by dispersion polymerization using *in situ* Poly(n-octadecyl methacrylate-*co*-2-hydroxyethyl methacrylate) stabilizer. The PCL microspheres are found to be well dispersed and uniform in size. The factors affecting in the preparation of polymer microspheres, such as polymer molecular weights and molecular weight distribution, particle size and distribution and morphology were investigated in details. The particle sizes of the prepared PCL microspheres were found in the range of 5-20 μm.



SEM images of PCL microspheres prepared under different reaction conditions

Project No : **CSC-0207**
Project Title : **North East Exploration of Pharmaceuticals**
Funding Agency : CSIR, New Delhi
PI & Members : Dr M J Bordoloi, D. N C Barua, Dr P K Chowdhury, Dr D K Dutta, Dr A M Das, Dr G Baishya, Dr P R Bhattacharyya, Dr M Bhuyan, Visva Bharati, Santiniketan

Objectives:

- Preliminary objective of this project is to develop affordable medicines from rich resources of medicinal plants of North East India.

- A data base on traditional herbal products used by different tribes/ethnic population in the North East India
- It will be arranged to secure IPR for such material and finally organize for transfer of technology to suitable Pharma Company.

Significant Achievements:

Natural Products Chemistry Division got the CSIR Technology Award-2013 in Life Sciences for "Herbal Drug Development for Management of Arthritis." Awardees from the division: Dr N C Barua (HOD & Chief Scientist) and Dr M J Bordoloi

Project No : **CSC-0206**
Project Title : **Advanced Polyolefins**
Funding Agency : **CSIR, New Delhi**
PI & Members : Dr SD Baruah, PI, Mr A Gautam, Co-PI, Mr NC Laskar, Mr RC Bohra, Mr L Phukan, Mr D Kalita, Ms U Baruah Ms M Saikia, Mr S Borphukan

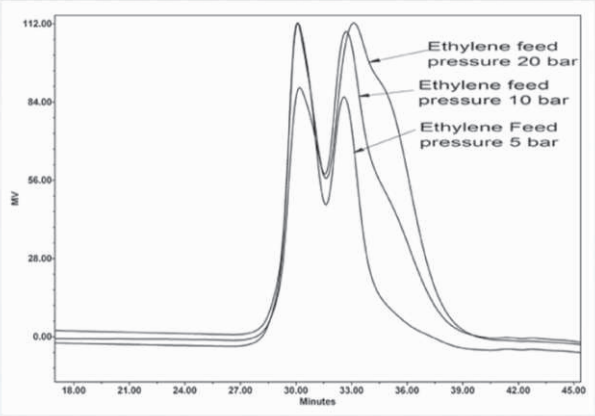
Objectives:

- Development of degradable polyolefins to achieve new properties, facilitate processing and precise control of heterogeneity of polymer systems.

Modeling and predicting structure-processing-property relationships of polyolefin copolymer systems

Significant Achievements:

Incorporation of polar monomers in olefins becomes a focus area of polymer research with increasing demand of olefinic materials for its broad range of commercial applicability. Design of ethylene and polar monomer based copolymers by iron(III) catalyzed reverse atom transfer radical polymerization (ATRP) technique with a controlled architecture were achieved with the tuning of ethylene pressure. With increase in polymerization time and ethylene feed, the conversion of copolymers shows linear dependency but the chain initiating species shows some exceptional behavior which results in bimodal molecular weight distribution. GPC results also reveal the formation of very high molecular weight copolymers with broad molecular weight distribution. Structural and morphological characteristics have been established by NMR, SEM and XRD analysis. Kinetic parameters of ethylene-MMA copolymer



GPC Chromatogram of Ethylene methyl methacrylate copolymers with bimodal molecular weight distribution

decomposition have been established from differential scanning calorimetric (DSC) and thermo gravimetric analysis (TGA).

Project No : **CSC-0301**
Project Title : **Affordable Cancer Therapeutics**
Funding Agency : CSIR, New Delhi
PI & Members : Dr Dipak Prajapati, PI, Dr Romesh Ch Boruah, Dr P J Bhuyan, Dr Pranjal Gogoi, Dr Sanjeev Gogoi

Objectives:

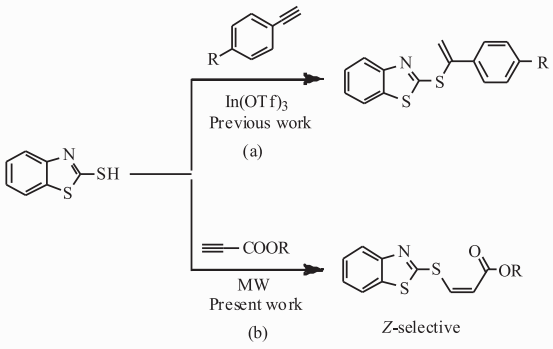
- Synthesis of new molecules based on molecular modification of the substrates indoles, pyrimidines and steroids
- Hetero annulation of the plant based intermediates via Semi-synthesis
- Biological assay for the novel synthetic molecules.

Significant Achievements:

Microwave-promoted regio- and stereoselective vinylation of heterocyclic thiols

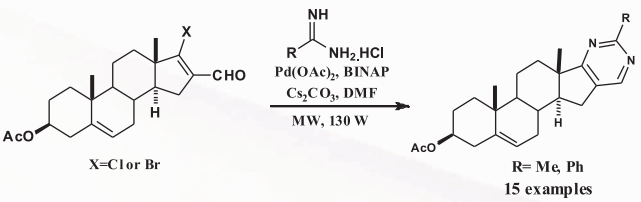
The first stereoselective vinylation of heterocyclic thiols has been investigated. Heterocyclic thiols are shown to react efficiently with activated terminal alkynes in anti-Markovnikov fashion in absence of any catalyst or additives under microwave irradiation to give *Z*-selective vinyl sulfides. This is a simple, efficient and stereoselective method for the formation of vinyl sulfides via hydrothiolation reaction between heterocyclic thiols and activated terminal alkynes under microwave irradiation. The key features of the methodology are short reaction time, good to excellent yields, absence of any side products and the

achievement of 100% stereoselectivity in case of heterocyclic thiols with no additional requirement of any catalyst and/or additives. This makes it an attractive protocol to obtain *Z*-vinyl sulfides.



Pd-catalyzed synthesis of fused steroidal and non-steroidal pyrimidines from β-halo-α,β-unsaturated aldehydes

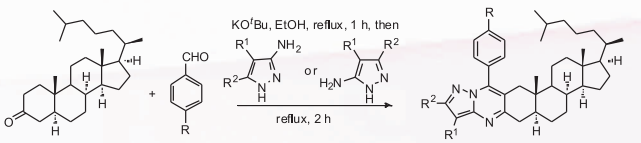
An efficient Pd-catalyzed synthesis of steroidal and non-steroidal pyrimidine derivatives from β-halo α,β-unsaturated aldehydes and amidines has been developed. The synthetic protocol was carried out under microwave irradiation. The β-halo α,β-unsaturated aldehydes are synthesized from corresponding ketones using Vilsmeier formylation reaction.



A facile one pot synthesis of 7-substituted pyrazolo[1,5-*a*]pyrimidines by base induced three-component reaction

We have developed one new method for the preparation of steroid/nonsteroid fused 7-substituted pyrazolo[1,5-*a*]pyrimidines by the one pot reaction of steroidal/nonsteroidal ketones, aromatic aldehydes and 3-amino-1*H*-pyrazoles/5-amino-1*H*-pyrazoles in presence of potassium *tert*-butoxide in good yield under reflux condition in ethanol.

Scheme 1:



(13 compounds of pyrazolo[1,5-a]pyrimidines, 65-79%)

An efficient route for annulation of pyrimidines to steroids and non-steroids *via* a base catalyzed one-pot three component reaction

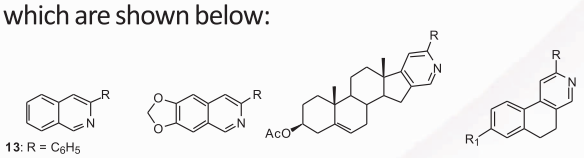
A new strategy for the synthesis of steroidal A- and D-ring fused pyrimidines has been accomplished in high yields *via* a one-pot reaction of steroidal ketones, aromatic aldehydes and amidine derivatives in presence of potassium *tert*-butoxide in refluxing ethanol. The generality of the reaction was also extended to non-steroidal bicyclic ketones.

Scheme 2:



(14 compounds)

One multicomponent copper catalyzed reaction to synthesize different isoquinolines and pyridine derivatives has been developed. Using this multicomponent reaction of *β*-halovinyl aldehyde, terminal alkyne and *tert*-butylamine we have synthesized couple of isoquinolines and pyridine fused steroidal/nonsteroidal molecules which are shown below:



13: R = C_6H_5
14: R = 4-Me-C_6H_4
15: R = 4-MeO-C_6H_4
16: R = 4-F-C_6H_4
17: R = 6-MeO-$C_{10}H_6$
18: R = $CH_3(CH_2)_2$
19: R = $CH_3(CH_2)_3$

20: R = C_6H_5
21: R = 4-Me-C_6H_4
22: 4-MeO-C_6H_4
23: R = 4-F-C_5H_4
24: R = $CH_3(CH_2)_3$

25: R = C_6H_5
26: R = 4-CH_3-C_6H_4
27: R = 6-F-C_6H_4
28: R = $CH_3(CH_2)_2$
29: R = $CH_3(CH_2)_3$
30: R = COOEt

31: R1 = H, R = C_6H_5
32: R1 = H, R = $CH_3(CH_2)_2$
33: R1 = H, R = $CH_3(CH_2)_4$
34: R1 = OCH_3, R = C_6H_5
35: R1 = OCH_3, R = $CH_3(CH_2)_2$
36: R1 = OCH_3, R = $CH_3(CH_2)_3$

Project No : **CSC-0408**
Project Title : CSIR Advanced Analytical Facility for North East
Funding Agency : **CSIR, New Delhi**
PI & Members : Dr Pulakjyoti Bhuyan, PI, Dr Lakshi Saikia, Co-PI, Dr Prabhat Kotoky, Dr Raju Khan, Dr Prkash Jyoti Saikia

Objectives:

- Creation of a Field Emission Scanning Electron Microscope (FE-SEM) with Energy Dispersive X-ray (EDX) facility
- Creation of High Resolution Mass spectrometer facility.
- Creation of a High Resolution Transmission Electron Microscope (HRTEM) Facility

Project No : **HCP0001**
Broad Title : Synthesis of new molecules and their bio-evaluation

Coordinator : Dr D Prajapati
Funding Agency : CSIR, New Delhi

The following five projects are sanctioned by CSIR OSDD under the broad title, "Synthesis of new molecules and their bio-evaluation" to carry out at NEIST Jorhat. The following are the projects along with the progress made during the period.

Project Title (A) : Synthesis of New Vitamin D Analogues and Related Compounds as Novel Class of Anti-TB Agent.

PI & Members : Dr Pranjal Gogoi, PI, Dr Romesh C. Boruah Co-PI

Objective:

1. Development of new synthetic methods for molecular fragment synthesis.
2. Synthesis of molecular fragments for the construction of vitamin D analogues and related molecular libraries.
3. Development of new methods towards C-C forming reactions and application to scaffold synthesis taking into account the green chemistry principles.
4. Synthesis of vitamin D analogues and related molecular libraries for TB.

Significant Achievements:

A ligand-free Suzuki-Miyaura cross-coupling reaction have been developed for the construction of C-C bond. The metho d has been published as "*Ligand -free Suzuki-cross-coupling reactions: Application to* β*-halo-*α,β*-unsaturated aldehydes" by* Pranjal Gogoi, Pranjal Bezboruah, Romesh C Boruah in *Eur. J. Org. Chem. 2013, 7291.*

A wide range of electronically varied boronic acids were efficiently coupled with structurally different β-halo α,β-unsaturated aldehydes. This protocol was extended to direct one-pot synthesis of polycyclic aromatic hydrocarbon via Suzuki-Miyaura cross-coupling/Aldol condensation cascade reaction under microwave irradiation. We have submitted 11 compounds out of these synthesized compounds for the antitubercular activity screening in CSIR-IICT, Hyderabad. Some of the screened compounds showed moderate antitubercular activities.

Project Title (B) : Development of Novel Steroidal Antimycobacterial Compounds

PI & Members : Dr Sanjib Gogoi, PI, Dr Romesh C. Boruah, Co-PI

Objective:

1 Development of new synthetic methods for the synthesis of library of heterosteroids for the screening of anti-TB activity.
2 Detailed Structure-Activity Relationship (SAR) studies of the lead compounds.

Significant Achievements:

So far we have submitted 29 steroidal and nonsteroidal samples, synthesized using new methodologies for the biological screening at IICT, Hyderabad. Some of the submitted compounds showed moderate anti-tubercular activities when they were screened against *Mycobacterium smegmatis*.

Project Title (c) : Discovery of new Antimalarials,
PI : Dr G Baishya

Project title (D) : Synthesis of substituted Quinoxaline and Quinazoline derivatives as potential Anti-Tuberculosis Agent

PI : Dr P Pahari

Project title (E) : Development of new antituberculosis molecules using microbial resources of Northeast gene pool

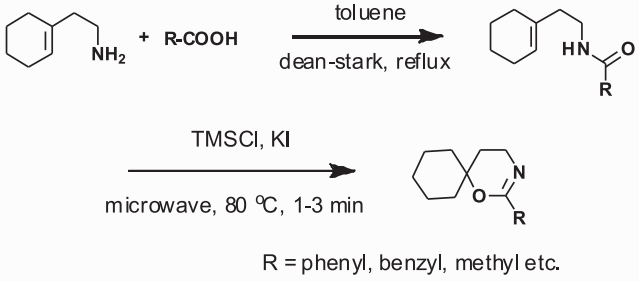
CoPI & PI : Dr T C Bora & Dr A K Singh,

Objectives:

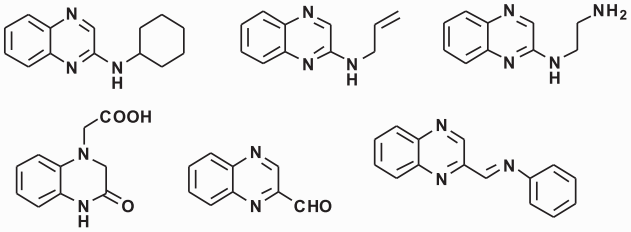
- Synthesis of a library of quinoxaline and quinazoline derivatives for the screening of potential anti-TB agents.
- Detailed Structure-Activity Relationship (SAR) studies of those lead compounds via linking of different known active functional groups or substituents to induce the better pharmacophoric properties

Significant Achievements:

A mild and efficient methodology has been developed for the synthesis of spiro-1,3-oxazine derivatives by the microwave assisted cyclization of N-2-(1'-cyclohexenyl)ethyl-acetamides/benzamides. Spiro-1,3-oxazines are well known for their wide range of biological activities and photochromic properties.



Few 2-substituted quinoxaline derivatives have been synthesized starting from 2-keto quinoxalines and ortho-phenylene diamine for the study of their antimicrobial activity.



Project No : **MLP3000/1**

Project Title : **Development of Analogues of novel bioactive molecules**

Funding Agency : CSIR, New Delhi

PI & Members : Dr Dipak Prajapat, PI, Dr Romesh Ch Boruah, Dr P J Bhuyan, Dr H N Borah, Mr K C Lekhok, Dr Pranjal Gogoi, Dr Sanjeev Gogoi

Objectives:

- Synthesis of analogues of antiviral, antibacterial and antitumor agents, anti gastric ulcer agents.
- New molecular entities for diverse biological activity.
- Assay for potential biological activity of the new synthetic molecules.
- Developments sustainable organic reactions.

Significant Achievements:

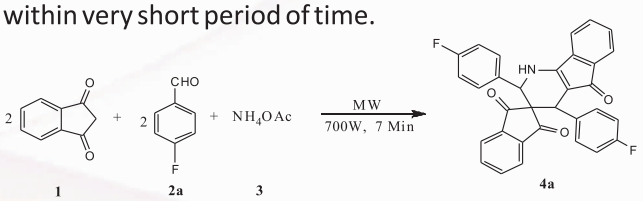
One-pot multicomponent synthesis of novel functionalized pyrrolo[2,3-*d*]pyrimidines and meridianin analogues.

In continuation of our interest in synthesis of novel pyrimidine fused heterocycles and drug intermediates from multicomponent reactions, we have developed a three component reaction for the synthesis of novel pyrrolo[2,3-*d*]pyrimidines and meridianin analogues under catalyst-free conditions. Because of the vast biological utilities of pyrrolo[2,3-d]pyrimidines several methods were developed for the synthesis of their new analogues. The domino mechanistic pathway of the reaction was proposed by conducting the reaction in stepwise. The method offer ease of execution of the reaction, mild reaction conditions, high yielding makes it an attractive strategy for the synthesis of novel pyrimidine analogues.



Microwave-promoted efficient synthesis of complex spiropyridine derivatives via a catalyst- and solvent-free pseudo one pot five component tandem Knoevenagel/aza-Diels-Alder reaction

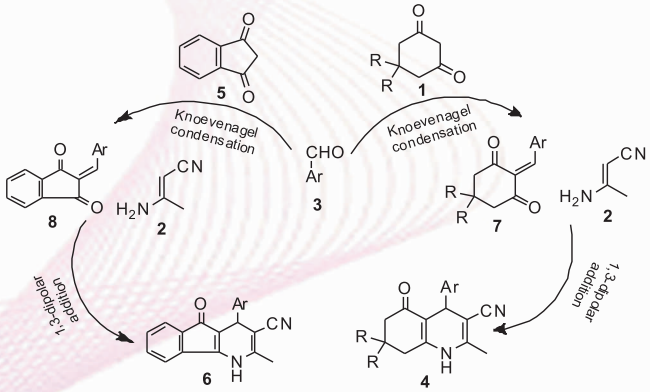
An efficient tandem Knoevenagel/aza-Diels-Alder strategy has been developed for the construction of some complex spiropyridine derivatives via a microwave-assisted, one-pot, pseudo five component reaction under catalyst- and solvent-free conditions where both diene and dienophile was generated in situ. The actual [4+2] nature of the reaction pathway was established by performing the reaction stepwise. Overall, this is a very simple, clean and green protocol for obtaining complex pyridine in excellent yields within very short period of time.



An efficient catalyst-free one-pot approach for the synthesis of fused 1,4-dihydropyridines (1,4-DHPs) at room temperature

An efficient catalyst-free one-pot strategy has been developed for the construction of functionalized 3-cyano containing 1,4-dihydro pyridine derivatives at room temperature. A three-component reaction of cyclic 1,3-diketones, 3-amino crotanonitrile and various aromatic aldehydes on stirring in ethanol at room temperature under catalyst-free conditions produced fused 1,4-dihydropyridines (1,4-DHPs) in excellent yields. The domino mechanistic pathway of the reaction was proposed by conducting the reaction

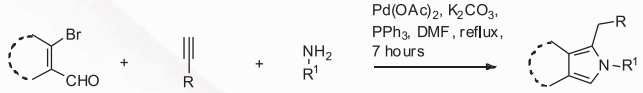
in stepwise. The method offer ease of execution of the reaction, mild reaction conditions, high yielding makes it attractive strategy for the synthesis of fused 1,4-dihydropyridines.



Palladium-catalyzed synthesis of pyrrole derivatives

An efficient method was developed for the synthesis pyrrole derivatives *via* multicomponent reaction of *β*-halovinyl/aryl aldehydes, terminal alkyne and amines in presence of palladium-catalyst. Presently, we are studying the scope of the reaction by using different *β*-halovinyl/aryl aldehydes, terminal alkyne and amines.

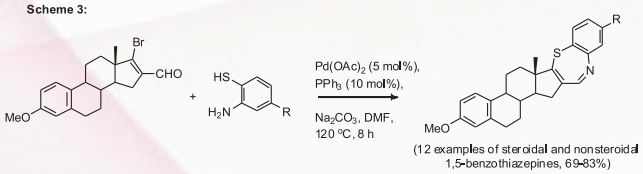
Scheme 1:



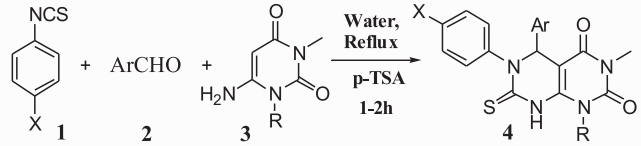
A facile synthesis of benzo[궥][1,4]thiazepine derivatives by palladium acetate catalyzed reaction

We have developed one new methodology for the preparation of steroid/nonsteroid fused benzo[*b*][1,4]thiazepines and 2-arylsubstituted benzo[*b*][1,4]thiazepines from $Pd(OAc)_2$ catalyzed reaction of steroidal/nonsteroidal *β*-halovinyl aldehydes and 2-aminothiophenols in DMF under heating condition.

Scheme 3:

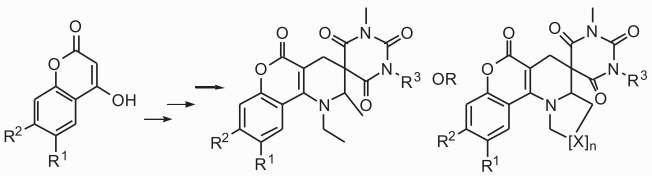


Pyrimido[4,5-*d*]pyrimidine derivatives are well known as useful bronchodilators, vasodilators, antiallergic, antihypertensive and anticancer agents. We have synthesized some novel functionalized pyrimido[4,5-*d*]pyrimidine derivatives via one-pot three-component reaction using water as solvent and *p*-TSA- as catalyst.



X=H, CH_3 R=H, CH_3

Coumarins are an important class of naturally occurring compounds with diverse pharmaceutical and biological activities depending on the sustituent in the benzopyran ring. Among those, pyridine fused coumarin derivatives possess varied biological activities like DNA adduct formation, energy transfer in photophysical processes, antitumor, anticholinergic, antidiabetic, anticoagulant, antiallergic, analgesic, antipsychotic, hypotensive activators, and antimicrobial activities. We have synthesised some novel spiro substituted pyrido[2,3-*c*]coumarins by exploring "tertiary amino effect" reaction strategy.



Project No : **MLP3000/2**

Project Title : **Development of a unique portfolio of plant and soil microbe derived bioactive extracts and pure compounds and their value addition involving partial & total synthesis**

Funding Agency : CSIR, New Delhi

PI & Members : Dr N C Barua, Dr P K Chowdhury, Dr M J Bordoloi, Dr D K Dutta, Dr A M Das, Dr G Baishya

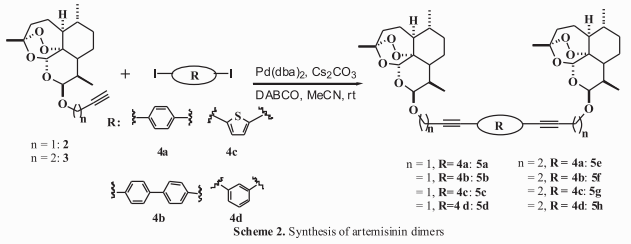
Objectives:

Under this programme besides working on phytochemical analysis of plants, work on chemical transformations of abundant natural products like diosgenin and solasodine is being pursued to add value to these molecules to develop soft-corticosteroids.

Significant Achievements:

Several artemisinin dimmers have been synthesizd involving dinitroaliphatic and triazole moiety as linkers. In continuation of the interest of maximizing the structural diversity of artemisinin analogues for further value addition, another series of artemisinin

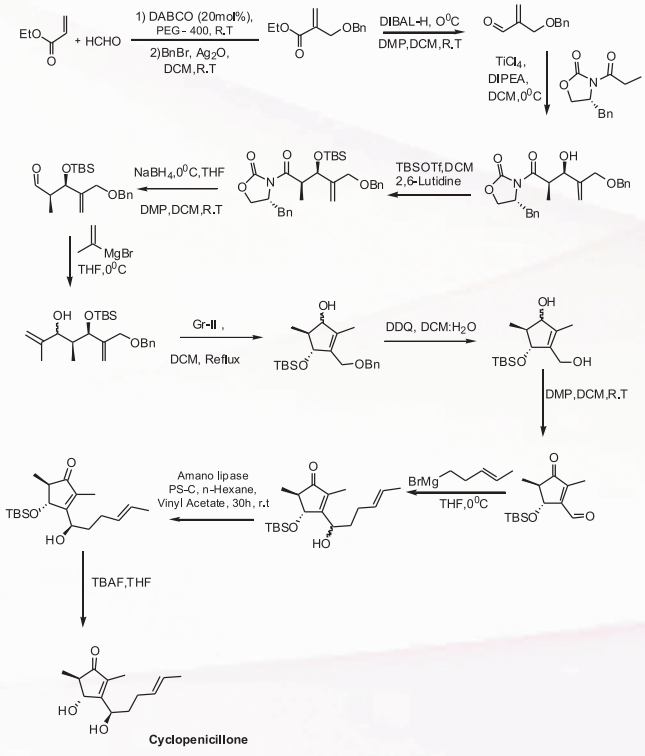
dimers have been prepared using Sonogashira cross-coupling reaction.



Scheme 2. Synthesis of artemisinin dimers

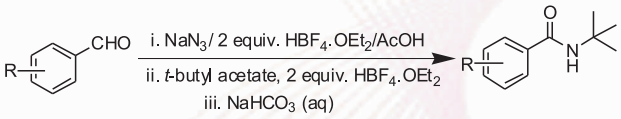
Bio-organic Med. Chem. Letters 2014, *24*,237-239.

Cyclopenicillone (1),a naturally occuring cyclopentanone possesing a unique 2,5-dimethylcyclopent-2-enone ring system, isolated from the cultures of broth of the fungus *Penicillium decumbens* by Wei-Dong zhang etal.1 It shows potent inhibitory effect against Lipopolys-acchrides(LPS)-induced NO production in RAW264.7 macrophages and is also dose dependent on its activity. Some of the cyclopenicillone derivatives may effectively ameliorate the fatal symptoms of hypotensive shock, which associated with endotoxin (LPS)-induced NO production. Due to its interesting biological activity, we were attracted towards its total synthesis. No synthesis has been reported till date. Herein, we wish to report the first stereo selective total synthesis of this molecule.



Unpublished results

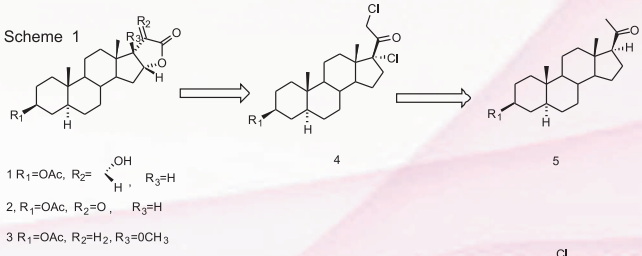
This report: One-pot sequential Schmidt and Ritter reactions

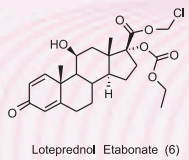


R = Both electron donating and withdrawing groups.

Construction of D-Ring fused 16α-Steroidal-γ-butyrolactones through metal mediated halogenation of 20-Oxopregnanes:

Fusion of a lactone ring on to steroidal nucleus in order to alter the biological activity of the parent compound has been a very productive attempt for medicinal chemists as many of these molecules exhibit antitumor activity. The steroidal lactone □ [1] –testololactone was the first lactone of this kind to show antitumor activity. The steroidal lactones have been found to inhibit the *5α-reductase*, a target enzyme for prostate cancer in men and the *aromatase*, another cytochrome P450 enzyme which converts androgens into estrogens contributing for the promotion of breast cancer in women. We earlier reported an efficient metal mediated halogenations technique for steroidal olefins & ketones which paved the way for synthesis of corticosteroid side chain and also for the synthesis of side chain Loteprednol Etabonate (6) - an ocular soft-corticosteroid. Here we would like report another application of the same technique to synthesize an important class of steroidal molecules, viz., D-Ring fused 16-Steroidal-γ-butyrolactones **1-3** starting from the immediate precursor 17 α, 21-dichloro-20-oxopregnane **4** which in turn could be obtained in very high yield (80%) from the readily available 20-oxopregnane **5** utilizing the above mentioned halogenation technique (Scheme 1):





Loteprednol Etabonate (6)

Project No : **MLP3000/03**
Project Title : **Creation of value–added products from renewable resources: A green approach**
Funding Agency : CSIR, New Delhi,
PI & Members : Dr Dilip Konwar, Dr Amrit Goswami, Dr Pallab Pahari, Mr Ram N Das, Mr Manash Jyoti Bora

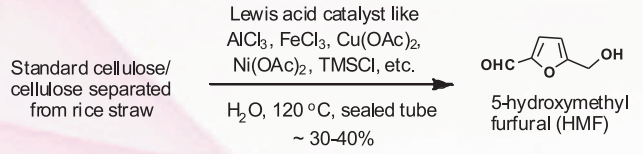
Objectives:

- Generation of cellulose, hydroxyl methyl furfural (HMF), chloromethyl furfural (CMF) etc as value-added products from renewable resources/ biomass such as agro wastes of rice straw, banana tree etc. using green methods.
- Conversion of cellulose to glucose and thus biologically important D - Mannitol and sorbitol using green chemical/ biochemical methods.
- Use of HMF, CMF and carbohydrates (generated from cellulose) as synthetic drug intermediates (imidazole, indole derivatives, macrocycles, levuliniac acid etc).

Significant Achievements:

Novel approach for preparation of 5-chloromethyl-2-furfural (CMF) and 5-Hydroxymethyl-2-furfural (HMF) from cellulose

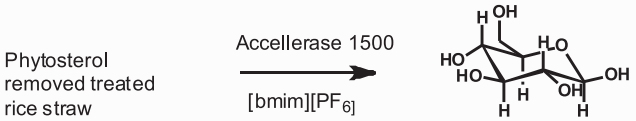
A methodology has been developed to prepare hydroxymethyl furfural (HMF) from cellulose using Lewis acid catalyst under sealed tube heating condition. Although the direct yield of the HMF is low, several recycling of the same starting material produces 30-40% overall yield. The process can be accelerated using microwave. Hydroxymethyl furfural is an important intermediate for the synthesis various industrially important chemicals and polymers.



A very useful starting material for the synthesis of various pharmaceuticals, thermo-resistant polymers and complex macrocycles

1. Glucose from rice straw

Hydrolysis of phytosterol removed rice straw was carried out using Accelerase-1500, a commercial formulation of cellulase enzyme complex developed by Genecor for lignocellulosic biomass hydrolysis in ionic liquid [bmim[PF_6] in biphasic system. The reaction was performed at a pH of around 4 in phosphate buffer in 48 hours at 30 °C. Formation of glucose by the hydrolysis of cellulose has been observed, however yield was not encouraging.



Project No : **MLP3000/04**
Project Title : **Natural polymer based nanocomposites and biodegradable polymers**
Funding Agency : CSIR, New Delhi
PI & Members : Dr SD Baruah, PI, Dr A Borthakur, Mr A Gautam, Mr NC Laskar, Mr A Sarmah, Mr RC Bohra, MT L Phukan, Mr RK Baruah

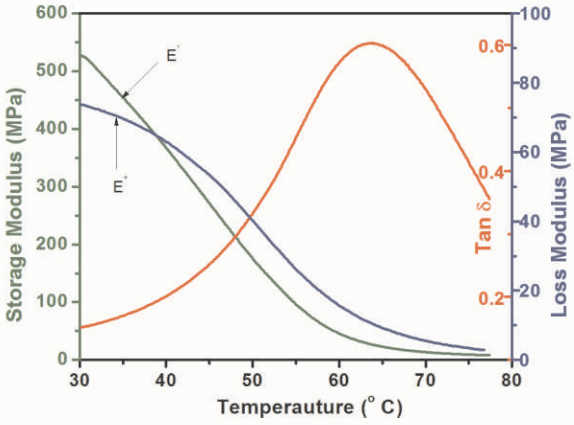
Objectives:

- Development of biodegradable polymers and biocomposites from renewable resources.
- Development of natural polymer nanocomposites.

Significant Achievements:

Perrformance characteristics of alkyd resins based on Ricinodendron heudelotii oil

Alkyd resins based on *Ricinodendron heudelotii* oil with long alkyl chains were successfully synthesized with phthalic anhydride and maleic anhydride at lower temperatures compared to general elevated temperature required to synthesize alkyd resins. The alkyd resins show low molecular weight and narrow molecular weight distribution. The resins exhibit improved characteristic in term of fast drying time at room temperature, adhesion, gloss, and contact angle, chemical resistance as well as mechanical properties and thermally stable up to 250 °C. Resins without maleic anhydride moiety show optimum performance. Oil from almond of *R. heudelotii* is a potential renewable candidate for the preparation of highly fast drying binder and resins suitable for surface coating applications and industry.



DTMA curve: blends of Ricinodendron heudelotii oil resin with phthalic anhydride (E': storage Modulus; E'': Loss Modulus)

Project No : **MLP3000/05**
Project Title : **Development of Sensors for Detection of Pesticides**
Funding Agency : CSIR, New Delhi
PI & Members :Dr Raju Khan, PI, Dr P Kotoky, Co-PI

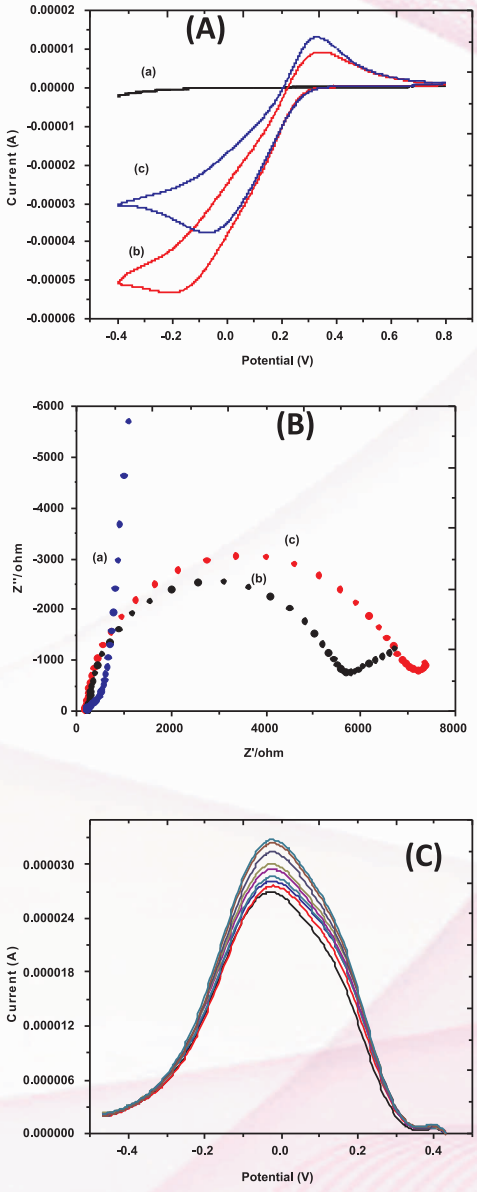
Objectives:

- Development of a cost effective sensor for the determination of pesticides in food samples based on flow injection analysis of pesticides using Screen-Printed Electrodes Containing Multi-Wall Carbon Nanotubes towards performing a pilot study on average pesticides intake.
- Use of proposed device to perform a correlative study of pesticides intake with human health (cancer occurrence).

Significant Achievements:

(a) Natural Polyhydroxyalkanoate-Gold Nanocomposite Based Biosensor for Detection of Antimalarial Drug Artemisinin

The current investigation aimed at fabricating a biosensor based on natural polymer polyhydroxyalkanoate-gold nanoparticles composite on indium-tin oxide glass plate for the analysis of artemisinin. The biosensor was fabricated using adsorbing horse-radish peroxidase enzyme on the electrode surface for which cyclic voltammetry was used to monitor the electro-catalytic reduction of artemisinin under diffusion controlled conditions. Electrochemical interfacial properties and immobilization of enzyme on to polyhydroxyalkanoate-gold nanoparticle film were evaluated, and confirmed by cyclic voltammetry, electrochemical impedance spectroscopy and scanning electron microscopy techniques. The differential pulse voltammetric peak current of artemisinin was increased linearly (concentration range of 0.01 - 0.08 µg mL^{-1}) with sensitivity of 0.26 µAµgmL^{-1}. The greater sensitivity of the fabricated biosensor to artemisinin (optimum limits of detection were 0.0035 µg mL^{-1} and 0.0036 µg mL^{-1} in bulk and spiked human serum, respectively) can be of much aid in medical diagnosis.



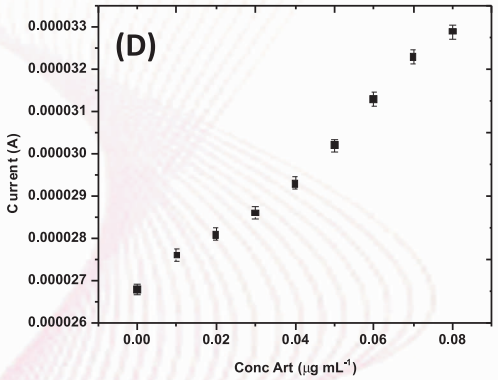


Figure. Cyclic voltammograms of [A] (a) PHA/ITO (b) PHA/AuNPs/ITO (c) PHA/AuNPs/HRP/ITO with the scan rate at 5 mV s^{-1} and electrochemical Nyquist plots of [B] (a) PHA/ITO (b) PHA/AuNPs/ITO (c) PHA/AuNPs/HRP/ITO electrodes in PBS (50mM, pH 7.0±0.1) containing 5mM $[Fe(CN)_6]^{3-/4-}$. (C) Shows biosensors response with increases concentration of artemisinin and (D) calibration curve shows linearity for artemisinin as 0.01 to 0.08 µg mL^{-1}

(a) Amperometric Immuno-Sensor for Detection of Toxin Aflatoxin B_1 based on Polyaniline Probe Modified with Mc-IgGs-*a*-AFB_1 Antibodies

Aflatoxins are a group of chemically related mycotoxins formed by common fungi (Aspergillus flavus, A. parasiticus, and A. nomius) found in corn, cottonseed, peanuts, and other nuts, grains, and spices. Aflatoxin concentration is the most important quality problem in food products worldwide with serious health implications for humans as well as livestock. Among them aflatoxin B_1 (AFB_1) being the most toxic in terms of both acute and chronic toxicoses. An amperometric sensor for determination of potential environmental toxin aflatoxin B1 (AFB_1) based on conducting polyaniline (PANI) using Mc-IgGs-a-AFB_1 Antibodies electrochemical polymerization is proposed. The electrode has been fabricated and used to monitor the electro-catalytic reduction of aflatoxin B1 under diffusion controlled conditions. The formation of the antibody–antigen complex by a simple one-step immune reaction between the immobilized Mc-IgGs-a-AFB_1 Antibodies and Aflatoxin B_1 in sample solution introduced an electrical barrier between the solution and the electrode surface which is confirmed by electrochemical impendence spectroscopy (EIS). Fourier Transform Infrared spectroscopy (FT-IR), Cyclic Voltammetry (CV) and Electrochemical Impedance Spectroscopic (EIS) techniques have been attempted towards characterization of electrochemical interfacial properties of surface modified electrodes. The proposed amperometric immuno-sensor reveals excellent electro-analytical properties relative to Aflatoxin B_1 in a linear range from 0.20 to 1.30 $ngmL^{-1}$ with a relatively low detection limit of 0.049 $ngmL^{-1}$. Further, the proposed methodology could be applied to the detection of Aflatoxin B_1 in various matrices.

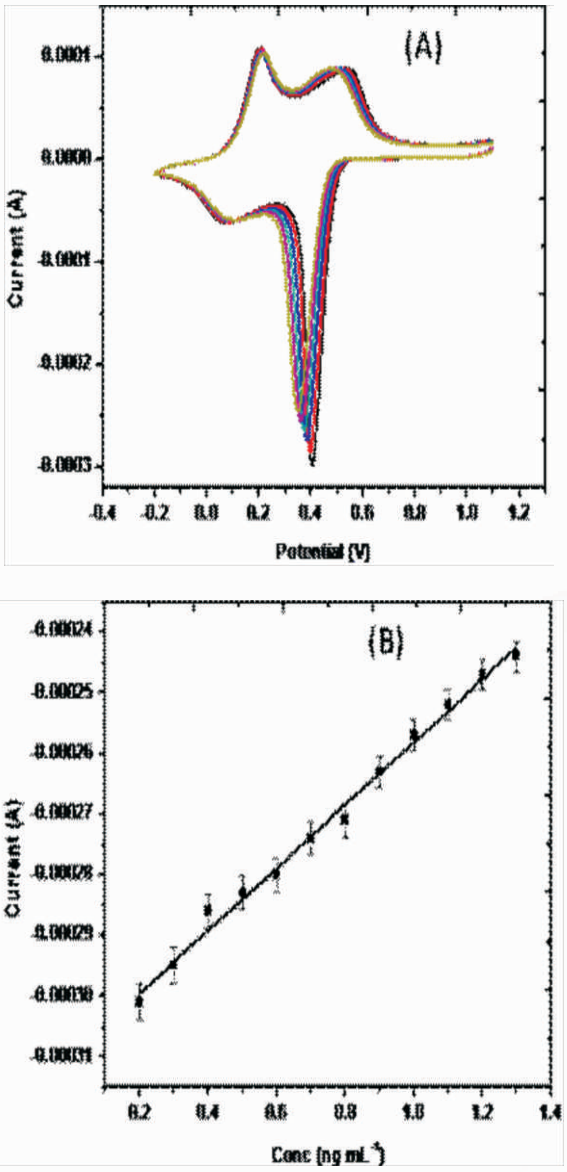
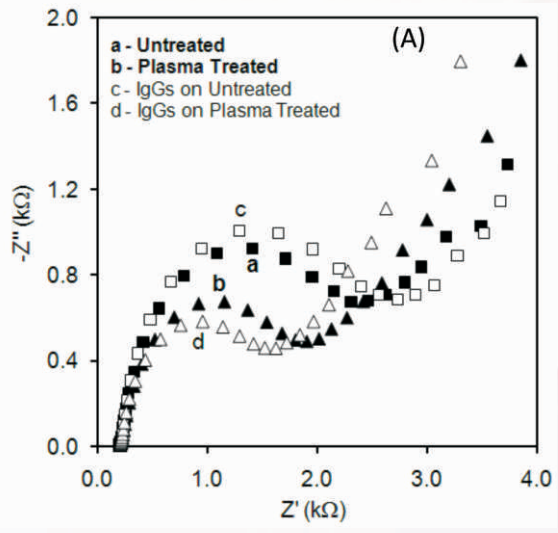


Figure. (A) Biosensors response with increases in concentration of aflatoxin B1 in 0.1 M phosphate buffer solution (PBS) containing 0.9% NaCl at a scan rate of 5 mV s-1 and (B) calibration curve shows linearity for aflatoxin B1 as 0.20 to 1.30 ngmL-1.

(C) **High Sensitivity Electrochemical Immunosensor based on Plasma Modified Chitosan/TiO2 for Ochratoxin-A.**

Radio frequency plasma treated nanocrystalline hybrid chitosan/TiO2 (CS/TiO2) matrix was used to develop high sensitivity electrochemical immnunosensor. Fourier transforms infrared (FT-IR) spectra of plasma treated matrix revealed that anti-symmetric deformation of NH_3^+ and NH_2^+ functionalities at the surface was enhanced after plasma treatment. The observed interfacial charge transfer resistance (R_{CT}) and double layer capacitance (C_d) of plasma modified matrixes were decreased from 2.4 to 1.7 k□ and 2.8 to 1.4 □ F, respectively. An improved strength of amide I and II groups in FT-IR spectra were observed which was associated with enhancement in immobilized rabbit antibodies (IgGs) on plasma altered surfaces. Electrochemically quantitative detection of Ochratoxin-A (OTA) concentrations varying from 0.1 to 10 ng mL^{-1} in buffer solution was carried out on IgGs immobilized plasma treated and untreated CS/TiO_2/ITO electrodes. Plasma modified electrodes showed very good sensitivity at very low OTA concentrations (< 1 ng mL^{-1}) with a linear response upto 2 ng mL^{-1} whereas the untreated electrodes sensitivity was deprived. The overall OTA detection sensitivity of immunosensor based on plasma treated matrix was enhanced by more than two orders relative to unmodified condition. This large improvement in detection sensitivity was due to an increase in surface energy, higher proportion of immobilized antibodies and better charge transportation through plasma treated matrix.



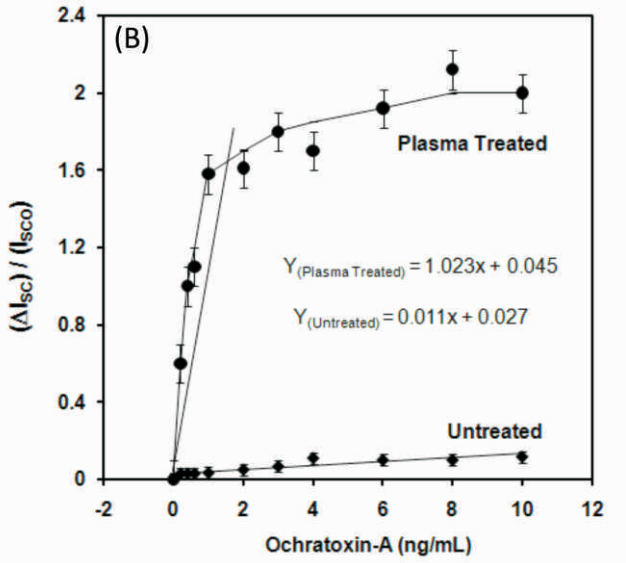


Figure: (A) Nyquist plot of electrochemical impedance measurements of untreated and plasma treated CS/TiO2/ITO electrodes before and after rabbit antibodies immobilization and (B) Linear response of immunosensor at different concentration of OTA on untreated and plasma treated CS/TiO2/ITO electrodes

Project No : **GAP 0224**

Project Title : **Synthesis of Some Versatile Steroidal Molecules: Approach To Synthesis of Hybrid Molecules Including Nine Membered D-Ring Steroids and Chemeric 7α-Substituted Derivatives**

Funding Agency : DST, New Delhi

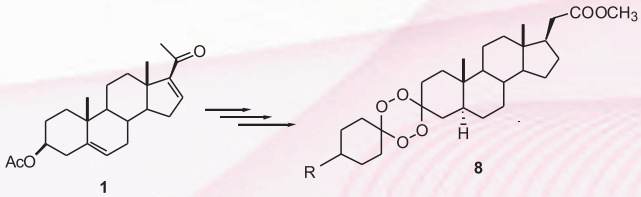
PI & Members : Dr A M Das

Objectives:

- The project work involves on Steroid Transformations to get potentially biologically active steroid molecules and important steroid drug intermediates as well as one step simple route of micro wave assisted reactions, new reagents etc.

Significant Achievements:

The work involved synthesis of potential biologically active steroidal molecules, viz., 1,2,4,5-tetroxane derivative of steroids from 16-DPA.



Project No : **GAP 227**
Project Title : **Synthesis of novel Pyrimidine Derivatives of biological significance based on inter and intramolecular cycloaddition strategy**
Funding Agency : DST, New Delhi
PI & Members : Dr Dipak Prajapat, iPI, Dr Romesh Ch Boruah, Co-PI

Objectives:

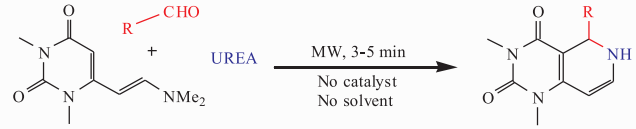
The main objective of the present proposal is to investigate the application of cycloaddition chemistry to the basic skeleton of pyrimidines to construct newer molecules of biological significance which will pave the way in devising a new methodology in the synthesis of complex natural products. Also to study

- The site selectivity and regioselectivity of the reaction
- The stereoselection or achieving the stereoselectivity in the end compound using suitably modified dipoles or dipolarophiles.
- To accomplish the synthesis of bicyclic and polycyclic heterocycles by a one-step process and establish the possible pathways for the construction of basic skeleton of natural products.
- To evaluate the biological acitivity of some new nucleoside/pyrimidine derivatives synthesized.
- Naturally, as mentioned above, the theme is the development of new knowledge of the most finest nature i.e. stereospecificity, regiospecificity and asymmetric synthesis.

Significant Achievements:

Microwave Promoted Catalyst and Solvent-free Aza-Diels-Alder Reaction of Aldimines with 6-[2-(dimethylamino)vinyl]-1,3-dimethyl uracil

An efficient aza-Diels-Alder strategy for construction of dihydropyrido[4,3-*d*]pyrimidine derivatives has been developed. A range of aromatic, heteroaromatic and conjugated aldehydes have been shown to participate in the reaction when carried out inside a microwave reactor in absence of any solvent or catalyst. The reaction can be suitably tuned simply by varying the reaction time to obtain aromatic pyrido[4,3-*d*]pyrimidines. It is further demonstrated that this methodology can be effectively exploited for the synthesis of dihydropyrimido[4,5-*d*]pyrimidines in an improved and eco-friendly way than previously reported procedures. Overall, this one-pot three-component technology is simple, efficient and provides an alternative towards removing organic solvents from organic synthesis.



Project No : **GAP-0238**
Project Title : **Development of low cost process for fluoride removal from contaminated water specific to NE region for public use**
Funding Agency : Ministry of Environment & Forest , Govt. of India
PI & Members : Dr(Mrs) Aradhana Goswami, PI Dr RL Goswami, Co-PI, Mr JJ Bora, Mr Tobiul hussain Ahmed

Objectives:

- Development of an economically feasible an environmentally sound simple process for defluoridation of water to provide potable water to the rural households.
- Gainful utilization of waste material like paddy husk ash and environmentally material like Ipomoea Cornea ash.

Significant Achievements:

The process developed presently for the adsorption of fluoride is based on the locally available raw material can be further taken up for integrated study along with other filtering bed media for removal of other organic, inorganic soluble species and microbial contaminants.

The study shows that the process developed for adsorption of fluoride is based on the locally available raw material produces certain sludges which can be further taken up for integrated study of permanent immobilisation in reservoir mineral repositories for safe disposal.

Since, the process would utilise locally available waste biomaterials therefore govt departments and agencies like agriculture department and pollution control boards could pull their resources to support and subsidise the adsorbent generation process so that ultimate cost to users of water treatment plants would be cheaper.

Compiling of an IPR application on defluoridation using hydroxy alumina coated *Ipomea carnea* is in progress. Similarly, another IPR application on sludge immobilisation using chemically modified paddy husk ash and lime-silica reaction is in compilation stage.

Another project titled Small Community Level Low Cost Process from Local Biomass for Iron and Flouride Removal from Bore Well Water of Assam (LOCAL-MASS) has been submitted to DST Delhi on similar line along-with one NGO and one SME.

Project No : **GAP-0241**
Project Title : **Economic Process for the Drying of UMOROK Chili and Turmeric and their quality evaluation with Stability Study**
Funding Agency : Ministry of Food Processing Industry
PI & Members : Dr(Mrs) Aradhana Goswami, PI, Mr Tobiul hussain Ahmed

Objectives:

- The main aim of the project is to develop a suitable economic method for drying Umorok chilli and turmeric. Umorok chilli is the the world's hottest chili specially grown in Manipur. In consideration of the congenial agro-climatic of the N.E region of India, considerable quantities of turmeric (*Curcuma Longa*) have been produced and their potentiality of increasing the cultivation to a great extent.

Significant Achievements:

Development of drying characteristics using hot air oven, microwave oven. The drying characteristics were studied in hot air oven at different temperature for Umorok chili. The characteristics were also studied for Umorok chilli & turmeric using microwave dryer absorbing various microwave power. The diffusion kinetics was studied for Umorok Chili. The water activity of the chilli is the function of moisture content and decreases with time at different microwave power. Some empirical drying model using kinetic data & standard software were tried.

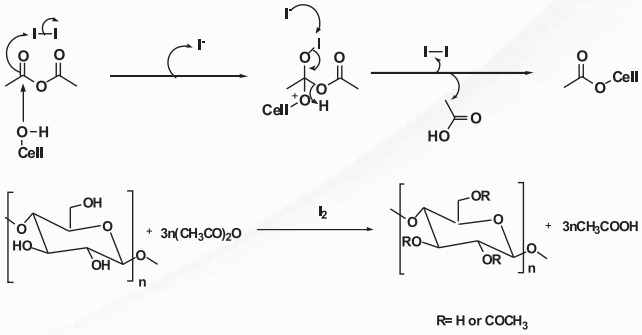
Project No : **GAP 0247**
Project Title : Utilization of lignocelluloses bearing plants of north-east India for potential source of energy: A green approach
Funding Agency : NEC
PI & Members : Dr AM Das, PI, Dr Dilip Konwar, co-PI, Dr NC Barua, co-PI, Dr T C Bora

Objectives:

- Collection of potential lignocelluloses bearing plants of North-East India for production of vanillin, ferulic acid, and ethanol.
- Extraction of lignocellulose components from plant materials and separation of lignin and cellulose.
- Conversion of cellulose to sugars by hydrolysis through green methods.

Significant Achievements:

a) A process for the isolation of cellulose from rice straw, wood materials and other renewable resources were done.
b) Preparation of vanillin from rice straw was done directly from rice straw.
c) Preparation of cellulose acetate from cellulose was done
d) Preparation of cellulose acetate using green chemistry from waste plant materials



Project No : **GAP-0258**
Project Title : **Domino Prins Cyclization Reactions: Syntheses of novel highly functionalized tetrahydropyran and piperidine derivatives**
PI & Members: Dr Gakul Baishya

Objectives:

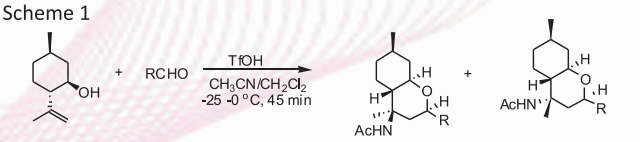
- To develop new domino Prins cyclization reactions as novel synthetic methods.
- To target some natural products of biological importance using aza-Prins cyclization reaction.

Significant Achievements:

2*H*-Chromene is also found to be the core structural motif of several biologically active natural products such as calonolide F which was isolated from

Calophyllum tesymannii. Calonolide F mainly exhibits anti-HIV activity, whereas its synthetic analogues show anti-hypertensive and nti-ischaemic activities. We successfully carried the strategy of Prins-Ritter reaction sequence for the synthesis of a library of some novel 4-acetamido octahydro-2*H*-chromene derivatives from (-)-isopulegol and aldehydes using triflic acid as a promoter under very mild conditions (Scheme 1, *RSC Advances* 2014, *4*, 22387).

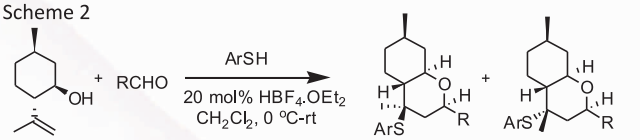
Scheme 1



(-)-isopulegol 4-acetamido-2*H*-octahydrochromene

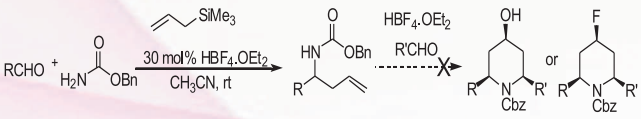
As a part of our ongoing research programme on the use of the Prins cyclisation methods we are now giving our focus on Prins-arylthiolation reaction of monoterpene (-)-isopulegol to synthesize some novel 4-arylthio-4*H*-octahydrochromene derivatives in a single step reaction (Scheme 2, unpublished result: manuscript ready).

Scheme 2



(-)-isopulegol 4-arylthio-2*H*-octahydochromen

In another experiment we tried to develop novel one-pot four component domino aza-Prins cyclization reaction. But the reaction failed to give the desired product and it stopped after the first step i.e. the preparation of *N*-Cbz protected homoallylic amines. We therefore generalize the first step of the proposed method and we found that there have been no reports as yet of the use of $HBF_4.OEt_2$ as a fluorinated acid catalyst to promote this synthetically important reaction for the one-pot synthesis of secondary and tertiary *N*-Cbz protected homoallylic amines.



Project No : **GAP-0286**
Project Title : **Sustainable and Biodegradable Hybrid Nano-Composites as Bio-integrated Materials for Advanced Functional Applications**
Funding Agency : Ministry of Science & Technology
PI & Members : Dr AM Das

Objectives:

To work involved the isolation of the lignocellulosic fibers from selected waste plants, plants and protein fibers in pure form and converted to nano cellulosic fiber and polymer-matrix composites using metal mediated reaction strategy and characterization. Biological activity of the synthesized products was also evaluated.

Significant Achievements:

Steroid-Chitosan Ketimine Nanoparticles for Antibacterial and Antifungal Activity carried out.

Project No : **GPP276**
Project Title : Development of Molecular Gate Membrane for CO_2 Separation and Green Emission Control
Funding Agency : DST, New Delhi
PI & Members : Dr Swapnali Hazarika, PI, Dr Dilip Konwar, Co-PI, Mr S Borthakur, Co-PI, Dr M M Bora

Objectives:

- Preparation and characterization of dendrimer and dendrimer derivatives and their characterization to make a comprehensive QSAR study in respect of molecular structure of dendrimer and its derivatives.
- Preparation and characterization of Molecular Gate membrane from dendrimer and dendrimer derivatives and optimize the preparation procedure followed by the studies on microvoid formation mechanism with respect to membrane preparation parameter.
- To study the equilibrium and kinetics of adsorption and desorption of CO2 and associated gas on dendrimer, develop appropriate model and estimate the model parameters. Also to make a molecular modeling study in order to understand the adsorptive interaction for deducing implication of molecular design of specific dendrimer.
- Extensive experimental study to understand permeation behavior of CO2 using simulated biogas and develop appropriate flux model incorporating solute diffusion, mass transfer, adsorption effects and optimize the process for Spiral wound membrane module.

Significant Achievements:

Half and zero generation dendrimer have been prepared using catalyst and characterized by IR, NMR and GCMS analysis. QSAR study has also been made for dendrimer molecules using Density Functional Theory. The synthesized dendrimer has been used for preparation of molecular gate membrane. The membranes have been characterized by TGA, DSC, pore size, gas permeability and surface morphology study.

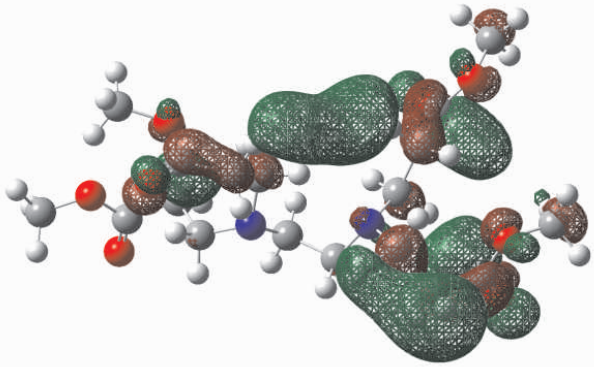


Figure: LUMO of half generation dendrimer

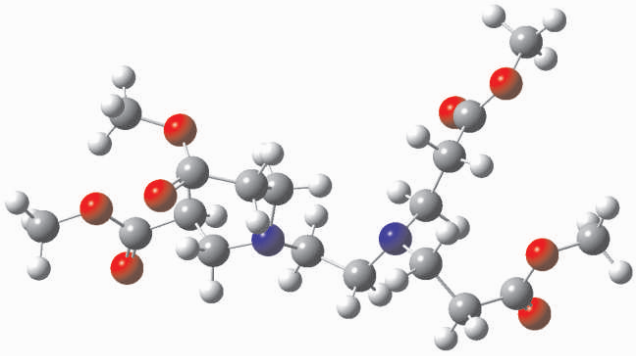


Figure: Optimized structure of half generation dendrimer

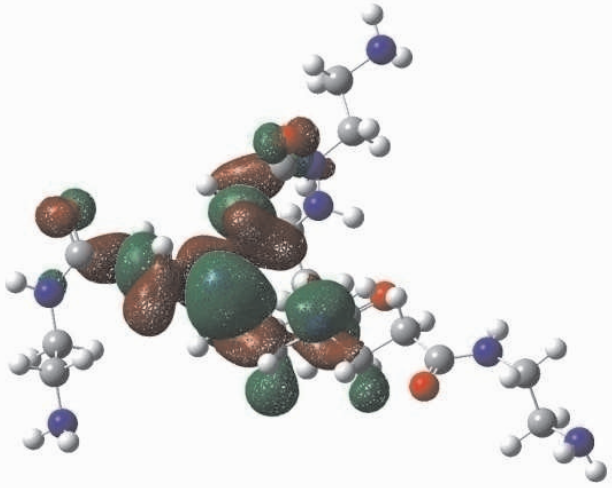


Figure: HOMO of 0G dendrimer

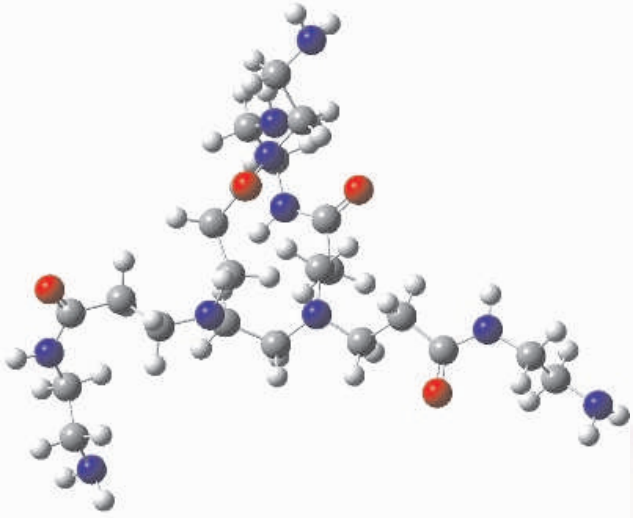


Figure: Optimized structure of zero generation dendrimer

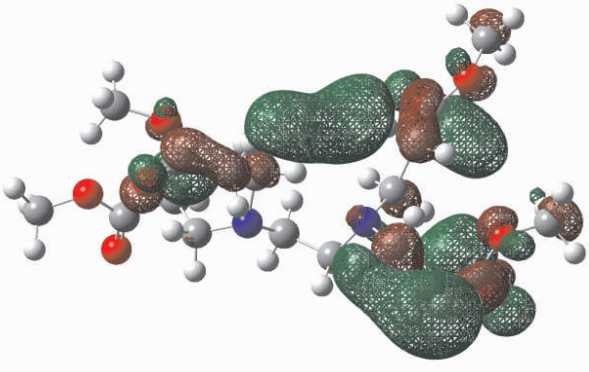


Figure: HOMO of half generation dendrimer

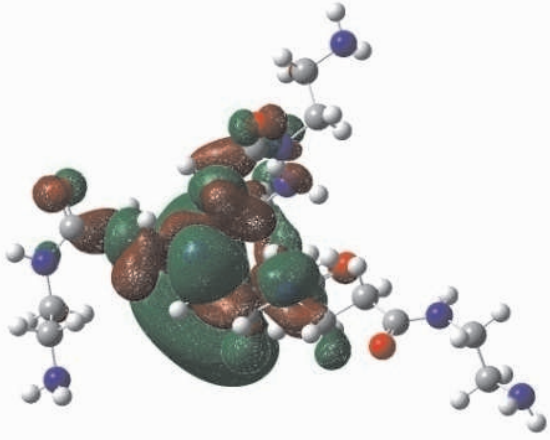


Figure: LUMO of 0G dendrimer

Project No : **GPP 0279**

Project Title : **Sustainable chemistry in the synthesis of some novel functionalised coumarins and assay for their potential biological activity**

Funding Agency : DST, New Delhi

PI & Members : Dr Pulakjyoti Bhuyan, PI
Dr H P Deka Baruah, Co-PI

Objectives:

- The objective of the project is to synthesize some novel functionalized annelated coumarin derivatives and assay for potential biological activity of the new compounds. Some biologically important molecular units like pyridine, pyrane, pyrimidine, pyridazine, isoxazole, pyrazole etc are to be fused to the basic coumarin molecule, finally to achieve well functionalized tri-, tetra-, and pentacyclic coumarin derivatives.

Significant Achievements:

Generated libraries of novel functionalized annelated coumarin molecules for bio-evaluation.

ENGINEERING SCIENCES

The engineering science areas have four divisions and provide engineering inputs and services to different R&D projects in the institute.

The Applied Civil Engineering Division has expertise in geo-technical and transportation engineering. This division is presently involved in R&D work for soil stabilization for use in roads and building construction, seismic vulnerability and risk assessment of buildings in selected cities of North-Eastern region. The division also renders consultancy services for soil investigation, road performances and testing of various roads and building construction materials.

Chemical Engineering Division provides engineering inputs to different areas and projects in the institute. Some of the major activities includes transport phenomena in solid /liquid membrane based separation processes, adsorption equilibrium kinetics in bio-molecule separation, molecular interaction through molecular orbital theory, fixed bed adsorption and simulation, development of nano-structured membrane materials like chiral polymers, cyclodextrin polysulphone composits, aqueous two phase extraction, scale up studies of bioprocesses in bioreactor and downstream processing, hazard and risk analysis in thermo- chemical processes, development of rice based food and nutraceutical products.

General Engineering Division is committed towards R&D in the field of mechanical design and product development, environmental studies, disaster mitigation, technopreneurship development and technological intervention for socio economic uplifting in rural areas. The division is also engaged in testing and consultancy services including engineering infrastructural services for the institute. The workshop is equipped with universal testing machine, hardness testing machine, CNC machines, EDM, rapid prototyping and various data acquisitions systems for different engineering and R&D related activities.

The Electronics & Instrumentation division is engaged in activities for support to institutional infrastructure like maintenance of equipments and total internal telephone network. The department has also R&D activities for development of electronic sensor based devices for pre-disaster management, gas monitoring and early warning systems for coal mines.

National Collaboration

Project No : **CSC-104**

Project Title : Membrane and adsorbent technology platform for effective separation of gases and liquids

NEIST Title :

Part A : Membrane Separation Processes for Liquids and Gases

Part B : Nano Oxidic Membrane Reactors by Green Chemical Approach

Funding Agency : CSIR, New Delhi

PI & Members :

(Part A) Dr Swapnali Hazarika, Nodal Scientist
Dr P Barkakati, Dr M M Bora, Mr S Borthakur

(Part B) Dr Dr Rajib L Goswamee, PI
Dr Mrs Aradhana Goswami

Objectives:

(Part A):

- Development of Nanofiltration membrane for Extraction and separation of value added products from Natural feedstock of North East region.
- Enzymatic conversion in Membrane reactor for naturally occurring substrates in Bioresource based chemical platform.
- Development of Chiral polymeric membrane for racemic resolution.
- Molecular Gate' membrane technology for gas separation e.g. CO2, CH4 for such application as biogas up gradation.

(Part B):

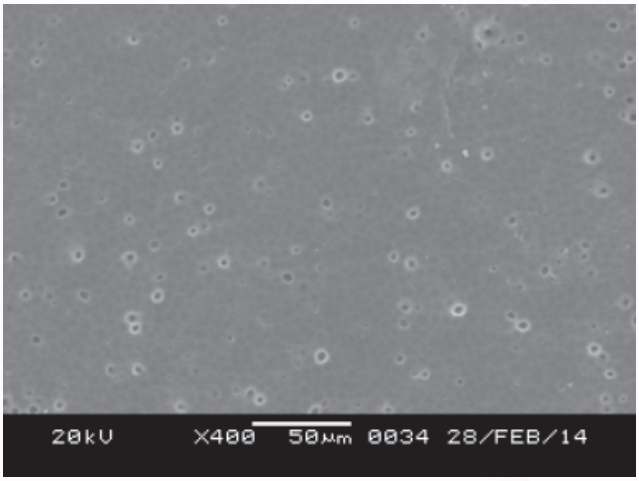
Design of mixed metal oxide nano sheet based Inorganic Membrane Reactors for environmentally / industrially important applications having following S&T Elements –

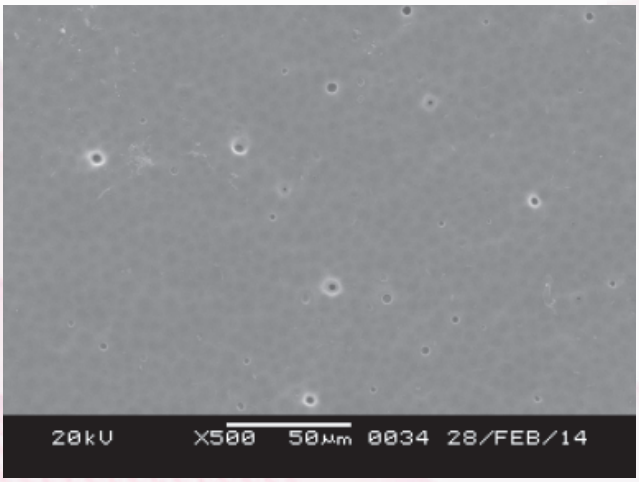
- Synthesis of nano oxide dispersions
- Coating over suitable performs to form thin films having catalytic and membrane properties
- Design and Fabrication of Catalytic Membrane Reactor for Conversion of CH_4 and N_2O.

Significant Achievements:

(Part A) :

Nanostructured membrane have been prepared and characterized by IR, XRD, SEM, TEM, pore diameter and permeability analysis. The pore sizes of the prepared membranes were found to be in the range of 52-70 nm. Spiral wound membrane module have been designed and fabricated for large scale separation of value added product.





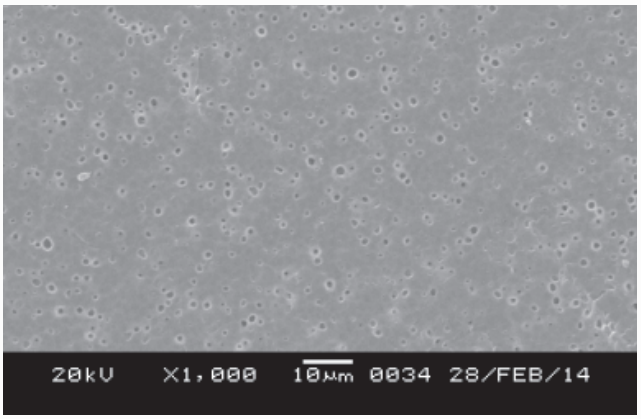


Figure : SEM photograph of Cyclodextrine Membrane

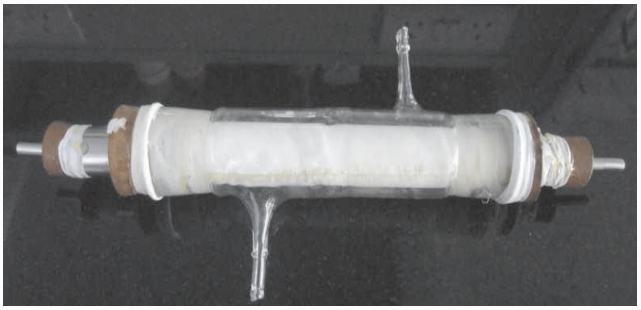


Figure : Spiral wound membrane (CD) module

Under this project, extraction of some value added products from plant samples such as *Artocarpus lakoocha Roxb. and Morus alba,* have been done using suitable extractant considering greener approach. During the investigation, extraction kinetics of Resveratrol from *Artocarpus lakoocha Roxb.* and *Morus alba* have been established using suitable kinetic model. The compound has been separated using indigenously developed nanofiltration membrane and compared the results with that of the commercial membrane. The purity of compound has found to be >98% while using indigenous membrane.



Figure: Artocarpus lakoocha Roxb. (tree) (Collected from Assam)



Figure : Artocarpus lakoocha Roxb.
(Leaf and fruit)

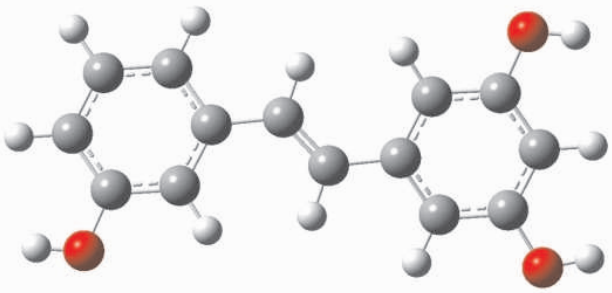


Fig: Structure of Resveratrol

Extraction of natural dye from the seed of *Mallotus Philipenesis* has been studied using suitable extractant. The extracted dye has been separated using indigenously developed nanofiltration membrane. The purity of the separated dye has found to be >90%.



Mallotus Philipensis



Mallotus Philipensis (Seed)

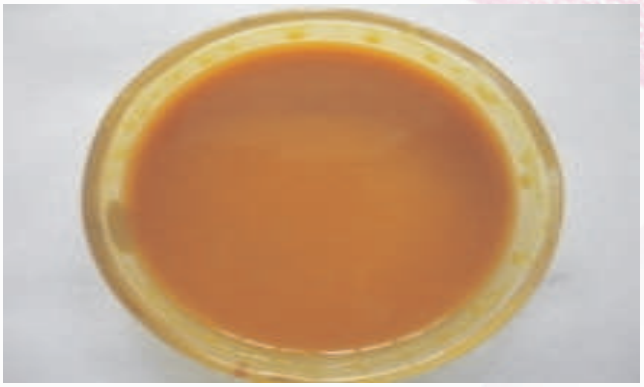


Figure: Dye extracted from Mallotus Philipensis (Seed) and separated by NF membrane

(Part B)

Hybrid Nanogels of Layered Double Hydroxides as Controlled Release Carrier of Antibiotics

Layered Double Hydroxides (LDH) nanosheets exfoliated using acrylamide as the organic monomeric prop was further inoculated with antibiotic molecule norfloxacin to give organic inorganic hybrid gel with flowable character suitable for coating over solid preforms like α- alumina. The coated materials showed qualitative antimicrobial activity against *E. Coli* bacteria. These studies can pave the way to process more advanced materials with localized targeted drug delivery capacity.

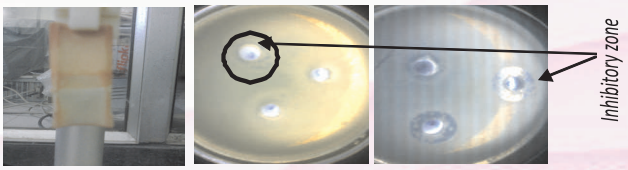


Fig. Photographs on coating and efficacy of hybrid-nano gels containing antibiotic molecule Norfloxacin a. silica supported Ni-Al LDH-Norfloxacin coated over alumina performs; b. bacterial (E-coli) colony growth behaviour in hybrid gel with 0.05% (w/v) loading of norfloxacin - after 1 hr; c. same as b but after 6 hrs of treatment

Coating of Metal Oxides by Metalorganic Chemical Vapour Phase Deposition (MOCVD)

MOCVD is a complex process for growing crystalline layers over solid surface which is used to deposit very thin layers of atoms onto a solid surface. Metal β-diketonates (Acac) are the most favourable precursors for MOCVD. Cu-Acac was coated by MOCVD over glazed ceramic tiles in an electric muffle furnace at 160 °C, the central blocked zone is due to small crucible. Further studies are going for further optimization of the process for thin films preparation over honeycomb preforms.

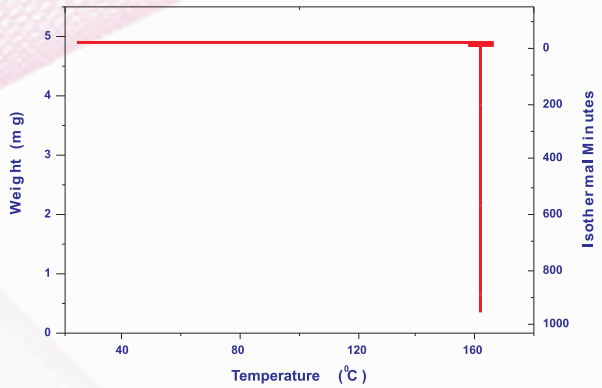


Fig. Isothermal Thermogram of $Cu(acac)_2$ at 160°C

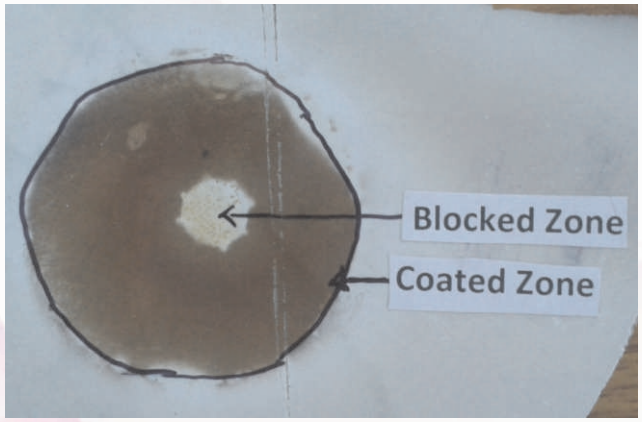


*Fig. Coating of Copper Oxide flims prepared by MOCVD from **$Cu(acac)_2$***

Project No : **CSC-107**
Project Title : **Inherently Safer Practices for Industrial Risk Reduction (INSPIRE)**
Funding Agency : **CSIR, New Delhi**
PI & Members : Mr Bipul Das, PI, Mr Tobiul Hussain Ahmed, Co-PI
Dr (Mrs) Aradhana Goswami,
Dr Swapnali Hazarika
Dr Pranjal Gogoi, Dr Pallab Pahari
Dr Sanjeev Gogoi

Objectives:

- Up gradation of Thermo chemical Laboratory.
- To build knowledge-base/expertise for evaluating chemical reactive systems by application of thermo-chemical techniques, towards implementation of inherently safer options.
- To integrate experimental findings on thermal hazard studies and to develop alternate process strategies to prevent runaways.
- To undertake Hazard Study and Risk Analysis of existing chemical and biochemical processes and to provide risk reduction solutions.

Significant Achievements:

Thermo chemical laboratory for studies on reactive hazard evaluation, heat of reaction, adiabatic temperature rise, reactivity and exothermicity data etc. for select runaway reaction systems developed and related works undertaken.

Project No : **ESC-0102**
Project Title : **Engineering of Disaster Mitigation and Health Monitoring for Safe and Smart Built Environment**
CSIR-NEIST Title : **Pre Disaster Management- Development of Optical fiber based Multiplex Sensor Network System for Landslide Monitoring.**
Funding Agency : CSIR, New Delhi
PI & Members : Mr. Khirod Buragohain, PI
Dr P Kataky, Mr Amar J Gogoi

Objectives:

- Design and development of an optical fiber based sensor usable for monitoring of landslide.
- Development of laboratory prototype multiplex network monitoring system for landslide and early warning.
- Field trial of the system in a landslide prone area in NE region.

Significant Achievements:

Determination of macro and micro bending property of commercial grade optical fibers at different wavelength.

(II) Inhouse, Grant-In-Aid and Consultancy Projects

Project No : **MLP-4000/1**
Project Title : **Studies on Process Intensification and Integration Process for Bioproducts, Chemicals and Fuel from Bio-resources and development of Soil stabilization technique**
Funding Agency : CSIR, New Delhi
PI & Members : Dr P Barkakati, PI, Dr Aradhana Goswami, Dr M M Bora, Mr S Borthakur, Dr Swapnali Hazarika, Mr Bipul Das, Mr Tobiul Hussain Ahmed

Objectives:

- Studies on Downstream and upstream Processing Techniques: Membrane and adsorptive separation process, Miscellar Enhanced ultrafiltration for Recovery of Biomolecules, industrial solvents from process stream, hydrocarbon contaminated waste water treatment, Resolution of racemic compound by membrane and enzyme membrane reactor.
- Esterification and transesterification of enantioselective synthesis of therapeutic intermediates from biomass based substrate.
- Process design for nutraceuticals, functional foods, pharmaceuticals and fine chemicals.
- To develop Insitu microcapsulation method utilizing "SMART" materials of polymer for control release of drug and nutraceuticals.

Significant Achievements:

Pretreatment of rice straw samples were done using ionic liquid as the media for process intensification study. The operating conditions for bioconversion of rice bran to value added products were optimized. The physico-chemical properties of Umorok Chilli, turmeric and rice bran samples were characterized. Umorok chilli was characterized for capsaicin content and drying characteristics. Turmeric sample were characterized for moisture and curcumene content.

Project No : **MLP-4000/03**
Project Title : **Study and development of soil modification or stabilization techniques for various types of soil used in construction activities in and around Jorhat and in some selected areas of Assam.**
Funding Agency : **CSIR, New Delhi.**
PI & Members : Mr Sanjay Deori, PI, Mr Dipak Basumatari, Co-PI, Mr Tapas Das Mrs Anjumoni Bharali, Mr Nibir Pran Borah, Mr Mukesh Agarwal

Objectives:

- To develop soil improvement techniques used in road sub-grade/sub-base, airfield, embankment etc.
- To modify and improve engineering properties of soil with admixtures such as lime, cement, bitumen, flyash or blends of any materials and with use of reinforcements like geogrids, geotextiles, and waste materials etc.

Significant Achievements:

- Soil samples were collected from different locations which are being used for construction activities.
- Determined the different properties of collected soil samples in the laboratory.
- RBI Grade-81 and Cement have been using as admixture for stabilization of collected soil samples.
- Soil samples with RBI Grade-81 and Cement admixtures in different proportions have been prepared and determined the MDD - OMC relationship.
- Evaluated the Strength characteristics (CBR test in un-soaked / 4-days soaked condition) of the stabilized soil samples in the laboratory.

Project No : **GPP : 0284**
Project Title : **Performance Evaluation of River Brahmaputra Bed Materials for use in construction of Embankment, Subgrade and Subbase**
Funding Agency : DST, New Delhi
PI & Members : Mr Sanjay Deori, PI, Mr Dipak Basumatari, Mrs Anjumoni Bharali, Mr Nibir Pran Borah Mr Mukesh Agarwal

57

Objectives:

- To evaluate the performance of stabilized river bed materials conforming to available Indian Specification for materials used in construction of road embankment, subgrade and sub-base.
- Performance evaluation of stabilized river bed materials through laboratory model studies.
- Preparation of specification/guidelines for use of stabilized Brahmaputra river bed materials in construction of road embankment, subgrade and subbase.

Significant Achievements:

- Procurement of equipments such as Concrete Mixer, Digital Concrete Test Hammer, Lab Permeability Test Apparatus etc. under process.
- Collection of Brahmaputra river bed materials from Nimatighat, Kokilamukh & Spur No.8.

Project No : **CNP-0461**
Project Title : **Soil investigation of Recycling Treatment Plant of Numaligarh Refinery**
Funding Agency : M/s Numaligarh Refinery Limited, Golaghat Assam.
PI & Members : Mr Sanjay Deori, PI, Mr Dipak Basumatari, Co-PI, Mrs Anjumoni Bharali, Mr Nibir Pran Borah, Mr Mukesh Agarwal, Mr Rajib Das

Objectives:

- To determine safe bearing capacity of foundation soil.

Significant Achievements:

- Various Field Tests such as Standard Penetration Tests (SPT), Static Cone Penetration Tests (SCPT), Electrical Resistivity Tests (ERT) were carried out.
- Laboratory Tests such as Atterberg Limit Tests, Consolidation Tests, Unconfined Compression Tests, Triaxial Tests, CBR Tests etc. were carried out.
- Submission of Final Report to M/s NRL, Golaghat with advice and recommendation on safe bearing capacities of foundation soil.

Project No : **CNP-0462**
Project Title : **Performance Evaluation Report on Rural Roads Constructed Using BitChem Cold Mix in Different District of Assam.**
Funding Agency: M/s BitChem Asphalt Technologies Limited, Guwahati Assam.
PI & Members : Mr Sanjay Deori, PI, Mr Dipak Basumatari, Co-PI, Mr Nibir Pran Borah, Mr Rajib Das

Objectives:

- Performance evaluation of 4-years old in-service rural roads constructed using BitChem Cold Mix technology for premix carpeting under PMGSY and MPNA Schemes in different district of Assam.
- Comparative sudy of 4-years old in-service surface condition of rural roads constructed using *BitChem Cold Mix* technology for premix carpeting under PMGSY and MPNA Schemes in different district of Assam.

Significant Achievements:

- Collection of details of rural roads sections from the concerned department's field engineers, which has already been completed 4-years of service.
- Selection of 4-years old rural constructed using Bitchem Cold Mix and hot mix for laying Pre-mix carpeting under PMGSY and MPNA schemes in different district of Assam.
- Visual observation of surface condition of cold and hot pre-mix bituminous carpeting in terms of distress developed after 4-years of service and their drainage conditions.
- Observation of traffic movement on the road sections.
- Collection of in-situ samples of Bitchem Cold Mix from few selected rural road sections.

(A) Project No. : **CSC -0113**
Title of Project : **Development of sustainable waste management technologies for chemical and allied industries. (SETCA) (NEIST WP:** Environment Friendly Measures of Disposal and Recovery of Solid Deposits from the Strainers and Other Sources Crude Oil Pumping Stations and Pipelines-DIRESCOP)

PI & members : Sri S C Kalita (PI); Sri J J Bora (Co-PI)
Members : Dipankar Neog, Dr. Bimala Prasad Baruah, Dr. Binoy Kumar Saikia

Sponsoring Agency:
Council of Scientific and Industrial Research

Objectives :

a) Determination of physical and chemical properties of deposited solids of high API gravity crude oil obtained from strainers and other sources of crude oil pumping station.

b) Development of process for cleaning of strainers / removal of solid deposits.

c) Design and Development of suitable device for recovery of different constituents of solid deposits for commercial exploitation.

Salient Achievement:

The experimental setup fabricated in order to carry out the study of solid deposits removal from the strainer and pollutant generated at different temperature is currently under field trials at Oil India Limited (OIL) Pumping Station-3 (PS-3). During the testing, the set-up was subjected to real time environmental factors which led to various modifications. The results obtained were highly acceptable and paved way to any further developments.



Field trials at OIL PS-3

Fabrication of a pipeline set-up for studying the effect of various parameters on crude oil is being done and is nearing completion stages. The purpose is to conduct an experiment to study the effects of varying parameters on crude oil. Model of a strainer is fabricated so as to study the deposition pattern of wax in the strainer.

(B) Project No. : ESC-0102
Title of Project : Engineering of Disaster Mitigation and Health Monitoring for Safe & Smart Built Environment (EDMISSIBLE) (WP 4.2): Post Disaster Management – Design and Development of Transitory Houses for Disaster Vulnerable Rural Sectors in the North Eastern Region.)

PI & members : Dipankar Neog, (PI), Deepak Basumatari (CO-PI)
Members : Dipul Kalita, JJ Bora, SC Kalita, P Barkakati, T Goswami, Sanjoy Deori

Sponsoring Agency : Council of Scientific and Industrial Research

Objectives :

(a) Design of assembled mass housing units, using locally available construction materials (major components) and metals, polymers (minor components) for their sustainability during post disaster mitigation for natural calamities like flood, earthquake, cyclone etc.

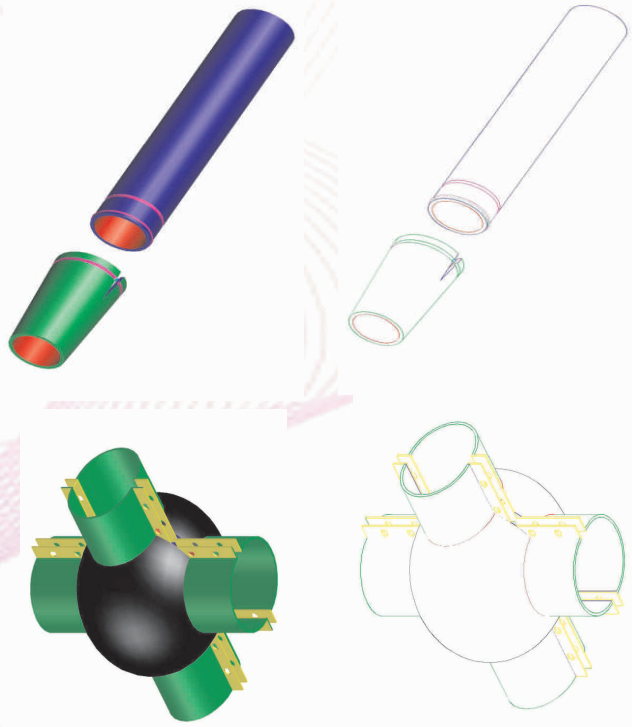
(b) Selection of different local materials which will be suitable for the proposed transitory housing and their processing for utilization in the proposed design.

(c) Detail analysis and testing of the designed housing units and their components with respect to their engineering properties, feasibility and environmental issues including health and sanitation.

(d) Construction of prototype units with field demonstration.

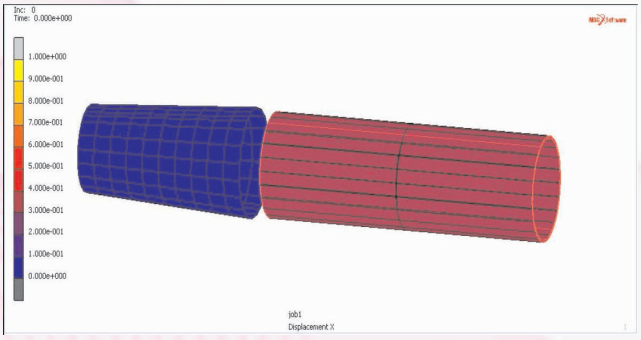
Salient Achievement: during 01.04.2012 to 31.04.2013 only.

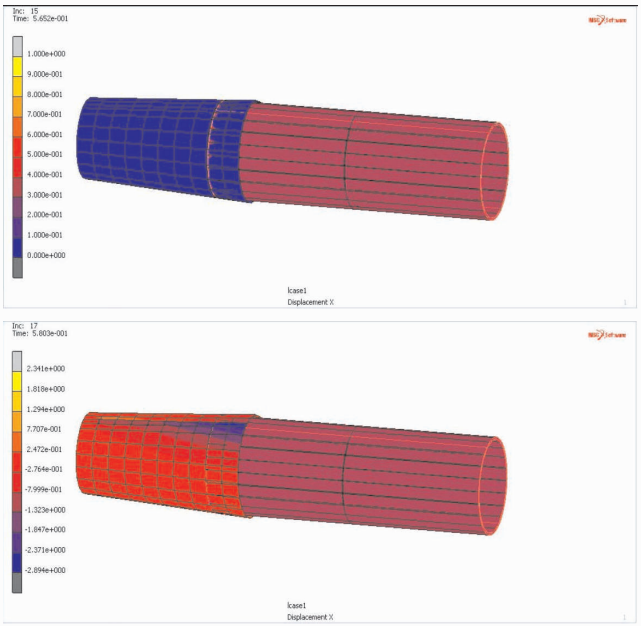
Chemical Treatment and Testing of Bamboo and selection of the most suitable species for the proposed transitory house. Design of the Connector / Connectors for the Transitory House.



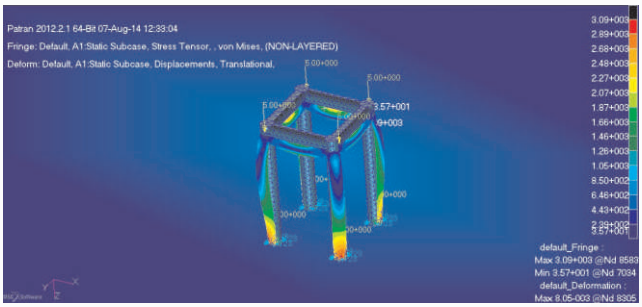
Some designed Connectors

The proposed transitory house will mainly comprise of bamboo as the structural member and connectors (of polymetric material) to restrict the degree of freedom. The design of the connector is a major work of the project which is going on during the period of report. Finite Element Analysis (FEA) technique is used in the design of the polymeric connector as well as the structure which is a widely used technique for stress related analysis. The software platform of MSCX-NASTRAN is used for FEA analysis of the same. During the period of report combination of proposed structures are analysed using MSC-NASTRAN. The necessary solid model is developed using 3D CAD software "Solid Works". The developed CAD model is imported from solid works to MSC-NASTRAN for necessary analysis.





Finite Element Analysis of connectors



Finite Element Analysis of proposed structure

(C) Type of Project : Govt. funded

Project No. : GAP-0214

Title of Project : Promoting innovations in individuals, start-ups and msmes (prism)

PI & members : Dipankar Neog, (Coordinator of TOCIC-NEIST, Jorhat) Sponsoring Agency: Department of Scientific and Industrial Research (DSIR) Duration/date of Project: Continuous project.

Objective of the Project :

- To promote and support untapped creativity of individual innovators.
- To provide all necessary scientific and technical support to the innovators.
- To assist the individual innovators to become technology based entrepreneurs.

- To assist the technopreneur in networking and forge linkages with other constituents of the innovation chain for commercialization of their developments.

Salient Achievement:

- 7 numbers of projects sanctioned by DSIR under TUC / TOCIC NEIST
  I. 5 numbers of projects have been successfully completed.
  II. Out of them 3 numbers have gone to commercial production
  III. 2 numbers of projects are ongoing.
- 15 numbers of projects are presently at various stages of review
  I. 2 numbers of projects have already been sent to DSIR, New Delhi for national level evaluation and sanction.
  II. 5 numbers of projects are at the review stage of Domain Knowledge Expert.
  III. 8 numbers of projects are at TOCIC level review.
- First Prism Advisory Committee (PAC) meeting was held at TOCIC-NEIST, Jorhat on 25-07-2014. The meeting was attended by PAC members who put on their thoughts regarding the ongoing projects. Various issues like commercialization, tenure extension of projects highlighted the agenda of the meeting.

(D) Type of Project : Govt. funded

Project No. : GAP-0232 and GPP-0238

Title of Project : (A) **Council of Science and Technology for Rural India (CSTRI) Center of CSIR – NEIST, Jorhat. (B) Setting-up of a Common Facility Center (CFC) on Weaving and Textile**

PI & members : Dipankar Neog (PI); Co PI: Ms I Ilika Zhimo; Members: Members: Dr. Pranab Barkakati, Mr. S C Kalita, J J Bora, Dipak Basumatari, Ajoy Barkotoki.

Sponsoring Agency: Department of Science and Technology (DST) Duration/date of Project: Continuous project.

Objective of the Project:

- To set up a Center for Council of Science and Technology for Rural India (CSTRI) which will act as an intermediate to solve the identified scientifically solvable problems of rural areas of North East Region (NER) of India through the inputs of funding, expertise domain experts, proved technologies, business scale up and overall monitoring of implementations of the projects.
- To develop the action plan of the center and form a core team to realize and implement the plan.
- To develop a format to evaluate the "Rural Resources and Need Appraisal" in the context of rural areas of the North East India.
- The center will identify the thrust areas in the rural NER such as- rural decentralized energy generation and distribution (e.g. bio-energy, solar energy, micro-hydral etc.); rural health including water, sanitation etc.; technology for bamboo based products & their value addition; appropriate technology for small tea growers; technology bases services during natural calamities like flood, earthquake etc.; technologies for food processing & preserving; technologies for mechanized cultivation; specific technologies for rural group having traditional expertise etc.
- Center would carefully assess the need and nature of the intervention required in the area at the specific location. Working along with the local groups in the rural areas, a proposal for interventions would be prepared and submitted to the council.
- The center will organize work-shop, training programme and technology demonstration in the identified areas.
- The center will provide secretarial assistance to the council for its activities.

Salient Achievement:

A two day training program on "Natural Dyeing" was held at the project site of New Sonowal area, Mariani, Dist-Jorhat on 27th and 28th May, 2013 under the aegis of CSTRI Centre, NEIST –Jorhat in association with Society for North East Handmade Paper

Development (associated NGO) and Clothing & Textile Department, Home Science College, Assam Agriculture University, Jorhat.



Training Program on natural dyeing at project site of New Sonowal area

One day training program on "Design Innovation For Textile Products And Complete Product Development With Demonstration For Marketing" was held at the project site of New Sonowal area, Mariani, Dist-Jorhat on 11th Dec, 2013, the event was organized by CSTRI Centre, NEIST –Jorhat in association with Society for North East Handmade Paper Development (associated NGO)



Training program on "Design Innovation for textile products and complete product development with demonstration for marketing.

A one day Ethnic Fashion Show was held at the International Trade Fair, Jorhat on 4th January, 2014 under the project "Setting up of Common Facility Center (CFC) on Weaving and Textile Product Manufacturing" (GPP-0283) (part of CSTRI Centre, CSIR-NEIST, Jorhat). The event was jointly organized by "Society for North East Handmade Paper Development" (associated NGO) and 3rd International Trade Fair, Jorhat organizers.



Ethnic fashion show at Jorhat Trade Fair, 2014

nauguration of Common Facility Centre on Weaving & Textile Product Manufacturing by Padma Bhuhsan Dr. T. Ramasami, Former Secretary, DST and Director General, CSIR in Presence of Dr. D. Ramaiah, Director, CSIR-NEIST, Jorhat on 16.05.2014.



Inauguration of Common Facility Centre inaugurated by Dr T Ramasami (Middle) Dr D Ramaiah, Director, CSIR-NEIST (Left) & Dr R C Boruah, Outstanding Scientist, (Right)

S&T Services & Training

(A) S & T Services

Technical support services were provided by the division towards various R&D projects as well as infrastructural activities of the laboratory by way of day-to-day services provided through :

Workshop: The workshops within the division are equipped with various metal- working and wood-working machines and facilities. In addition, testing of engineering materials vide an Universal Testing Machine for prestigious clients throughout the country is a regular feature.

Glass Blowing Section: The Glass Blowing section is responsible for fabricating non-standard and standard glass equipment required during R&D and project activities for various R&D divisions of the institute. This section has completed 290 nos. of jobs during 2012-2013.

Refrigeration & Air conditioning Section: Refrigeration & Air conditioning section maintains around 265 numbers of AC units along with the Central AC Plant of Dr. JN Baruah Auditorium. It provides repair and maintenance service, on demand, to all users of AC 's and other cooling equipments.

Electrical Section: Electrical section maintains the power house of CSIR NEIST having 3 nos. of DG Sets apart from grid supply and also carries out day to day maintenance works of single and 3 phase electrical distribution network with transformers and other electrical installations. Apart from this it also provides electrical repair and maintenance service to all users within the institute office campus and housing colony

Vehicle Section: This section maintains the institute's vehicles and takes care of all repair/maintenance activities associated with them. Apart from the institute's vehicles, hired vehicles are also engaged for conveyance of office staff and school duties, project-related activities and also for conveying guests and VIPs during official meetings and seminars which is controlled by this section.

(B) Apprenticeship Training

The division also imparts training to ITI Passed candidates every year under the Trade Apprenticeship Training scheme by the Directorate of Apprenticeship Training, Ministry of Labour, (D.G.E.&T.), Govt. of India. The trades covered include Draughtsman (Mechanical), Welder, Fitter and Carpenter.

GEO SCIENCES

The Northeast India has a complex structural framework with changing behaviours of Seismic activity in different tectonic domains controlled by ancient Plate margin. It occupies a distinct position in the World Seismicity with two great earthquakes of M≥ 8.7 and 1950, and the entire region lies in the severe Seismic Zone –V. The two great earthquakes caused wide scale destruction throughout NE India where alluvial plains suffered extensive damage in the form of ground rupture. Although, the death tolls due to the past great earthquakes in those days were small, the rapidly growing human habitat, and industrialization continually increases the risk posed by the recurring scenario of earthquake occurrence. It is unfortunate that the region has a very brief history of past earthquakes which is inadequate for future hazard estimation. Thus, real-time monitoring of active faults along plate margin to assess the seismic hazard potential, dissemination of scientific knowledge in public decision making and create mass awareness to mitigate the adverse effects of earthquakes by reducing the vulnerability are the main agenda today.

Project No : GAP 0142

Project title: On-line/Real-time Seismic Network for Disaster Mitigation in NE India

Principal Investigator: Dr R Duarah

Funding Agency: North Eastern Council, Shillong

Achievement:

A wide area network of 27(twenty seven) remote, unmanned observatories of high resolution 3 component broadband weak-motion seismographs powered by Solar Modules, and linked using Ext C VSAT with the Central Recording Station (CRS) equipped with High performance Multi-tasking Computing system for remote command control, on-line data acquisition & processing, real-time seismic event location for dissemination of earthquake bulletin has been installed, and in continuous operation. The Network is capable of monitoring the seismicity of the region and fulfils the need of local earthquake data, and takes the moral obligation of providing real-time earthquake information.

Project No: **GPP 0288**

Project Title: M 8.7 Shillong 1897 Earthquake Scenario: NE Multi State Preparedness

Principal Investigator: Dr R Duarah

Funding Agency: National Disaster Management Authority, New Delhi

Background

During the last few decades, India has witnessed several damaging earthquakes taking more than 100,000 lives. Unlike other hazards, earthquakes cannot be predicted to give **abjectly location** and size of next major earthquake cannot be determined in advance. However, the areas that are prone to large earthquakes are well identified. So, even though earthquakes cannot be predicted, their impact can be estimated through consequence analysis. The consequence analysis is typically carried out using scientifically valid earthquake damage scenarios. The earthquake damage scenarios are invaluable for advocacy of seismic safety and for disaster risk management. The disaster scenario information can be used to sensitize the various stakeholders regarding the risk and the potential consequences of earthquakes. The scenario can also help to identify the most vulnerable areas and population groups that will

require special attention in the aftermath of the scenario earthquake. The cost-benefit of various risk management interventions can also be evaluated using earthquake disaster scenario tools by simulating the effectiveness of these measures in reducing losses over time, and rigorous refinement of processes through mock exercise.

The use of disaster scenario is very useful for both urban and rural areas. Urban areas are characterized by intense concentration of population, infrastructure and resources that are generally get affected by a damaging earthquake. The impact of large earthquake is typically very severe and well beyond the coping capacity of the people or the response capacity of the local government agencies. The response to earthquake disasters in urban areas therefore often results in suboptimal prioritization and consequent underutilization of resources to the detriment of the affected people and the society at large. Disaster risk management plans that are prepared based on rigorous risk assessment and scenario development can take advantage of this information for optimal prioritization of resources. The assessment of seismic risk involves the estimation of consequences of an earthquake in the chosen area in terms of the expected damage and loss from a given hazard to given elements at risk. Seismic risk assessment involves evaluation of seismic hazard, vulnerability of structures, exposure and finally loss estimation. Seismic hazard quantifies the ground motions generated due to an earthquake. Local effect such as due to soil properties and unstable mountain slopes may also be incorporated in hazard assessment. Seismic vulnerability of buildings quantifies the propensity of types of buildings to be damaged due to specified earthquake ground motions. When carrying out risk assessment of large areas, where the built environment information may be available only at low resolution, vulnerability of the buildings implied in macro-seismic intensity scales is most commonly used. Vulnerability assessment can also include the impact of the scenario ground shaking on various lifelines and critical infrastructure in the affected region. This includes its impact on the road and rail transportation system, critical facilities such as hospitals and communication facilities, dams and reservoirs, major industrial facilities, etc. Exposure evaluates the impact of the hazard and vulnerability on the people in the affected area. Based on the building vulnerability, the extent of human casualty can be anticipated. This, in turn can be used to assess the requirement of immediate response, search & rescue, relief and rehabilitation. The economic consequences of the scenario earthquake may also be estimated to assess recovery duration. The exposure analysis can thus provide information on estimation of the impact of the scenario earthquake in local and regional context.

The Shillong earthquake of 1897 (M8.7) is the largest known Indian Intraplate earthquake. It raised the northern edge of the Plateau by more than 10m, resulting in destruction of manmade structures over la large area, caused widespread liquefaction and flooding in the adjacent valley areas. However, the loss of life and property damage caused by the earthquake at that time was minimal. But, if it recurs today, the damage could be enormous and unbelievable due to increase in human population, and reckless constructions for rapid urbanization. *Therefore, an attempt has been made to develop a scenario as a basic planning tool to reduce the seismic vulnerability taking into account the past shaking intensity (isoseismal zones, Oldham, 1899), current population growth rate and building typology (Census 2011) and factors that may lead to local increments in the ground amplification to make the people understand the alarming situation through awareness campaign and training education while, continued refinements in efforts by identifying the gap areas through mock exercises.* The Scenario program is expected to provide a common understanding of the consequences of a large earthquake among various stakeholders, and NE

State Governments to:

- Identify the extent of affected area due to a major earthquake in the region, and importance of critical factors such as earthquake risk, vulnerability of buildings etc.
- the direct and indirect consequences of the earthquake in the affected areas including damage of buildings and critical facilities such as lifeline buildings.
- to update the disaster management plans, and identify the gaps in plan preparations through

mock exercise for further refinements and implement the disaster management plans.

- Evaluate intra-agency and inter-agency coordination capability by the state governments for evaluation of coordination capability. and identify the gaps.

The scientific scenario development and capacity development training programs to fulfil the defined aims & objectives are in progress.

Project No: ISC 0301 (CSIR Network Program

Project Title: "Crustal Movement and Lithospheric Deformation along Indian Plate Margin" *under ARiEEs, CSIR Network Program)*

Project leader: Dr. R. Duarah

Funding Agency: Department of Science & Technology(DST), New Delhi

Background:

The NE India has a high risk of major earthquakes, and therefore systematic GPS measurements to estimate the rate and direction of Crustal Plate movement will help understanding the rupture behavior along the plate margins and nature of the resultant intra-plate block movements. The present day global geodetic measurements suggest that the Indian plate is still moving in a north northeasterly direction causing direct collision with the Eurasian plate and oblique convergence to trans-current movement with respect to Burmese Block. It is expected that continuous GPS measurements and Real-time Seismic monitoring will provide valuable information in understand the plate kinematics, stress pattern, rupture mechanism and frictional properties of the major faults in assessing earthquake occurrence in space & time. Therefore, the proposed GPS Network will provide valuable information in understanding the phenomena related to Crustal Plate movement & associated Seismic activity.

Objectives:

- Setting up of GPS/GNSS Network along Indian Plate margin to monitor Crustal movement
- Rate & direction of Plate movement to correlate crustal deformation related to large Quantify
- Slip movements chronology & Modelling of time-dependent co & post-seismic deformation
- Earthquake rupture mechanism, fault dynamics and precursory signatures
- Plate kinematics, stress pattern and rupture mechanism to identify the location and timings of future large events.

Achievement:

4 (four) permanent GPS observatories have been installed for continuous operation, and processing of data to monitor Crustal plate movement is in progress.

Project Title: Seismic Vulnerability Assessment of Major cities in N E India

Project No : GPP 0275

Principal Investigator: Dr S Boruah

Project Cost: Rs. 184.25lakh

Funding Agency: North Eastern Council

Objective:

To develop earthquake damage scenario which describes the consequences of possible earthquake

Seismic hazard assessment: To select the hypothetical earthquake to be adopted for use in the project and to estimate the distribution of seismic intensities for the adopted earthquake.

Seismic vulnerability and risk assessment: The objective of the vulnerability assessment is to prepare vulnerability functions and recovery functions that are applicable to local conditions.

Achievement:

1. Site amplification characteristics of Shillong city has been estimated.

2. Microearthquakes spectra from Shillong region are analyzed to observe the effect of attenuation and site on these spectra. The spectral ratio method is utilized in order to estimate the Q values for both P and S-wave in subsurface layer wherein the ratio of spectral amplitudes at lower and higher frequencies are taken into consideration for three stations at varying epicentral distances. Average estimates of Q_P and Q_S are 178 and 195. The ratio of Q_S to Q_P was estimated to be greater than one in major parts of Shillong area which can be related to the dry crust prevailing in Shillong region. The variation in corner frequencies for these spectra is inferred to be characteristics of the site. Simultaneously, observation from spectral content of local earthquakes recoded at two stations with respect to reference site yields greater amplification of incoming seismic signal in the frequency range of 2 to 5 Hz which is found to be well supported by the existing local lithology pertinent to that region.

Project No: GAP0273

Project Title: Literature Survey of available Earthquake Hazard Assessment Studies related to North Eastern Region

P. I : Dr S Boruah

Co-PI: Dr. P K Bora

Funding Agency: Assam State Disaster Management Authority, Guwahati

Objective:

1. To create high quality database based on literature survey related to earthquake hazard and its mitigation related studies.
2. To determine standard benchmark required for Earthquake Hazard Assessment Studies.
3. To prepare earthquake catalogue of Northeastern region of India from medieval period to present (2012).

Achievement:

Compiled and submitted to ASDMA the First Interim Report of the 'Literature Survey' project in the form of an Earthquake Catalogue of Northeastern region of India from the Medieval period to 1999. The catalogue comprises of about 7843 events with the Day of occurrence, Origin time, Epicenter (Latitude & Longitude), Depth (km), Magnitude and the concerned agency. Six epicentral plots with magnitudes have been prepared from the database as follows:

(a) Epicentral plot from Medieval period to 1885 (65 earthquakes)
(b) Epicentral plot from 1897 to 1949 (177 earthquakes)
(c) Epicentral plot from 1950 to 1969 (351 earthquakes)
(d) Epicentral plot from 1970 to 1979 (329 earthquakes)
(e) Epicentral plot from 1980 to 1989 (2127 earthquakes)
(f) Epicentral plot from 1990 to 1999 (4794 earthquakes)

Description of some of the historical earthquakes of undivided Assam from historical records has been included and are as follows

(i) An earthquake at Garhgaon, 1548 AD *(Ahom Buranji, pp. 81-82, para 61)*
(ii) An earthquake at Gajala in 1596 AD
(iii) Several earthquakes in Upper Assam in 1642 AD (History of Assam, Gait 1905)
(iv) Three earthquakes in Upper Assam in April-May, 1649 AD (Sastri Buranji)
(v) Mild earthquakes Kajali, near Gauhati, 1663 AD *(Fatehiya-e Ibriya, pp. 186-87)*[22]
(vi) An earthquake at Tingkhang & Charaideo Hill in 1714 AD (*Tungkhungia-Buranji,)*
(vii) Destruction of Kamakhya temple, earthquakes prior to 800-1700 AD

Further, the earth science studies of the region in different aspects of seismology including the works carried out by various organizations, Universities etc. are incorporated.

Project Title: Active Tectonics & Paleoseismic studies using Geophysical Parameters, along the mountain frontal part of Eastern Syntaxial Bend, Lower Dibang Valley and Lohit Districts, Arunachal Pradesh

Project No: GAP 0259

P. I Dr. R. K. Mrinalinee Devi

Funding Agency: Department of Science & Technology(DST), New Delhi

Objective:

- Studies on Active Tectonics and Neotectonics activity of the study area with the help of structural as well as tectonic geomorphology
- Studies of the seismicity and past earthquakes of the northeast India for understanding the seismically unstable nature of the study area
- Paleoseismological measurements for estimation of the average recurrence interval of large/great earthquake
- Identification of the primary as well as secondary coseismic features in Holocene and late Pleistocene sediments

Achievement:

The northwestern trending lithotectonic units of the Mishmi block are juxtaposed with the almost N-S trending eastern Himalayan lithotectonic units along the Siang fracture. Earthquakes occurring on the Indian peninsula are the outcome of the Indian plate under thrust towards the Eurasian continent. A large window in the Siang river section exposes Paleocene rocks interbeded with Abhor volcanic as the subthrust package and MBT as the roof thrust. Mishmi block, tectonically separates the eastern Himalayan and the Indo-Myanmar mobile belts and form 'a linkage' in between. Active faulting along the Himalayan Front is observed. Left-lateral strike slip faults displacing Mishmi Thrust Zone had been observed. Morphological and sedimentary records at Siang, Dibang and Lohit rivers at Pasighat, Dambuk, Roing, Tezu and Parsuramkund areas in the NE Himalaya were studied with the help of terraces, for the evidences of the climate-tectonic interplay. Drainage maps were prepared and structurally controlled drainages were observed in the study area. Mishmi Thrust zone is found to be tectonically active with the uplifting of the Quaternary fluvial sediments for a height of about 40m from the present day river channel.

MATERIAL SCIENCES

Materials Sciences Area comprises three divisions, viz., Materials Science, Coal Chemistry and Cellulose Paper & Pulp Division. In these divisions, R & D works are being continued in the areas of (i) nanoparticles, coordination complexes, layered materials, nano material coated membranes etc. for separation and catalysis of organic reactions, (ii) construction materials, (iii) bio-pulping for paper, (iv) value added products from wastes, (v) composite materials, (vi) resource quality assessment of North Eastern coal, (vii) clean coal initiatives etc., which have resulted in technologies, publications, patents, PhDs and also testing, analytical & consultancy services. During the reporting period the technology for Liquid Deodorant and Low Dust Chalk were transferred to 51 micro entrepreneurs (MSME). 2 (two) patent were granted (one US and one Indian) and 4 (four) Indian patents were also filed in the area of clay/nanoparticle based catalysts for organic synthesis, resin coated bauxite proppants, nano sheet coated monolithic membrane. 2 (two) fellows received PhD degree during the period in the subject area of nanoparticles/coordination compounds and nano-coated membranes. 24 (twenty four) papers were published from Materials Science Area during this period with average Impact Factor of 2.65 and highest Impact Factor of 4.75. During the period, materials science area has rendered testing, analytical and consultancy services in the areas of construction and building materials, coal and coke, paper and board, etc. Sophisticated facilities like XRD, thermal analyzer, surface area–pore volume analyzer, particle size analyzer, zeta potential analyzer, high pressure reactor, proximate analyzer, ion chromatography, gas chromatograph, sulphur analyzer, flue gas analyzer, beehive coke oven etc. apart from pilot plant facilities are available in Materials Science Area.

INTERNATIONAL COLLABORATION

Project No : **GPP-0287**

Project Title : **Synthesis and Reactivity of Nanoporous Metal–Silica Composites – Novel Heterogeneous Catalysts for Selective Oxidation Reactions.**

Funding Agency : DST, New Delhi and Russian Foundation for Basic Research (RFBR)

PI & Members : Dr Lakshi Saikia, Indian-PI, Dr Oxana A Kholdeeva, Russian-PI, (*Boreskov Institute of Catalysis, Novosibirsk, Russia*) Dr Dipak Kumar Dutta

Objectives:

- To synthesize nanoporous metal-silica materials by using surfactant/ block copolymer as structure directing agent under hydrothermal conditions.
- To characterize the composite materials by different sophisticated techniques like CP-MAS NMR, DR-UV-Vis, XPS etc.
- Catalytic evaluation for the liquid-phase selective oxidation of hydrocarbons, alcohols, sulfides, amines etc.

Significant Achievements:

Mesoporous Silica materials are good support for generation of metal nanoparticles of noble metal like gold to get well dispersed Au^0 - nanoparticles on the surface as well as inside the pores. Mesoporous material Ti-MMM was used as support for preparation of Au-Ti-MMM with to different amount of Au loading in our laboratory. The initial characterization like N_2 adsorption-desortion, XRD were carried out. These catalist were tested for catalytic oxidation of cycloalkane and phenolic type of compounds. The oxidation of cycloelkane to get cyclic alcohol and carbonyl compounds was performed with H_2O_2 as oxidant at moderate temperature of 70^0 C for 6,8 and 24 hrs. About 100% celectivity of the cyclohexanol was achieved even though conversion was less. Similarly, oxidation of phynolic type of compound was also tested with both the catalysts to have quinine type of compounds in presence of H_2O_2. Further, another catalyst Au-Ti-SBA-16 was also prepared comparative catalytic activity study for oxidation reaction.

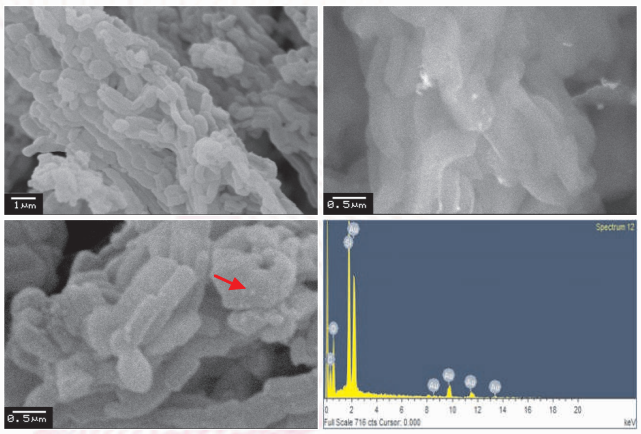


Fig. SEM images of (a) SBA-15, (b) SBA-15-pr-NH_2, (c) SBA-15-pr-NH_2.Au0 and (d) EDX analysis of SBA-15-pr-NH_2.Au^0 nano hybrid material

NATIONAL COLLABORATION

(I) Network Project

Project No : **BSC 0112**

Project Title : Nanomaterials: Applications and Impact on Safety, Health and Environment

CSIR-NEIST Title : Nanoparticles (Metal and Metal Oxides): Impact on Safety and Environment.

Funding Agency : CSIR, New Delhi

PI & Members : Dr Dipak Kumar Dutta, PI (Activityl), Dr Montu Bhuyan, PI (Activity-II) Dr Lakshi Saikia, Dr Pinaki Sengupta, Dr Bibek Jyoti Borah, Dr TC Bora, Dr Ratul Saikia, Dr PR Bhattacharyya

Objectives:

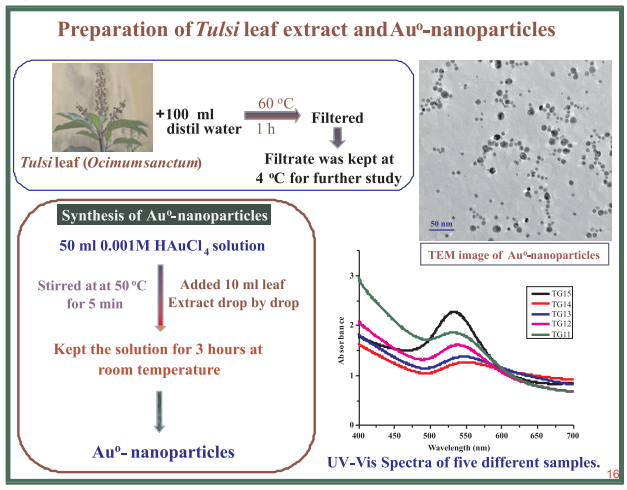
CSIR-NEIST, Activity-I:

- To synthesis nanoparticles of metals (Transition, Platinum and noble metals) and Metal oxides of different size fractions in the range of 0.1 - 100 nm.
- To evaluate the toxicity of the nanoparticles of metals and metal oxides of different size fractions (micro-, meso- and macro-sized) as synthesized in the range of 0.1 - 100 nm.

CSIR-NEIST, Activity-II :

- Identification of route entry of selected nanoparticles into silkworm and its impact.

Significant Achievements:



Project No : **CSC- 0103**

Project Title : **Zero Emission Research Initiative for Solid Wastes from Leather**

CSIR-NEIST Part : **New composite materials for apparel and goods from leather waste of EI shaving, buffing dust and dyed trimmings**

Funding Agency : CSIR, New Delhi

PI & Members : Dr T Goswami, PI, Dr D Neog, Co-PI, Dr D Kalita, Co-PI, Mr D Dutta, Ms P K Das

Objectives:

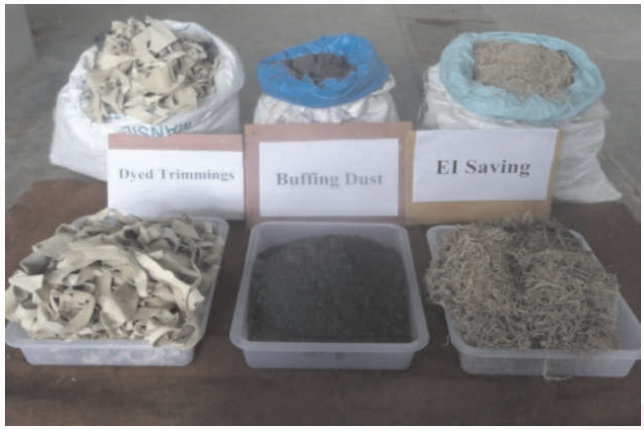
- Characterization and determination of the physico-chemical properties of EI Shaving, Buffing Dust and Dyed Trimmings.
- Mechano-chemical treatment of the solid wastes (EI Shaving, Buffing Dust and Dyed Trimmings) for better processing by adopting different methods.
- Development of suitable process for converting EI Shaving, Buffing Dust and Dyed Trimmings to composite materials suitable to use for Apparel and Goods.
- Determination of engineering properties of developed composite materials.

Significant Achievements:

- Certain physical properties e.g. bulk density, moisture content, pH and ether solubility of buffing dust, EI saving and dried trimmings were determined.
- Bulk density of EI shaving, Buffing dust and dried trimmings were measured and found

5.649 cc/gm, 5.917 cc/gm & 3.89 cc/gm, moisture content 23.45%, 8.85% & 11.8%, pH were measured 3.68, 5.25 & 4.31 and ether solubility were recorded 26%, 13.5% & 18% respectively.

- Two stocks consisting of 50: 50 and 60: 40 blending of EI shaving and *H. sabdariffa* fibre were prepared for making flexible board.
- Blending property of EI shaving and Mesta fibre (*H. sabdariffa)* were tested and found compatible for making composite and flexible board.
- Study on the properties of the dried trimmings after shredding action and suitability of the material were tested by making composite board adopting dry process.
- Prepared flexible board from the mixer of dried trimmings and Mesta fibre both by dry & wet process. The sheets were treated with latex solution to make flexible. The work is in progress.



Leather Waste Material
EI Saving, Buffing Dust & Dried trimmings



Board Making from Leather Waste

Project No : **CSC 0125**
Project Title : **Catalysts for Specialty Chemicals (CSC)**
CSIR-NEIST Title : **Nanostructured Materials and Metal Complexes for Efficient Catalysis**
Funding Agency : CSIR, New Delhi

PI & Members : Dr Dipak Kumar Dutta, PI, Dr Dilip Konwar, Dr Lakshi Saikia, Dr Pinaki Sengupta Dr Bibek Jyoti Borah.

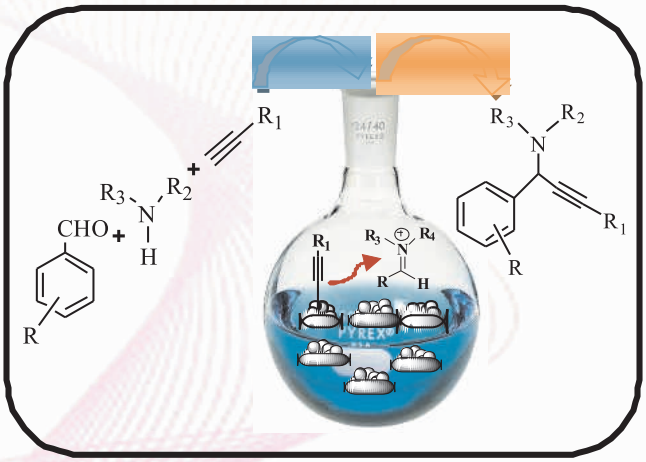
Objectives:

- To develop Nanostructured (nanoparticles and nanoporous) catalysts based on metals and metal oxides and their evaluation in important industrial organic reactions.
- Utilization of renewable polysaccharides as template/support/catalyst and their catalytic activity in organic synthesis, particularly, Green synthesis of drugs precursors and others.
- Development of some cheaper and efficient homogeneous catalysts or catalytic processes for hydrogenation and C-C bond formation reactions for the synthesis of industrially important organic compounds based on non-precious metal (like Ni) complexes of hemilabile ligands.
- Isolation, purification, and characterization of cellulose from different plants like bamboo, straw, cotton etc.
- Synthesis of metal nanoparticles on cellulose templates.
- Examination of the catalytic activity of the nanoparticle on cellulose templates on 1,3-dipolar cycloaddition reactions, synthesis of drugs intermediates and other industrially important compounds preferably in green solvents.

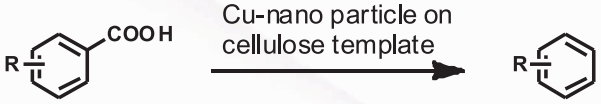
Significant Achievements:

1. Efficient One-pot Three-Components Coupling Reactions Catalyzed by Cu°-nanoparticles stabilized on Modified Montmorillonite Clay

In situ generation of Cu°-nanoparticles into the nanopores of environmentally benign modified Montmorillonite clay and their catalytic performance in three components (A^3) coupling reactions of Aldehyde, Amine and Alkyne in one-pot to synthesize propargylamines with excellent yield and selectivity.



Attempts were made to synthesize Cu-nano particles on nano-porous cellulose templates by using different reducing agents from $CuSO_4,5H_2O$ and $Cu(OAc)_2$ in different solvents at room temperature under nitrogen. The nano particles, so produced, were analyzed by FTIR, XRD, and TEM. The studies revealed that Cu-nano particles are in Cu(0) and Cu(I) oxidation state and the particle sizes are in the range of 6-20 nm. A preliminary study on the reactivity of those nano particles towards the decarboxylation of aromatic acids were carried out. It was observed that the catalysts can effectively decarboxylate aromatic carboxylic acids under ligand and base free condition.



Project No : **CSC- 0131**

Project Title : **Environmental Research Initiative for paper and process industry (ERIPP)**

Funding Agency : CSIR, New Delhi

PI & Members : Dr T Goswami PI,Dr A Goswami, Co-PI,Dr T C Bora,Dr P Sengupta, Dr H P Dekabaruah, Dr R Saikia, Mrs A Yadav Mr A Kakoty, Mr P Barkakati, Dr (Ms) S Hazarika, Dr M Borah,Mr S Borthakur,, Dr D Kalita, Dr S C Nath, Mr D Dutta, Ms Puspa K Das, Dr P Pahari, Dr S P Saikia, Mr J J Bora.

Part A: Technology Initiatives for Utilization of Iron Oxide Waste from Titanium Processing Industries, a clean technologyfor paper and pulp.

Part B: (Process part): Metal and metal oxide based nanoparticle assembled on iron oxide and oxy(hydroxide) for water purification.

PI & Members : Dr Manash Ranjan Das,PI, Dr Sekh Mahiuddin,Mr Tapas Das, Mr Om Prakkash, Sahu, Ms Archana Yadav.

Part C: (Organic Part): Oxidative transformation of lignin/degraded lignin products generated from microbially treated lignocellulosic materials for value addition

PI & Members : Dr Amrit Goswami, PI, Dr Pallab Pahari

Objectives:

Part A: Isolation, identification, characterization and screening of suitable microbial strains from different niches against different lignocellulosic materials for their lignolytic activity and development of green biochemical/chemical process for pulp and other value added aromatics preparation.

Part B: Design and development of iron oxide nano particles with tailored surface properties for the removal of harmful bacteria, protozoa and toxic irons from water.

Part C: Development of green biochemical/chemical process for the preparation of value added aromatics such as vanillin etc from lignin/ degraded lignin generated during microbial/ green. chemical delignification of lignocellulosic materials for paper and pulp processing.

Significant Achievements:

(Part A)

- Two Bamboos species eg. *Bambusa tulda* and *Bambusa nutans* were selected for the green pulping process based on their availability, higher bio mass yield, suitable wood density and better physico chemical properties. For microbial delignification of lignocellulosic Bamboo and unbleached bamboo pulp, potential microbial strains were collected from different areas including Jagiroad paper mills, Gibbon Forest areas, Kaziranga national forest areas. Out of 56 collected microbial samples two microbes were found Xylanase positive and two were found Laccase positive which may help in delignification of unbleached pulp and bamboo chips .Preliminary experiments on enzyme production by the selective microbes under different conditions shows encouraging result. Optimisation of enzyme production in

bio reactor condition is in progress.

- Experiments on eco friendly pulping of bamboo with green chemicals under different conditions is in progress under ERIPP Project.
- 40 Potential lignolytic fungal strains were isolated from soil samples.18 strains were found pectinase positive.7 strains were found Lignin peroxidase positive.8 strains were found to be laccase positive.
- Out of 40 fungal strains,one laccase positive microbes were inoculated in raw bamboo strips for 30-90 days. Degradation of lignin at different periods was observed.

Optimized the process parameters for preparation of microbial culture *Chrysosporium* with respect to pH, temperature, media and other operating conditions. About 15-22 U/ml enzyme activity was recorded in 6 days of culture at 4.5 pH and 30 deg. C in malt extract media.



Control



Treated with Laccase positive microbe (2C) after 18 days



Microbial degradation(2C) of bamboo strips after 30 days of treatment

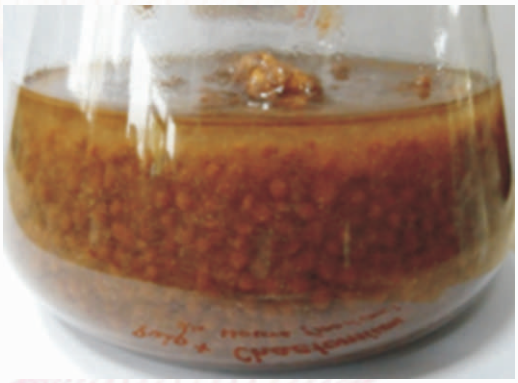
- Scale-up production of xylanase enzyme with BS-1 was carried out in 5L bioreactor at 30ºC and 4.5pH. The highest enzyme production was recorded 8.45U/ml in 96 hrs.
- The enzyme extract was taken for bleaching of unbleached Bamboo pulp using different conditions. The preliminary observation is encouraging and further investigation is in progress.



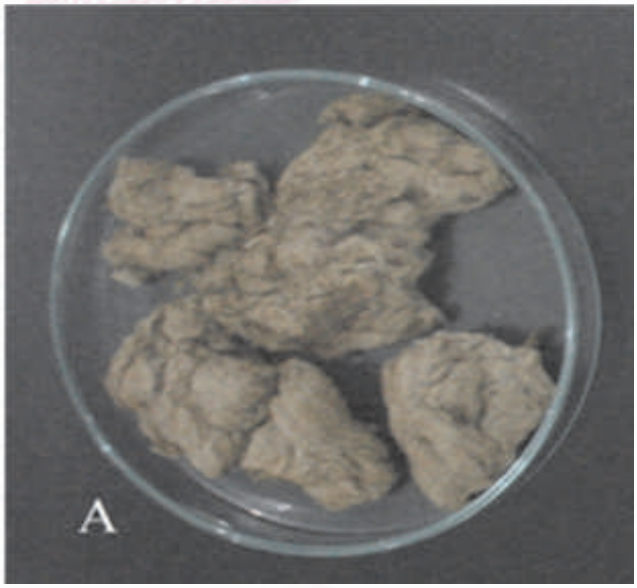
After 24 hours of treatment



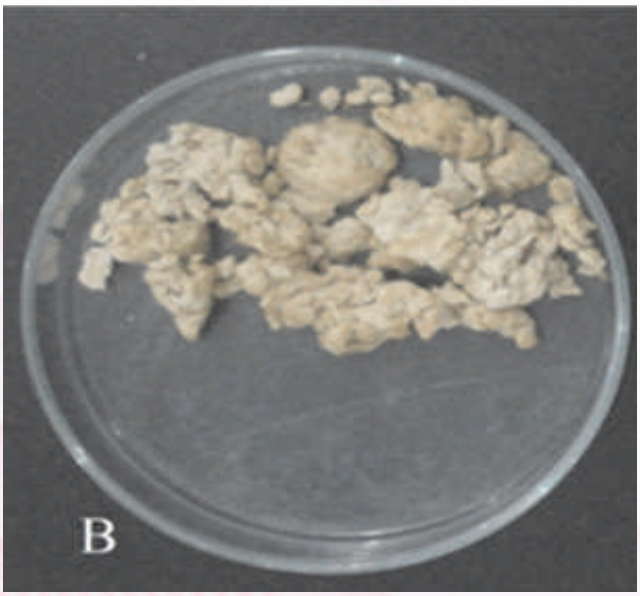
After 36 hours of treatment



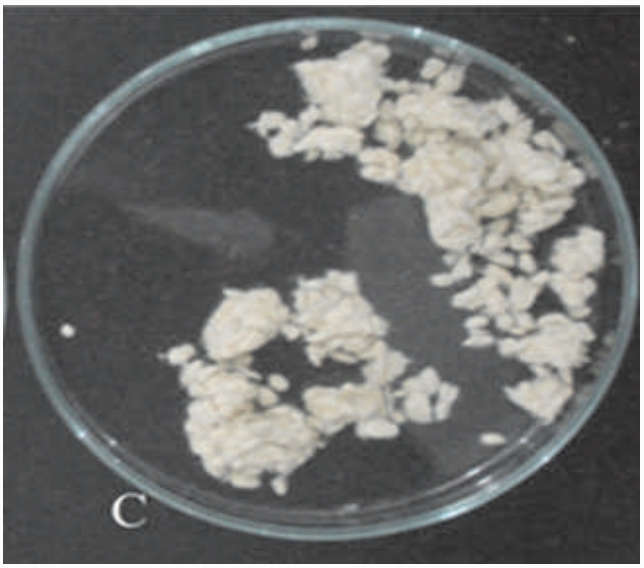
After 48 hours of treatment



Unbleached bamboo pulp



Microbial pre-treated unbleached pulp



Microbial pre-treated pulp with single step H_2O_2 treatment

(Part B)

TEM analysis of iron oxide nanopowder synthesized by mechanical ball milling method was carried out to study the morphology, particle size, size distribution, crystalline property of the particles. It was observed that with the increase in milling time, the particles tend to be spherical and smaller in size. TEM images of iron oxide nanopowder namely milling at 9 h and at 600 rpm are shown below.

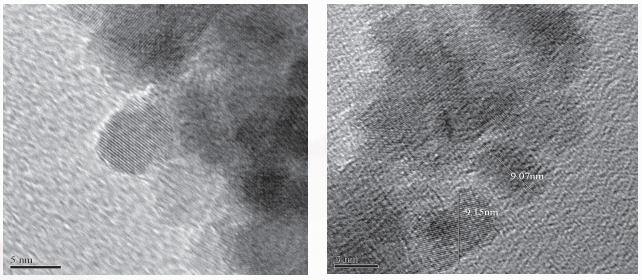


Fig.: TEM images of the Fe_3O_4 nanopowder

Adsorption behavior of methyl blue on the iron oxide nanopowder:

The adsorption kinetics of methyl blue, a mutagenic agent (initial concentration: 5 mM) on Fe_3O_4 600 (9h) was performed at 18°, 25°, 30° and 35 °C at pH 5. The plot of qt vs. time is shown in Figure below it was observed that adsorption of methyl blue on Fe_3O_4 600 (9h) increases with increase in time. The kinetic equilibrium for 18°, 25°, 30° and 35° was reached at 45, 60, 35 and 50 min respectively. After attaining equilibrium, the adsorption density gradually decreases with increase in time in all temperatures

which indicates that desorption of dye molecule takes place from the surface of the adsorbent molecule after equilibrium is attained.

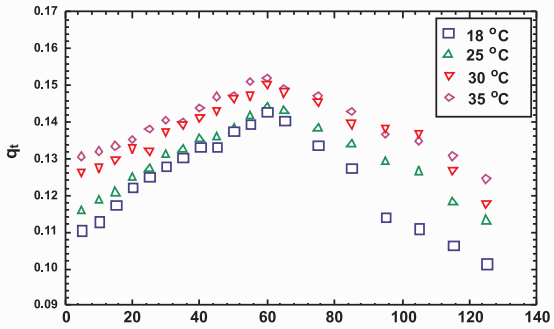


Figure: Adsorption kinetics of methyl blue on Fe_3O_4 600 (9h) at pH 5 at 18, 25, 30 and 35 °C

Characterization of the waste iron oxide sample:

The XRD pattern shows (Fig. below) the characteristic *d*-spacing value at *d* = 2.685, 2.507, 2.1954, 1.6903, 1.4818 Å for iron oxide, *d* = 3.227, 2.195, 1.6903, 1.451 Å for TiO_2 and *d*= 3.2269, 2.5075, 1.6903 Å for aluminium oxide.

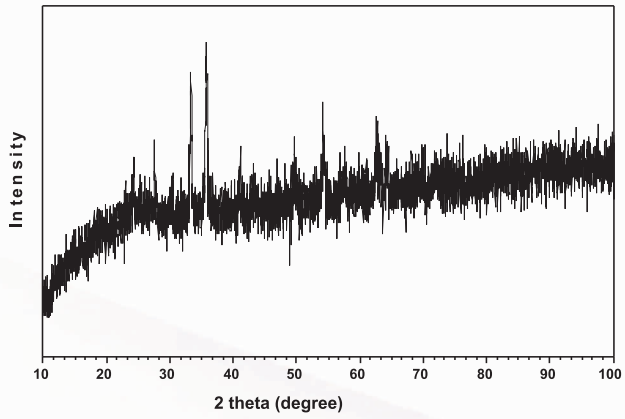
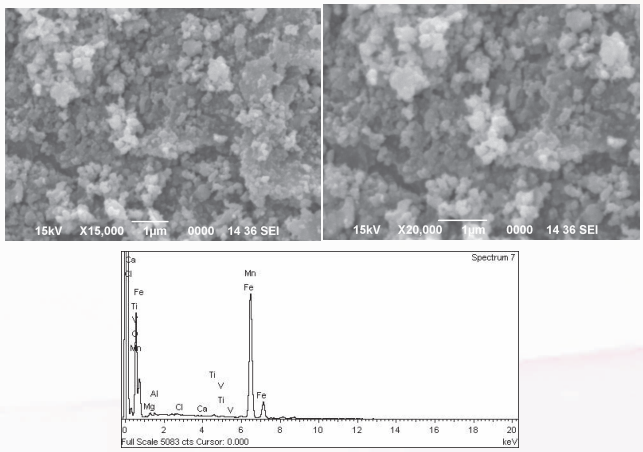


Fig. XRD pattern of the waste

The SEM-EDX analysis also shows the presence of the Fe, Ti, Al elements as depicted in the following figure



The zeta potential measurement was carried out in pH range from 2.5 to 10 and it is presented in following Fig.

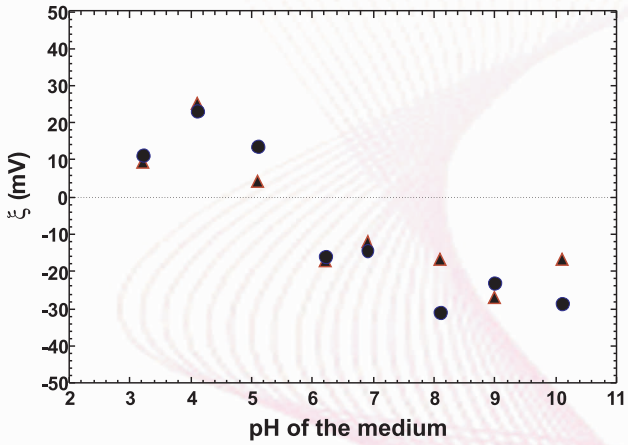
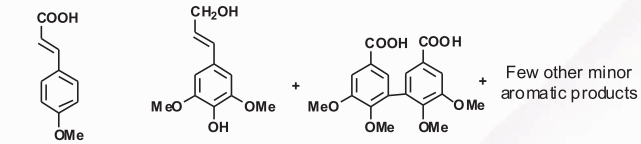


Figure: Zeta potential curve of the waste iron oxide

(Part C)

Studies on the organic component of the waste black liquor from Jagriroad Paper Mill revealed the presence of many small polyphenolic molecules. Few of them were isolated and then identified spectroscopically as given below.



p-coumeric acid | 3,5-dimethoxy-4-hydroxy cinnamyl alcohol | dehydrodivertirc acid

Studies on the lignin components obtained by microbial degradation of bamboo chips also showed the presence of methoxy substituted aromatic components from which vanillin and related type of compounds are derivable. Detailed study of these components is in progress.

Project No : **CSC 0135**

Project Title : **Speciality Materials Based On Engineered Clays**

CSIR-NEIST Title: **Development of layered indigenous Montmorillonite clay based composites for adsorption and catalysis**

Funding Agency: CSIR, New Delhi

PI & Members : Dr Dipak Kumar Dutta, PI, Dr Lakshi Saikia, Dr Pinaki Sengupta, Mr Bibek Jyoti Borah.

Objectives:

- Development of supported / intercalated / intersalated Montmorillonite clay based layered composites.

- Development of non-layered nanoporous (micro- and mesoporous) Montmorillonite clay matrix.
- Application of modified Montmorillonite clay as catalyst supports, catalyst for important industrial organic reactions such as Esterification, Alkylation, Isomerization, Diels-Alder reactions, Coupling reactions and for adsorption study.

Significant Achievements:

Modification of Montmorillonite clay by acid activation

Purified Na-Mont. was activated with minerals acids in order to produce a matrix having high surface area and nano range pores on the surface. The dry Na-Mont. was powdered and treated with 100 ml of 1-4 M mineral acid (HCl or H_2SO_4) and the slurry was refluxed for different time intervals (15 min - 4 h). After cooling, the slurry was filtered with suction, washed with distilled water and finally dialyzed against distilled water till the conductivity of the dialyzate approached to that of distilled water and showed negative test for Cl^- ion with $AgNO_3$. The mass was then dried at 50 ± 5 °C in hot air oven to obtain the solid product. These activated Montmorillonite were designated as Mont.-AT-I, Mont.-AT-II, Mont.-AT-III and Mont.-AT-IV indicating the activation time of 15 min, 1, 2 and 4 h respectively. The XRD pattern given below shows the depletion of layered structure on prolonged acid activation. The N_2 adsorption / desorption isotherm curves for mesoporous matrix are produced as figers.

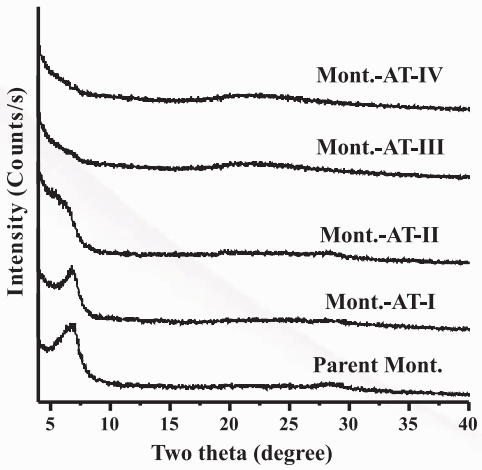


Fig.: Powder XRD pattern of different Montmorillonite clay

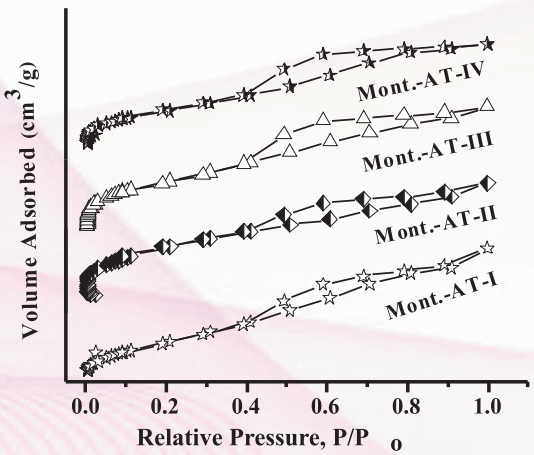


Fig.: N_2 adsorption / desorption isotherm of different Montmorillonite clay

Project No : **PSC-0112**
Project Title : **Probing the Changing Atmosphere and its Impact in Indo-Gangetic Plains (IGP) and Himalayan Regions**
Funding Agency : CSIR, New Delhi
PI & Members : Dr Bimala Prasad Baruah, PC, Dr Prasenjit Saikia, Activity Leader Dr B K Saikia, Dr UN Gupta, Mr T Das.

Objectives:

- Chemical characterization of Aerosol and their seasonal variability.
- Development of emission inventories of trace gas and aerosol.
- Source apportionment study for aerosol.
- Capacity building activities to strengthen the scientific through national and international collaboration.

Significant Achievements:

A compiled data of weather parameters from Jorhat, Imphal and Itanagar is prepared. Apart from inorganic

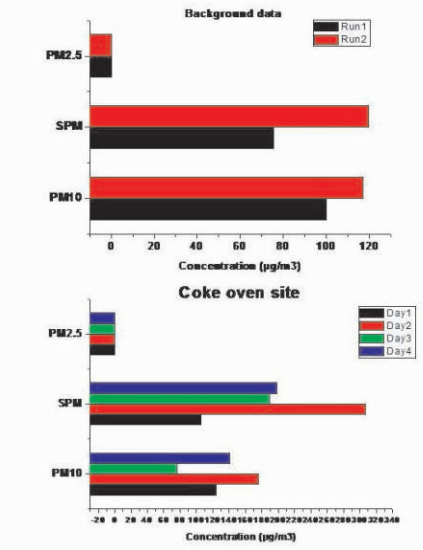




Figure 1: Concentrations of the particulate matters collected from coke oven site and background site

Figure 2: Installation of Weather Monitoring Stations at Itanagar site

(ii) Progress of Inhouse, Grant-in-aid and Consultancy Projects

Project No : **MLP-6000/1**

Project Title : **Development of Efficient and Benign Catalysts and Catalysis**

Funding Agency: CSIR, New Delhi

PI & Members : Dr Dipak Kumar Dutta,PI, Dr Lakshi Saikia, Dr Pinaki Sengupta , Dr Bibek Jyoti Borah .

Objectives:

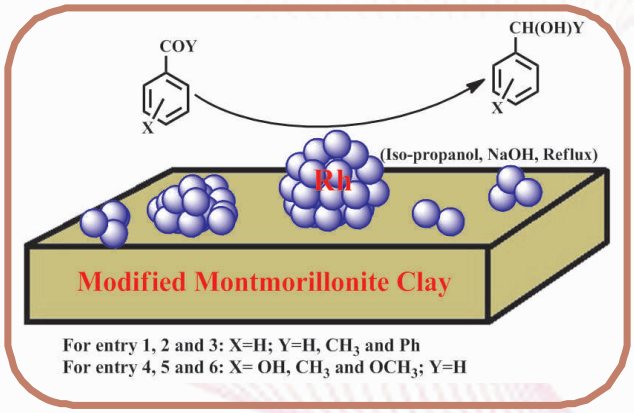
- To synthesize and characterize potential ruthenium, rhodium, palladium, nickel, copper etc. complexes of functionalized phosphine and nitrogen donor ligands.
- To evaluate the efficacy of the metal complexes in catalytic hydrogenation, oxidation, coupling reactions for the production of commercially important organic intermediates and products.

To develop Nanostructured catalysts based on metals and metal oxides and their evaluation in important industrial organic reactions like hydrogenation, oxidation, various coupling reactions etc.

Significant Achievements:

Stabilized Rh°-nanoparticles-Montmorillonite clay composite: Synthesis and Catalytic Transfer Hydrogenation reaction

Rh°-nanoparticles of around 4 nm size distributed homogeneously into nanopores of acid activated Montmorillonite clay were generated by incipient wetness impregnation of $RhCl_3$, followed by reduction with ethylene glycol. Acid activation of the Montmorillonite clay was carried out by treating with H_2SO_4 under controlled condition to increases the



surface area by generating nanopores upto about 10 nm sizes, which act as a host and stabilize nanoparticles into the pores. The supported metal nanoparticles serve as efficient heterogeneous catalyst for reduction of some important aromatic carbonyl compounds leading to corresponding alcohol through transfer hydrogenation upto 100% conversion and selectivity. The catalysts remained active for several runs without significant loss of their catalytic activities.

Project No : **MLP-6000/2**

Project Title : **Bacterial adhesion on the metal oxides surfaces**

Funding Agency : CSIR, New Delhi

PI & Members : Dr Manash Ranjan Das ,PI, Dr Sekh Mahiuddin

Objectives:

- Modification of natural iron oxide, aluminium oxide and silica surface
- Preparation small particles of iron oxide, aluminium oxide and silica.
- Studies of interaction of the bacterial cell onto iron oxide-, aluminium oxide- and silica-water interface

Significant Achievements:

Iron oxide nano powder was synthesized by ball milling method and characterized by XRD and TEM analysis

Project No : **MLP-6000/3**

Project Title : **Clean Coal Initiatives for North East Indian Coals**

Funding Agency : CSIR, New Delhi

PI & Members : Dr B P Baruah,PI Dr Binoy Kumar Saikia, Dr Prasenjit Saikia,Dr U N Gupta, Mr Dilip Kumar Dutta, Mr Tonkeswar Das

Objectives:

- Resource Quality Assessment
- Utilization potential of NE coals
- Studies on heterogeneous mineral matters
- Study of environmental issues related to coal based industries

Significant Achievements:

Nano-mineralogy and geo-chemistry of NER coal and fly ash: An environmental study

Coal derived nano-particles has been receiving much attention recently around the world for their adverse effects on human health and the environment during

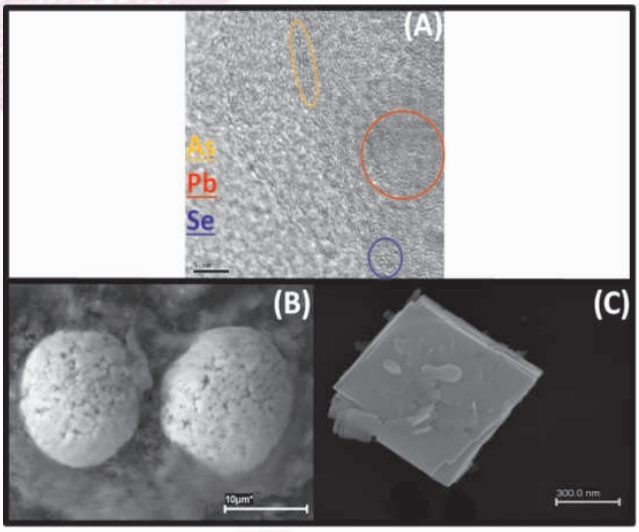


Figure 7: Nano-pyrites and hazardous elements in NER coals and fly ash

their utilization. In our investigation, the mineral matter present in some industrially important Indian coals and their ash samples were evaluated. Coal and fly ash samples from a coal-based captive power plant in Meghalaya (India) were characterized and nano-mineralogy studies made (**Figure 7**) which showed occupational health hazards.

Petro-chemical analysis, thermal analysis (TGA-DTA) and Combustion Efficiencies of NER Coals samples

The Tertiary Indian coals, classified as sub-bituminous rank, have found less industrial application owing to their indifferent physico-chemical attributes. These coals are found to contain low ash (>15%), high volatile (>35%) and high sulphur (2-8%) in nature. The majority of the sulphur is in organic form affixed to the coal matrix owing to marine influence during digenesis are and retardant to removal. The coal maceral analyses showed the dominance of vitrinite (>75%) with lesser amounts of liptinite and inertinite. Reflectance measurements (Rmax) of these sub-bituminous coals fall in the range of 0.57 to 0.65. In our study, the maceral, thermal and other physico-chemical analyses of few low rank tertiary sub-bituminous coals from North-East India were carried out to predict their potential for combustion, liquefaction and coal bed methane formation as well as design of reactors for individual process. The relative combustion efficiency of the coals was measured from the Thermo Gravimetric Analysis (TGA) of the coals. Petrography analyses are shown in Figure 8.

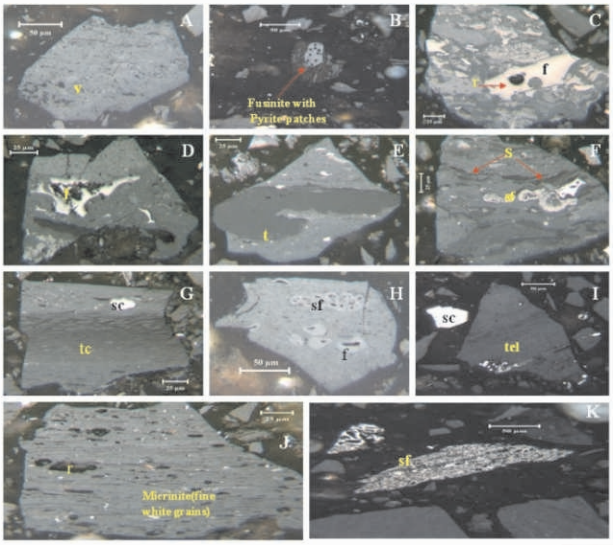


Figure 8: Petrography of NER coals

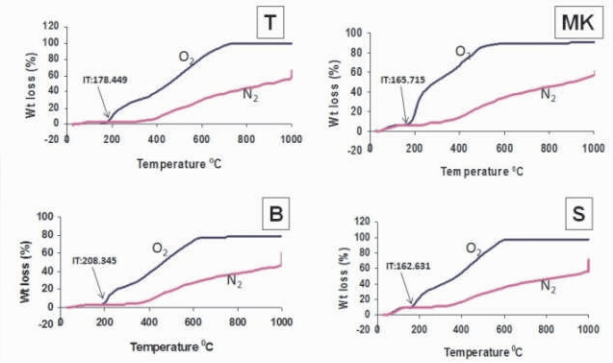


Figure 9: Thermal analysis (TGA) of NER coal samples to determine the Ignition temperature (IT)

Pyrolysis of NER coal samples and Emission studies

The pyrolysis experiments were carried out at 450°C, 600°C and 850°C temperature and kept constant for 1 hour for complete evolution of gases. The gas samples were collected at 450°C, 600°C and 850°C respectively in Tedlar bags for analyzing in Gas Chromatography. The characterization of gases with indicates utilization,

efficiency of the process leading development of CCT programs.

Resource quality assessment of NER high Sulfur coals, its genesis and statistical analysis:

The RQA of NER coals have made economic benefits to the state holders and will contribute to the established power plants and other coal based industries. The processes developed in the mining sector will largely help to restore the degraded environment in the coal mining sector. The genesis of NER coals were studied by using statistical analysis. The study revealed the detrital nature of the ash forming elements in these coals. Moreover due to insignificant relationship of ash yield with the oxides present in the coal ash, no conclusion can be obtained about the origins of these coals which may be due to their different physico-chemical properties, recent origin and marine influence during coal formation.

Development Non-recovery coke ovens for North-east Indian coals:

Non-recovery type of coke oven is energy efficient and environment friendly. The production of coke from North Eastern region coals in non-recovery coke ovens has been established as a viable proposition and has been found to be appropriate in the cement making by VSK technique. The newly developed coke ovens specially for NER coals provided with sufficient free space between the oven top and the coal bed, where the volatile matters coming out from the coal charged during carbonization get combusted. The adequate free space as well as controlled supply of air ensures efficient combustion of the hydrocarbons present in the volatile matter. The unburnt volatiles along with the hot flue goes to the sole via down comer provided at the side walls of the oven where secondary air is injected to facilitate the complete combustion of the remaining hydrocarbons. The burning of the volatile matter in the sole increases the temperature of the coke oven bed that increases the efficiency of the coke oven with better product quality and reduced coking period. Also an additional combustion chamber has been provided for complete combustion of volatiles and settling down of particulate matters. All the above mentioned pollution control devices are inbuilt in the oven system. The clean flue gas can also be utilized in heat recovery units. The process developed is a low carbon and low sulfur emission process.

Thermal Properties of NER coal:

- The ignition temperature, onset temperature, maximum decomposition or degradation temperature and enthalpy at non-isothermal condition in nitrogen and oxygen environment (Figure 10) were evaluated from the TGA-DTA analysis.
- Kinetics modelling was established from the TGA-DTA data.

Agglomeration followed by carbonization of low grade, oxidised and blended coal fines:

- The Physico-chemical properties of carbonized nodules (CN) of coals and coal blends are found to be within the existing limits for industrial and domestic purposes (Figure 11).
- The process developed will be useful for cement industries, tea gardens factory and also for other domestic as well as Industrial purposes.
- The nodules are strong enough to withstand handling and transportation.
- The process and product developed will find utilization of low rank coals and coal fines of NER with insitu arrest of sulfur and low emissions.

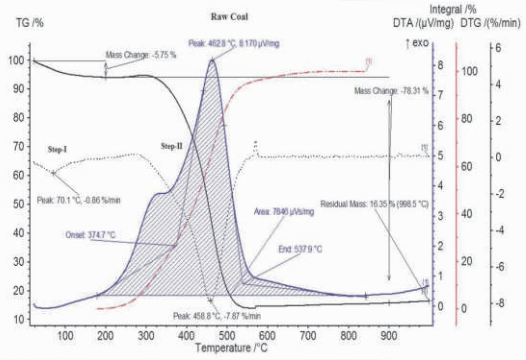


Figure 10: TGA-DTA analysis of NER coal samples

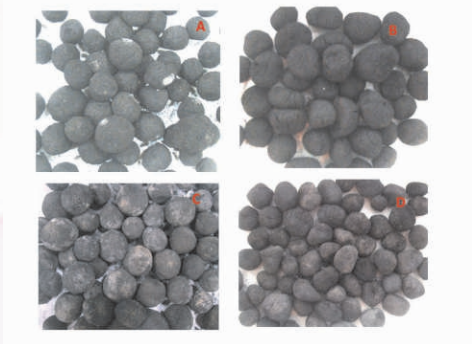


Figure 11: Green Nodules (A, B) and Carbonized Nodules (C, D)

Project No : **MLP- 6000/04**
Project Title : **Sustainable development of high valued products and processes from lignocellulosic bio resources of North East India**
Funding Agency : CSIR, New Delhi
PI & Members : Dr T Goswami,PI, Dr D Kalita, Co-PI Mr D Dutta ,Ms P K Das

Objectives:

- Development of suitable process for treatment of bamboo, wood, cane etc. available in NE India for enhancement of durability in commercially important product.
- Evaluation of non-conventional bio-resource materials for extraction of fibres suitable for handmade paper and fibre based industries.
- Development of suitable process for setting up industries in rural sector.
- Eco friendly process and product development from lignocellulosic bio-waste materials.

Significant Achievements:

Experiments were conducted in the laboratory for preparation of pulp from three species of non conventional plants eg *Arundo donex* (Nol) *Andropogon squarosus)* (Birina) and *Saccharum spontanium* (Kahua) collected from the bank of river Brahmaputra near Nimati Jorhat. Pulping experiments were carried out in the laboratory using kraft process varying chemical concentration from 10-15%, time of cooking from 2-4 hrs and temperature from 140-170 ^{0}C.The pulp yield and quality obtained from different digestions were determined and the digestion conditions were optimized in lab scale.

A parallel study was also carried out for enhancement of physical strength properties of handmade paper using suitable additives during beating operation. 2-3% rosin sizing, 3% starch and rubber latex solution (5%) was found best additives for enhancement of properties like tensile strength, tearing strength and bursting strength of paper by 20-30%.

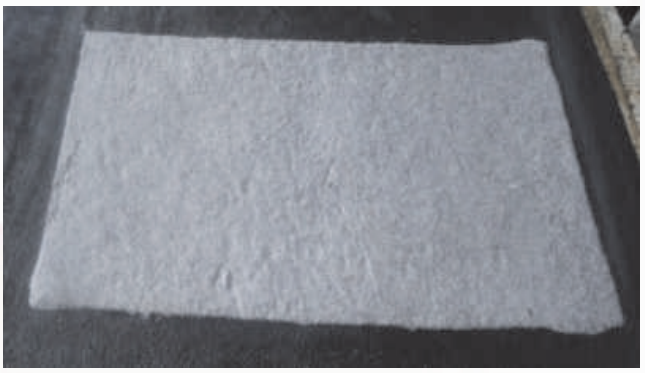
Different pulping methods viz kraft, soda, urea/sodium chloride etc were carried out in the laboratory to determine the suitable pulping method for digestion of the above three plant materials. It was observed from the experiment that Kraft process found suitable among all other process in terms of yield and pulp quality



A. Arundo donex



B. Andropogon squarosus



C. Paper samples from A. donex

Project No : **GAP-0239**
Project Title : **Planned Development of protocols for utilization of the Tide Land for Brick Manufacturer after analysis of Geo-Consequences of Mining**
Funding Agency : DST, New Delhi
PI & Members : Dr Pinaki Sengupta,PI, Mr Dipak Kumar Bordoloi, Mr Jayanta Jyoti Bora, Mr Vaskar Rajkhowa, Mr Dipak Basumatary

Objectives:

- Zonation of tilla and existing brick field clusters based on soil characteristics.
- Raw mix design
- For conventional burnt clay brick making for each tilla zones
- For making Compressed Stabilized Earth Block (CSEB) as an alternative to conventional brick.
- To establish long term feasibility of the project in terms of economics, availability of land mass and demand of bricks
- To develop a feasible protocol for brick production based on environment impact assessment.

Significant Achievements:

Fields visit to Northern and Southern Tripura during 22 to 27 August 2013, total six (6) sites namely Belonia, Udaypur, Khowai, Kamalpur, Kumarghat and Kailasaher were visited and about 1200 kg soil samples were collected for evaluation and preparation of CSEB. During the visit, few Tillas of the sites as stated above were also surveying for the amount or volume of excavatable Tilla soil using total station (including software).





Photographs of surveying

Project No : **GAP-0242**

Project Title : **Synthesis of novel composite board from coir fibre for engineering application**

Funding Agency : Coir Board, Min. of Micro, Small, & Medium Entrepreneurs, GOI

PI & Members : Dr D Kalita,PI Dr T Goswami,Co-PI, Mr D Dutta, Ms P K Das

Objectives:

- Feasibility study and evaluation of possible methodologies of utilizing coir fibers in combination with poly waste materials to synthesize composite boards and converting coir fiber derived bio-precursor to silicon carbide (SiC) based composite ceramics.
- Identification of methods for producing poly waste composite boards and biomorphic SiC ceramics using coir fibers.
- Characterization of polywaste composite boards and biomorphic SiC ceramics synthesized using coir fibers.
- Comparison of properties of composite boards synthesized using coir fiber and poly waste materials and other conventional materials.
- Comparison of properties of SiC ceramic composite synthesized using synthetic precursor and coir fiber derived precursor.
- Examination of application potential of novel poly waste composite boards and biomorphic SiC composite ceramics as engineering materials.

Significant Achievements:

Optimization of process for making bio-precursor from Coir fibre.

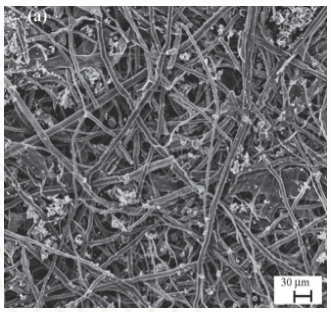
Evaluation of properties of the composites.

Development of porous SiC ceramics from coir composite









Project No : **GAP-0248**
Project Title : **To develop a process of non-glossy borer resistant polymeric composition suitable for application on various bamboo and cane articles.**
Funding Agency : SEED Division, DST, Ministry of Science & Technology, GOI
PI & Members : Dr Dipul Kalita,PI ,Dr T Goswami,CoPI

Objectives:

- The prime objective of the proposed project work is to develop a non glossy borer resistant polymeric composition suitable for bamboo and cane craft articles which will prevent from damage and decay due to moisture absorption and attack of borer.
- The process technology proposed to be adopted will be easily adoptable by rural artisans and will not require any sophisticated equipment and high skill labour.
- To create awareness among the rural artisans to improve the quality of their products so that they can fetch a better price which will directly help in their economic upliftment thereby induce the societal benefit.

Significant Achievements:

Developed a formulation for insect and fungal resistant suitable for bamboo and cane articles to prevent damage caused by insect and fungus.

Create awareness among the rural artisan to improve their product quality.

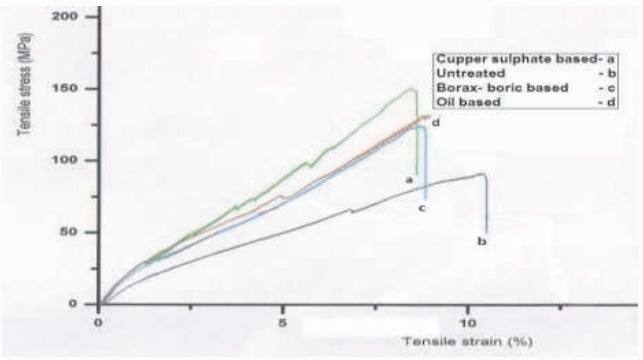


Treatment with the formulation





Study on strength property



Untreated bamboo

Project No : **GAP-0249**
Project Title : **Development of technology to produce clean coal from high ash and high sulphur Indian coal: Desulphurization of high sulphur NE Indian Coals**
Funding Agency : Ministry of Steel, GOI
PI & Members : Dr B P Baruah,PI ,Dr Binoy Kumar Saikia, Co PI ,Dr Prasenjit Saikia, Mr Dileep Kumar Dutta,,Mr Tonkeswar Das

Objectives:

- Evaluation/ characterization of sulphur functionalities in high sulphur Assam coals.
- Evaluation of effective desulphurization methodologies for quality enhancement with reference to end applications.
- Optimization of process parameters for desulphurization of Assam coals.
- Removal of mineral matter/ash along with trace and heavy metals from coals during process steps.

- Sulphur mapping for NE coals.
- Scale up and pilot plant trials.

Significant Achievements:

Physico-chemical properties of few selected high sulphur coals from different coalfields of North East India were carried out. Different suitable chemical processes were evaluated for Desulphurization of NER Indian coals. The environmental consequences of energy production from coals are well known, and are driving the development of their cleaning technologies. In our investigation, ionic liquids were used for oxidative de-sulfurization and de-ashing of industrially important high sulfur sub-bituminous Indian coals in order to make them clean. The ionic liquids, (IL1 and IL2) were employed for desulfurization of the Indian coal samples in presence of per-acids and catalyst. Results show the maximum removal of all the forms of sulfur in this process (Figure 12).

An attempt of using low ultrasonic energy (~20 KHz) has also been made to clean some low rank high sulfur coal samples from northeast India in presence of H_2O_2 solutions. The study shows satisfactory removal of all the forms of sulfur and mineral matters (ash) from the coal samples. The physico-chemical characterizations of the raw and ultrasonicated coal samples were carried out by using Fourier Transformation Infrared (FT-IR) spectroscopy, X-ray diffraction (XRD), Scanning Electron Microscopy (SEM) and Thermogravimetry-Derivative Thermogravimetry (TG-DTG) techniques to evaluate the final product quality. The quantitative FT-IR spectroscopic analysis demonstrated the formation of oxidized sulfur species (S=O and -SO_2) and their subsequent removals from coal samples during ultrasonication. The XRD profiles supported the partial removal of some minerals from coals including their de-ashing. The TG-DTG profiles of the beneficiated coals revealed their improved quality for using in thermal plants with better combustion efficiency (Figure 13).

The 500kg/batch reactor was designed and fabricated in the Institute, which is suitable for multiple processes viz. Desulfurization of Coal, Desulfurization of Oil, Humic acid from low rank coals (Figure 14). Pilot plant scale-up studies of Oxidative Desulfurization (ODS) of NER coal were also carried out for different batches. In the batch wise pilot plant scale up studies, the removal of sulphur and ash content was found to be significant. The process has shown merit for industrial uses, however is dependent upon the particle sizes of the feed coal.

The NEXAFS data analysis of raw and oxidised coal samples (Figure 15) reveals the presence of sulphur and organic sulfur in NER coals. It also informs the changes in sulphur concentrations during the course of Oxidative desufurization reaction. Figure 36 shows the comparison of NEXAFS of model sulfur compounds, raw coal samples and oxidized coal samples. It is clear from Figure 36A that sulfur in the oxidized form (sulfate and sulfone) is at a much higher energy (>2480 eV), and the spectra of reduced sulfur species (sulfide, di-sulfide and thiophene) have peaks in the lower energy region (<2473 eV). The S 1s peak of the intermediate, organic sulfur species such as sulfoxide can be found around 2475 eV. This trend demonstrates the sensitivity and the potential applicability of S 1s NEXAFS in the sulfur speciation in coals. From Figures 36B and C, it is clear that the surface (from TEY) of all coal samples has relatively higher sulfate signal than in the bulk (FY), likely due to surface oxidations. The sulfate signal on the surface in the treated sample is much lower than that in the raw coal sample, indicating the removal of sulfate after the oxidation, in agreement with the chemical analysis. For T1 coal, the intensity of 2475 eV peak is observed to increase in both TEY and FY spectra after the oxidation treatment. This peak can be assigned to the sulfoxide, resulting from the oxidation treatment during which sulfide and thiophene are oxidized (reduced peak intensity around 2472 eV) to generate sulfoxide and sulfone (~2480 eV peak). The same trend can also be observed for MK coal, as shown in Figure 36C. We should also note that the MK coal contains relatively higher pyrite concentration, as indicated by the strong feather around 2471 eV in spectra C and D shown in Figure 36C. This pyrite peak is much reduced after oxidation and IL extractions (Spectra E and F in Figure 36C). These results clearly showed that oxidation treatment has effectively removed inorganic sulfur (pyrite and sulfate) and there was organic sulfur transformation after the treatment.

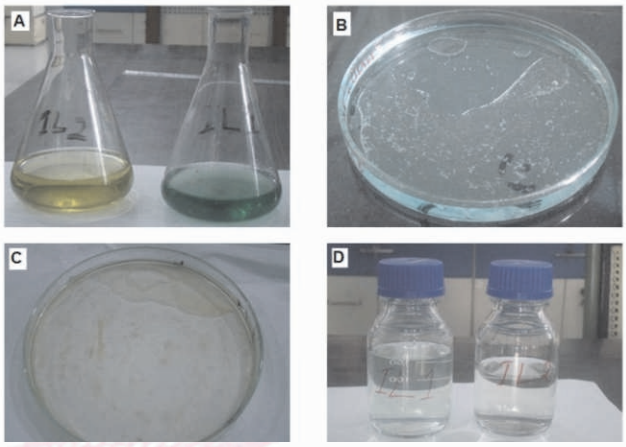


Figure 12: Recovery and recycling of ILs during EDS for NER coals

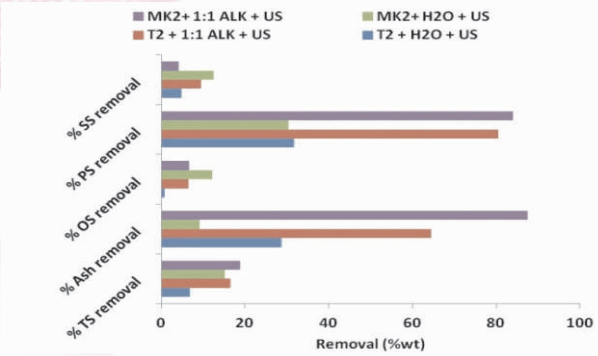


Figure 13: Removal of the sulphur components and ash during ultrasonication of NER coals



Figure 14: Inauguration of Coal Processing Reactor at CSIR-NEIST

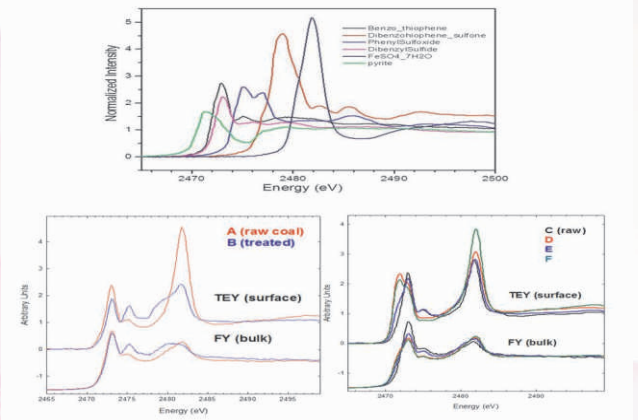


Figure 15: NEXAFS Spectra of model sulfur compounds, raw and treated coal samples recorded in Total Electron Yield (TEY; surface sensitive) and Fluorescent Yield (FY; bulk sensitive); A: T1 coal, B: T1-Oxd, C: MK coal, D: MK-Oxd, E: MK-Oxd-IL1, F: MK-Oxd-IL2

Two step oxidative desulphurization process (oxidation and extraction) shows sulphur removal along with removal of ash. Extraction with alkali and electron donating solvents is also effective for removal of sulphur and ash from high organic coals. Oxidative desulphurization could be useful for the pre combustion desulphurization of high sulphur NER Indian coals and effective reduction of ash in coal.

Project No : **GAP-0261**

Project Title : **Development of feasibility assessment model for adaptation of Underground coal gasification technology in the North-East Region of India**

Funding Agency : Ministry of Communication and Information Technology

PI & Members : Dr Bimala Prasad Baruah,CI,Dr Prasenjit Saikia,Dr Binoy Kumar Saikia, Co-I, Mr T Das, Co-I

Objectives:

- Development of feasibility assessment model for adaptation of underground coal gasification (UCG) technology in the North-East Region of India.
- Development of gas monitoring and power cut-off system for existing underground coal mines to avoid explosion.
- Development of database related to coal deposits of North- East Regon and web-enabling of the information.

Significant Achievements:

The potential sites of Makum coalfield (Tipong, Tirap, Ledo and Namdung collieries) for underground coal gasification were identified. The collection of coal, geological materials from Tipong colliery for chemical, mechanical and thermal analyses has been done. The vertical and cross-sectional view of the different coal seams of Tipong Colliery is shown in Figure 16 and Figure 17.

The seam-wise physico-chemical characteristics and thermal properties of Makum (Tipong) and Meghalaya coals were determined.

Ash analysis of the Tipong coal to study the slagging behaviour and other effects during gasification process has been completed.

Mineralogical study of Tipong coal ash through XRD showed that coal ash consist of Quartz (Q), Kaolinite

(K), Hematite (H), Calcite (C), Alumina (A) and Montmorillonite (M). (Figure 18)

Study of the physico-chemical characteristic of borehole of NE coal samples were carried out.

Installation and operational of the flue gas analyzer and desorption canisters were done to study the flue gas gas compositions.

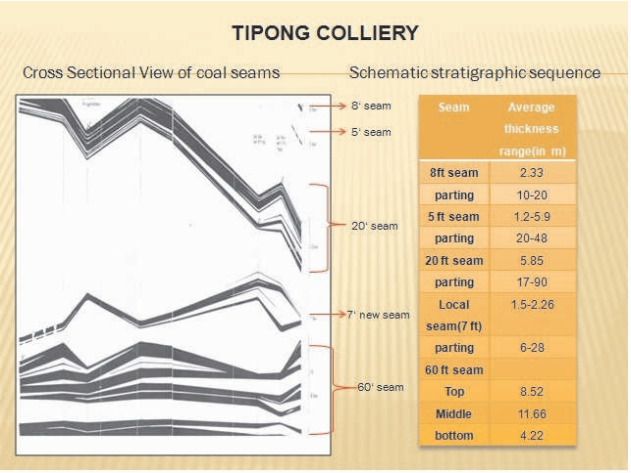


Figure 16: Geological Cross Sectional View of Tipong Colliery coal seams Colliery Coal seams

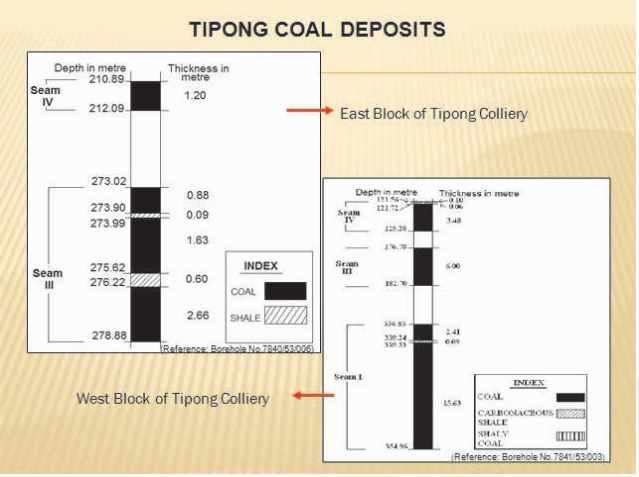


Figure 17: Geological Vertical view of Tipong

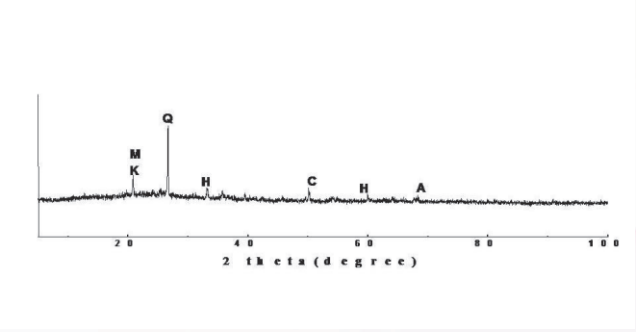


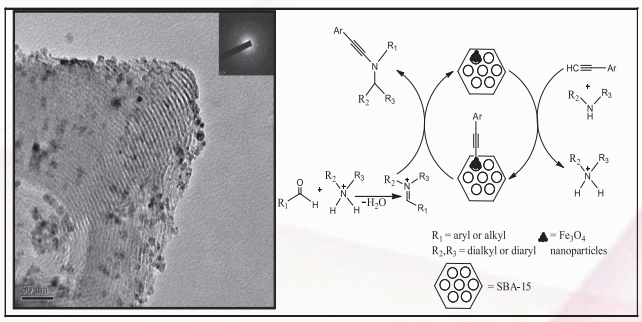
Figure 18: XRD spectra of Tipong coal sample.

Project No : **GPP-0267**
Project Title : **Hierarchical Porous Solid as Catalyst and Catalytic Support**
Funding Agency : DST, New Delhi
PI & Members : Dr Lakshi Saikia, **PI**
Objectives:

- To synthesize hierarchical porous materials by using block copolymer and naturally occurring cellulosic materials as structure directing agent and by template free methodology.
- To characterize the support and modified materials (metal/metal oxide nanoparticles, surface functionalized)
- Catalytic evaluation for reactions like hydrogenation aromatic and condensed aromatic system, oxidation, coupling reactions etc.

Significant Achievements:

The Fe_3O_4@SBA-15 was successfully synthesized and characterized using wide angle and low angle XRD, N_2 adsorption-desorption isotherm, TEM, FTIR, XPS analysis. The synthesized Fe_3O_4@SBA-15 catalyst is magnetically recoverable and exhibit better catalytic activity for three component coupling reaction of aldehyde, amine and alkyne catalyzed by Fe_3O_4 nanoparticles. The reported catalyst is recyclable and could be recycled up to five times without significant loss in catalytic activity. (Figure shown below)



Project No : **GPP-0269**
Project Title : **Solution Chemistry Approach for Synthesis of Metal Nanoparticleson the Graphene Oxide/Graphene Nanosheets**
Funding Agency : DST, New Delhi
PI & Members : Dr Manash Ranjan Das, PI
Objectives:

- To study the solution chemistry approach for synthesis of the metal nanoparticles (Ag, Au,

Pd, Pt, Ni, Cu) on the graphene oxide/graphene nanosheets using different mild reducing agents in aqueous medium at different pH and temperature.

- To study the solution chemistry approach to synthesis of the metal nanoparticles (Ag, Au, Pd, Pt, Ni, Cu) on the graphene oxide/graphene nanosheets in aqueous medium using microwave irradiation condition.
- Complete characterization of the synthesized metal nanoparticles (Ag, Au, Pd, Pt, Ni, Cu)-graphene oxide/graphene composites materials and find out the suitable condition for the formation of metal nanoparticles (Ag, Au, Pd, Pt, Ni, Cu) on graphene oxide/graphene sheets to prevent restacking of the graphene oxide/graphene nanosheets and well dispersed metal nanoparticles on the graphene oxide/graphene sheets.
- Investigation for the catalytic performance of the few synthesized metal nanoparticles-graphene composites materials will be carried out.

Significant Achievements:

The graphene oxide nanosheets decorated with gold nanoparticles (Au NPs-rGO) using an eco-friendly route and investigated to biocompatibility to HeLa cell and its antibacterial activity against Gram positive and Gram negative bacteria. The composite material was synthesized by using an environmentally friendly reducing agent, ascorbic acid, under ultrasonication. The composite material was characterized by UV/vis spectroscopy, X-ray photoelectron spectroscopy (XPS), X-ray diffraction (XRD), small angle X-ray scattering (SAXS), high resolution transmission electron microscopy (HRTEM) and thermogravimetric analysis (TGA). HRTEM analysis revealed the formation of spherical Au NPs particles of 8-45 nm in size on the folded graphene nanosheets which was further confirmed by XRD and SAXS analysis. The Au NPs-rGO showed good biocompatibility to cervix carcinoma, human (HeLa) cells, while possessing high antibacterial activity against two Gram positive bacteria (*Staphylococcus aureus* and *Bacillus subtilis)* and two Gram negative bacteria (*Escherichia coli* and *Pseudomonous aeruginosa)*. The bacterial cells death was due to leakage of sugars and proteins from the cell membrane in contact with the Au NPs-rGO composite material.

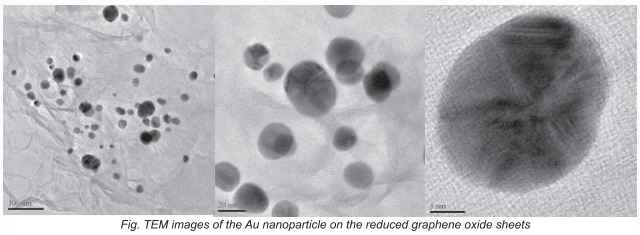


Fig. TEM images of the Au nanoparticle on the reduced graphene oxide sheets

Project No : **GPP-0278**

Project Title : **Potential Rhodium complexes of functionalised phosphines and nitrogen donor ligands: synthesis, reactivity and catalytic carbonylation of alcohols**

Funding Agency : DST, New Delhi

PI & Members : Dr Dipak Kumar Dutta, PI

Objectives:

- To synthesise and characterize potential electron rich rhodium complexes of functionalized phosphine and nitrogen donor ligands containing hemilabile chelating phosphine-chalcogen donors.
- To evaluate the effect of multidentate chelating ligands with "Soft and Hard" chalcogen donors (O, S and Se) on the "lability" of the metal - O/S/Se bonds.
- To study the reactivity (Oxidative addition reactions, kinetics) of the suitable metal complexes with the small molecules like CO, H2, CH3I, etc. and other substrates for conversion to value added products.
- To evaluate the catalytic efficiency of the synthesized complexes towards carbonylation reactions of different alcohols like methanol, ethanol, benzyl alcohol etc. to corresponding acids and esters.

Significant Achievements:

Cationic carbonyl complexes of the type [M(CO)L]Cl (**1**) [M = Rh (**a**) and Ir (**b**); L = $P^{/}(CH_2CH_2PPh_2)_3$] have been synthesised and characterised by various spectroscopic techniques including the single crystal X-ray diffraction. The complexes show catalytic activity towards the hydroformylation of alkene to the corresponding aldehydes under the reaction conditions: Pressure 35 ± 2 bar, temperature 80 ± 2 ^{0}C,

500 rpm and time 5-8 h. The yields of the aldehyde products are in the ranges 55-75%.

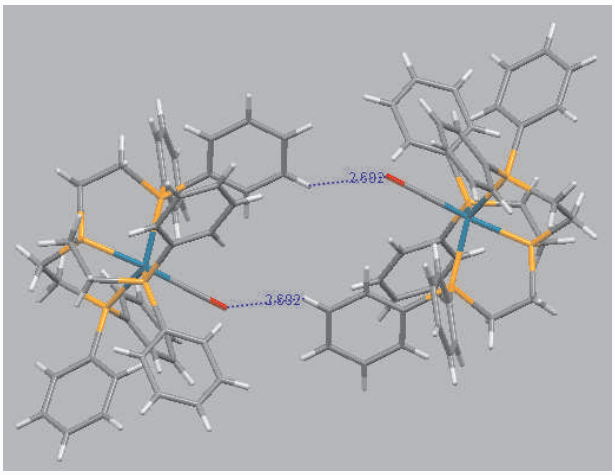


Fig. Intermolecular hydrogen bonding in 1a.

Project No : **CLP 0284**
Project Title : **Development of green composites by utilizing agricultural waste for building construction and other application**
Funding Agency : M/S Sathguru Management Consultant Pvt Ltd. Hyderabad
PI & Members : Dr Dipul Kalita, PI

Objectives:

- Screening and selection of agricultural waste or other fibres and suitable binding material as green chemical
- Manufacture of green composite boards by utilizing agricultural wastes and agro based fibre and their quality evaluation.

Significant Achievements:

Composites were prepared utilizing pineapple, jute and banana non woven sheet and biodegradable soy protein isolate based binding material and found suitable for building, furniture and other appliance as green composite material.

Agreement signed:

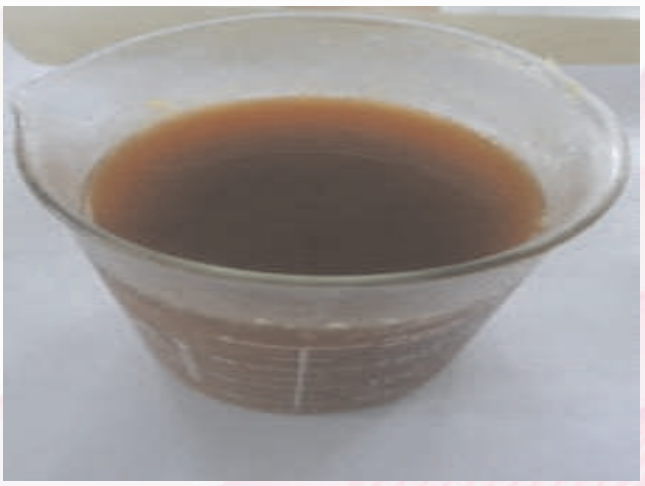
An agreement has been signed with Sathguru Management Pvt Ltd, Hyderabad for a consultancy project entitled "**Development of Green composite utilizing agricultural waste for building, construction and other applications"** in collaboration with College of Home Science, AAU, Jorhat.



Pineapple fibre



Nonwoven Pineapple sheet



Soy protein resin



Pineapple composite board

Project No : **CNP 0464**
Project Title : **Gradation (Annual) of NE Indian Coals**
Funding Agency : Coal India Ltd.,Margherita

PI & Members : Dr B P Baruah, PI,Dr Binoy Kumar Saikia, Dr Prasenjit Saikia, Mr Dilleep Kumar Dutta, Mr Tonkeswar Das

Significant Achievements:

The tertiary coals of NER can better be used in the industries (as low to medium coking coals) for their high calorific values. The coals of NER will certainly have better preference from commercial point of view. During the course of experimental studies, it is found that the coals of NECL have a GCV range from 6200kcal/kg to 7600kcal/kg and can suitably be graded as '**A**' Grade coals. The annual as well as overall gradations of NER coals will have economic benefits to the industries.

MANAGEMENT SCIENCES

The management sciences consist of five major divisions mainly Planning, Information and Business Development, Project Monitoring Evaluation, Human Resource Development and Information Communication Technology. Each Division is having individual activities to support the R&D communities of the institute as well as to support the Director and administration. The Planning and Monitoring Division basically involve in the R&D management in terms of resources (Budget, Manpower & outputs), planning and allocation, evaluation and outcomes of R&D projects through management of limited resources in a gainful manner. The division is working for dissemination of information on all projects. Compilation of annual plans, monthly and quarterly performance reports are another activities of the division.

As to serve as the window of the institute, the Information and Business Development Division continued to maintain liaison activities with both public and industrial houses, entrepreneurs etc. who were in need of assistance from the institute. I&BD also disseminate the expertise and capabilities of the institute to the external clients. This division is also responsible for bringing out Annual Report, NEIST News, Highlights and other in house publications of CSIR-NEIST. This division is responsible for protection of IPR on the outcome of the research findings of the Institute. The division maintain liaison with various academic/research Institutes/entrepreneurs for research collaboration and catalyzes technology transfer. Besides these activities, attending different quarries, popularising the technologies through exhibitions, advertisements, liaison with press and media are other major activities of the division.

Human Resource Development Division of the institute with its focused objectives of HR development with knowledge management solution for R&D output of the institute and also undertakes management of research workers, project workers, apprenticeship trainers, co-ordinating in imparting training to scientists and officials outside CSIR-NEIST, motivation programme under CSIR Scheme for bright SC/ST students. etc.

The knowledge Resource Centre (KRC) is continued to provide library and information services to all R&D and technical staff, research fellows, outsides students, universities, and colleges of NE Region. Keeping record, procuring of the major journals and books for the benefit of readers are major activities of the centre.

Information Communication Technology Division is basically engaged in maintenance of networking system and maintenance of website.

Human Resource Development

Human Resource is the most critical and valuable asset for any organisation, particularly in R&D institute like CSIR-NEIST, Jorhat. The HRD Division of the institute with its focused objectives of HR development with knowledge management solutions was instrumental in realizing R&D output of the institute. The Division was also able to organize and nucleate human resource management activities in the institute, catering to the needs and aspirations of the students and teachers of NE-Region in particular and the country in general. The following structured processes were carried out involving Engagement & Induction, Competency Enhancement, Motivation & Training, Learning & Development for achieving the objectives of the institute.

Structured and customised induction process and S & T management :

Research Workers:

The Division encouraged young talents to take up steps for joining in the fellowship scheme of CSIR and other funding bodies to carry out basic research in frontier areas of science. The institute has been able to attract talents not only from the country but also from abroad for carring out research activities. During the period a few researchers, selected at national and international level in fellowship scheme joined the Institute. Presently, they are working as Principal Investigator (PI) under Women Scientist Scheme (WSS) of DST, Senior Research Fellow and Junior Research Fellow of CSIR, UGC and other funding bodies. The Institute inducted DST Inspire fellow, CSIR-TWAS Fellow and Centre for International Co-operation in Science (CICS)'s Research Training Fellowships for Developing Country Scientists (RTFDCS) in order to augment the research activities. The Division also arranged to engage a few lecturers / teachers of nearby colleges and other Institutes as Guest Workers for their research work leading to PhD. The progress of work of the research fellows were monitored and reviewed in specified time frame for taking up corrective measures and based on the recommendation of the designated authority the fellowship was upgraded or extended from time to time. The above activities were supported with proper record keeping and correspondence with HRDG – CSIR, DST – New Delhi, UGC – New Delhi, etc.

***Research Worker under Academy of Scientific and Innovative Research* (AcSIR):**

The *Academy of Scientific and Innovative Research* (AcSIR) was established by an act of Parliament *in 2011. The Academy was declared as an institution of national importance and is established for furtherance of the advancement of learning and research activities in the field of science and technology. The Division facilitated in achieving the objective of the Academy, to* disseminate advanced knowledge in science and technology, by providing teaching and research facilities in emerging areas and conduct courses in inter-disciplinary and multi-disciplinary areas covering Chemical & Biological Sciences, etc.

The Division is the functionary unit of AcSIR in the institute and have actively participated in formulation and structured activities of AcSIR, like course curriculum preparation, registration of students, constitution of Doctoral Advisory Committee (DAC), preparation of Provision Grade Report of the students, collection of fees, etc. During the period three (3) new students enrolled under different Research Fellowship scheme for Ph D courses of AcSIR taking the total numbers of students enrolled at AcSIR in this Institute to fifteen.

Project Workers:

Realising the importance of proper human resource towards successful implementation and completions of the projects, external manpower as Project Assistants / Project Fellows / etc were engaged by the Division which helped in achieving the targets of R&D projects. The Division customised process for attracting young talents in different areas of science to this Institute through different means and had empanelled sufficient numbers of talented candidates with desired specializations on merit basis. The empanelled candidates were engaged, as and when required, in externally funded and CSIR projects of the Institute as well as at its Branch Labs. During the period 84 Projects Assistants were engaged to assist the scientists for continuing the project activities and altogether, 153 Projects Assistants / Project Fellows / etc worked in different projects of the institute. Moreover, some of the Project Assistants, etc engaged in earlier years were permitted to pursue research work leading to Ph D degree based on entrance test of universities, course work and review of their progress of research work.

PRogramme to **A**u**G**ment & re**J**uvenate **Y**outh thr**O**ugh **T**raining for econom**I**c, **S**ocial & **H**olistic development **(PRAGJYOTISH)**:

The project (PRAGJYOTISH) was prepared and the same was approved as MLP-7000 for the 12 five year plan. The following are the few Milestones / Targets achieve since April, 2012 under the project:

Apprentice Training Programme:

Apprenticeships are a powerful vehicle for skill development because they facilitate "learning by earning" and "learning by doing". The institute is continuing skill development technical training programme for educated youths of the state under Apprentice scheme of Govt of India. The Division coordinated various activities of the training programmes for Graduates and Diploma holders in engineering disciplines and Apprentice training programme and during the period,1 Graduates degree holders in engineering disciplines joined this institute. Under Trade apprentice training programme, 9 ITI qualified candidates in different trade like draughtsman, electrician, welder, fitter, electronic mechanic, plumbers, etc and 9 in laboratories assistant trade were engaged in the institute. The duration of the training period ranged from one year to three years. During engagement, registration, imparting training and also in examination process the Division interacted with Board of Practical Training-Kolkata, Directorate of Technical Education-Assam, and other organisations. Certificates were awarded to the successful apprentice trainees.

Training Programme / Project Work for the Students of different institute / universities:

Enduring the need to organized linkages / networking with other organizations / academic institutions for HR development towards fostering research in different branches of science, the Division had arranged facilities for multi-theme and multi-level training programme like: summer training, industrial training, practical training, dissertation, etc. to selected students of different universities, colleges and institutes of the country. The modules for these programmes are designed, evolved & formulated in-house keeping in view the institutional scientific pursuit and career needs. At the request of the authorities of universities, colleges and other institutions and also the students, this institute permitted the students to undertake training programme under a scientist. The duration of the programme ranged from one month to one year and after successful completion of training / dissertation, certificates were issued. During the period a total of Three Hundred Sixty Two (362) applications from students were processed of which Two Hundred and Thirty Two (232) students at different levels up to postgraduation were permitted to work in the institute, out of which One Hundred and Sixty One (161) students had actually undertaken the training programme / project work.

Training for Scientist and Officials, outside CSIR-NEIST, Jorhat:

Training and re-training is a process for developing human resources continuously. In the multi-facet area, the Division regularly interacted with HRDC, CSIR and also with other institutes / organizations for need-based training of scientists and officials of the institute. The Division also helped the scientists and officials of the institute to undertake different training programmes at those organizations.

Science Dissemination & Motivation under CSIR Scheme of Cash Award to Bright SC/ST Students:

CSIR- New Delhi introduced a scheme of Cash Awards to motivate Bright SC / ST Students to take up science studies at +2 / Junior College level. It is well acknowledged that education acts as feeder to any development, so motivating students in this sphere with incentive mechanism will definitely accelerate the process of development of SC / ST students and subsequently their community which in turn will add to our contribution of nation building. The award ceremony was held on the foundation day of CSIR i.e. September 26, 2013.

In order to implement the scheme the Division interacted with the State government authorities of north-eastern states for nominating the bright SC / ST students for the programme. Altogether, 12 bright SC / ST students and who have passed Class X examination in the year 2013 from State Boards of north-eastern states were nominated out of which five students were awarded, some of the students could not attend the programme owing to their routine examination.

Established network with other organizations to promote research/studies and skill upgradation:

Nomination for Awards / Fellowships:

The Division coordinated with different organizations and institutions of the country in sending nomination of the scientists and technologists of the institute for awards, fellowship of different organizations. The proposals were examined through a designated process and were sent to different organizations. Altogether nomination of three scientists: Dr R Saikia, Dr M Bhuyan and Dr D Kalita were sent during the period for the Award of Biotechnology Overseas Associateship for Scientist working in North Eastern States of India instituted by DBT, New Delhi. Also information about different Award and Fellowship were circulated among students for award like Lady Tata Memorial Trust's Scientific Research Scholarships, etc.

University linkage to promote research

The regional partnerships and collaboration with universities / institutes is one of the missions of the institute. The institute signed MOU with different research institutes and universities of NE Region with a view to augment the basic research in frontier areas of science and it is also one of the authorised research centre of different universities of the Region. The Division regularly interacted with different Universities of the region regarding Ph D registration, course-work, grading, etc. During the period 7 research workers were awarded Ph D degree by Dibrugarh University, Dibrugarh, Gauhati University, Guwahati. The following are the details of Ph D awarded during the period:

International Scientific Collaboration:

It is an essential tool to remain competitive in the world and to increase the dept of expertise and talent in priority areas of strategic importance for the institute and the country. It is believed, the same can be achieved by building relationships and developing collaborative projects with academic and government partners of international bodies. Professional exchange of scientists is an important tool for cross-fertilization of ideas which helps in formulating bi-lateral and multi-lateral research projects. The Division played an active role and assisted scientists and technologists of the institute for initiating international scientific collaboration. The Division interacted with different organizations for deputing scientists and technologists aboard under exchange of scientists programme, fellowship programme, training programme, participation in conference and symposium, etc. The proposals were examined critically through designated process and the Division interacted closely with ISTAD, CSIR during the process, which also include monthly reporting of foreign visits of scientists and officials. During the period the scientists of the institute were deputed to visit countries like Malaysia, China, Vietnam, Czech Republic, Japan, Thailand and Spain under different programmes.

Societal and Strategic Development

S&T Infrastructure Support to the Colleges of North-Eastern Region

The Department of Science & Technology, Government of India, New Delhi, in a proactive measure, had announced a special package for North East Region for strengthening science and technology teachings and researches at college level. The holistic objectives include renovation of the infrastructure, strengthening S&T teachings and researches at college level and making the colleges a source of generating high caliber manpower and repositories of national intellectual wealth in S&T sector, which in turn will lead to the human resource development of NER-region in particular and country in general. NEIST-Jorhat is acting as a Central Agency for the facilitation of the same and the Division has been assigned the task of implementing the project activities in 58 colleges of North-East India belonging to 10 universities. The project was implemented in four phase in each of the 58 colleges: 1st Phase consists of Renovation of Computer labs and Teaching labs by Rs. 5 lakhs and Procurement and installation of Computer and other equipment of computer lab of Rs. 5 lakhs; 2nd Phase consists of Procurement and installation of teaching lab equipment of Rs. 10 lakhs; 3rd & 4th Phase consists of Renovation of Teaching

labs by Rs. 5 Lakhs and Procurement and installation of teaching lab equipment of Rs. 15 lakhs. All the major work of the projects was completed in previous years. However, physical verification of the renovation work carried out by the colleges and the use and maintenance of equipments were overviewed during the visits to the colleges during the year.

Other Activities:

Research Council:

The Division carried out different activities of the Research Council (RC) of the institute. During the process it interacted with the scientists and other officials for preparation of RC agenda document and other issues of RC. During the period the approved minutes of the 46th & 47th RC meeting was sent to CSIR Hqs. and action to be taken on recommendations were circulated to different divisions of the institute for taking up follow up actions. The 47th RC meeting was organized at CSIR-NEIST, Jothat during October 30 - November 1, 2013. The agenda document of 47th RC meeting was prepared and the draft minutes were circulated among the RC members.

Database Management

The Division is managing different databases on manpower of the institute. The databases are being regularly updated. Some of the databases are: Foreign visit of scientists, Research workers, Ph D recipients, Manpower, Apprentice trainees, etc. The reports of the databases were being used for taking up effective measures of manpower management. Some of the reports were sent to different organizations of the country such as, ST Commission of G.O.I, Parliament Secretariat, New Delhi, etc. as and when required. The Division continued the assignment in furnishing information of Group IV scientist to RAB, CSIR on half – yearly basis, visits of scientist abroad to ISTAD, CSIR on a monthly basis. The Division also continued to assist the Director in different S&T activities.

Right to Information Act 2005

The Institute being a national institute of Council of Scientific & Industrial Research, New Delhi falls under the ambit of Right to information Act 2005. The Division is providing information of the institute to the citizens under the Act. During the period a large number of applications were received from different parts of the country and information was provided to all within the stipulated time. Correspondence with CSIR, New Delhi was continued from time to time. The quarterly report was uploaded in the website of the institute and the web-based report was sent to Central Information Commission, New Delhi.

Infrastructure Management:

The Division managed different activities of the Boys' and Girls' hostels, Guest house and Guest house annexe of the institute. Steps were taken to purchase new electronic gadgets, furniture's, cooking-ware, cloth materials and other essentials required to preserve the brand image of the institute.

Information & Business Development

As usual the Information & Business Development division continued to serve as the window of the Institute to the outside world and coordinated the overall business development activities of the Institute. The division continued to maintain the liaison activities, both public & industrial houses, entrepreneurs etc who were in need of assistance from the laboratory and also disseminated the expertise and capabilities of the Institute through various means for economic, societal and other benefits of the clients, customers and users.

Exhibitions/workshop organised

The I&BD division has during the year organized the CSIR-NEIST exhibition stall and participated in the following exhibitions organized on various occasions

Exhibition cum workshop programme	Amguri town, Sivasagar district, Assam.	09.04.13
North East Farm & Food Tech Programme	Maniram Dewan Trade Centre, Guwahati	20.04.13-23.04.13
Farmers Day 2013	Regional Agricultural Research Centre (RARS), Titabar	06.11.13
National Science Congress, Jammu, CSIR exhibtion	Display Technology poster and samples of CSIR -NEIST	20.02.14
Exhibtion at CSIR- innovation centre Kolkatta.	Display Technology poster and samples of CSIR -NEIST	14.09.13

Organised StudentsVisits

Gyanjatra and Gyanjyoti programme

During the year more than 3000 students from all over district of Assam were visited CSIR-NEIST under the Chief Ministers Jyanjyoti Programme, Govt. of Assam and more than 2500 Students under Jyanjatra programme frame by Inspector of Schools Jorhat, Golaghat and Sibsagar district.

Moreover Students from differents Universities, Colleges,Technical Institutes,& Schools of North Eastern Region visited CSIR-NEIST along with the guide teachers .

Publications

During the period the division brought out the following regular and need based publications on different occasions.

- *Annual Report 2012-13* - The bilingual (Hindi & English) Annual report of the institute was brought out and released on the 71st CSIR Foundation Day celebration on 24 September 2013
- *Highlights 2013-2014* - Highlights 2013-14 of the institute (which is compilation of institutes activities) was brought out and released on the CSIR-NEIST Foundation Day celebration on 18 March 2014
- *NEIST News (Bimonthly Bilingual Hindi-English newsletter)*
- *INFOWATCH* (*Inhouse Weekly*)

Patents filing

The division is responsible for processing of the institutes patent application for filing in India and abroad and for this is continuously coordinating with IPU, CSIR, New Delhi.

Processing of New Project Proposal

The division is also responsible for processing of new project proposals. The proposals so received are forwarded to the respective committee for scrutiny.

Technology Transfer

The division is responsible for the commercialization of the technologies developed by CSIR-NEIST. It is responsible for drafting of technology/knowhow transfer agreement and acts as bridge between the entrepreneur and the division responsible for demonstrating the knowhow package.

Testing & Analysis

The division is also responsible for processing of the samples received by the institute for testing and analysis. The samples are sent to the respective division and on completion of the analysis, the reports received by the division are sent to the respective parties.

MoU/Agreement

In addition to the MoU signed for technology/knowhow transfer, agreements were signed with various organization/universities for different purpose as given below:

Type	The party	Work
MOU	M/s Sarada Clinics Pvt.Ltd., Kolkata	For transfer of marketing rights on Fungi-Destruct
Agreement	M/s Sukanta Self Help Group, Jirania R.D Block, West Tripura	For transfer of knowhow on Herbal incense sticks with Mosquito repellent properties.
Agreement	M/s OMICS Pharma Pvt. Ltd., Ahmedabad, Gujarat	For transfer of marketing rights on herbal products, Anti-Arthritis and Fungi-Destruct
Agreement	M/s Amrit Organic Fertilizer Plant, Dibrugarh, Assam	For transfer of knowhow on TP-16 Biofertilizer for sustainable crop yield and to provide consultancy for setting up of the manufacturing unit.
MOU	International Advanced Research centre for Powder Metallurgy and New Materials (ARCI), Balapur village, Hyderabad.	For collaborative development of Honeycomb based membrane reactors.
Agreement	Mr Samman Lowang Rajkumar, District Tirap, Arunachal Pradesh.	For preparation of "Detailed Project Report for the proposed composite Forest Farming at Malisa Tea Garden area, Tirap district, Arunachal Pradesh
Agreement	Smt. Bapi Malakar, W/o late Ajay Malakar, Duliajan, Dibrugarh	For transfer of knowhow on Mushroom Spawn Production Technology
MOU	Earth Observatory of Singapore, Nangyang Technological University, Singapore	To develop research & scientific cooperation for their common goal of better understanding of India-Tibet and India-Burma Tectonic convergence process so as to enable better hazard assessment of earth
Agreement	M/s Sarada Clinics Pvt. Ltd., Kolkata	For transfer of knowhow on Herbal anti-asthmatic formulation
Agreement	M/s Triveni Enterprise, Jorhat, Assam.	For transfer of marketing rights of Anti-Arthritis.
MOU	Directorate of Biotechnology, Dept. of Science, Technology & Environment, Govt. of Tripura, Agartala, Tripura	For collaboration.
Agreement	M/s Loli Geotech and Associates, Dimapur, Nagaland	For collaborative research.
MOA	Society for North East Handmade Paper Development (SNEHPAD), Jorhat	For setting up and utilizing Common Facility Centre (CFC) on weaving and textile products manufacturing.
Agreement	Assam power generation corporation limited, Guwahati	Carrying out micro earthquake studies at lower kopili hydro electric project (120 mw) in the districts of Dima Hasao/Karbianglong, Assam
MOU	Indian Council of Agricultural Research	In respect of All India co-ordinated Research Project, revolving fund or any other such scheme sanctioned by the council
MOA	DBT, NEW DELHI	Isolation and characterization on of anti fungal peptides from muga silkworm *Antheraea assamensis* Helfer
MOA	Soceity for Institute of Integrated Resource Management (IIRM), Sonitpur, Assam	For implementation of the 12 FYP project " S & T interventions to combat malnutrition in women and children"

Knowledge Resource Centre

The Knowledge Resource Centre (KRC) continued to provide library and information services to R&D division, Research Fellows, outside students and individuals like from universities of NE region and R&D and industrial institutions such as Rain Forest Research Institute, Jorhat, Tezpur University, Dibrugarh University, Gauhati University, Assam University, Assam Engineering College, Jorhat Engineering

College, etc. The KRC also provides services to NEIST Branch Laboratory, Itanagar, Arunachal Pradesh and Imphal, Manipur. During the period the KRC added 3 books to its stock. It subscribed to 24 foreign and 42 Indian journals of which 20 in electronic form. During the period, the KRC also collected Annual and other reports from various R&D and academic institutions.

The KRC continued to maintain database on publications and presentation of papers from the laboratory on the basics of which various reports with bibliometric analysis of laboratory's publications were carried out as and when required by the management. A data base on available Ph.D. thesis of NEIST, Jorhat was updated.

The library earned Rs. 670/- as membership fee from outside institution, individuals and students during the period. The KRC has online access to SCOPUS database through institution IP address. NEIST have e-access to number of core journals from Elsevier Science, John Wiley, OUP, Blackwell, Springer, Taylor & Francis, etc through from DBT e-resource Consortium, New Delhi, CSIR e-journal Consortium (NKRC, NISCAIR). Further the institute is also being facilitated with e-access to Scifinder through NKRC during the year.

Planning and Project Monitoring

Planning and Project Monitoring (PPM) Division basically involved in the R&D management in terms of resources (Budget, Manpower & other outputs), planning and allocation, evaluation and outcomes of R&D projects through management of limited resources in a gainful manner. The PPM Division serve as the main centre for appropriate dissemination of information regarding Network projects (BSCs, CSCs, ESCs, ISCs, OSCs, PSCs, etc), Other Lab Projects (OLPs), Headquarter Controlled Projects (HCPs), Technology Leadership Projects (TLPs) and In-House projects (MLP, STS) as well as the other externally funded projects like (GAP, GPP, CNP, CLP and SSP) to the management and as well as the concerned Scientists. The division provides proper logistic support to the management in respect of successful implementation and completion of the projects which would reflect in the growth of the institute. The division also prepares the annual performance target of the projects and the laboratory as a whole by focusing the R&D thrust areas which was in accordance with the CSIR vision and National mission. The division also acts as a link between CSIR HQ and laboratory with respect to formulation of the Five Year Plan (FYP), Annual Plans and their execution, monthly and quarterly performance reporting and developmental activities of the laboratory. The division is also entrusted with preparation of various documents such as Man-month Distribution of projects, Task Assignment of staff, Manpower Profile, etc. The division updates the information of various projects and reports were prepared regularly for management support and other purposes. Processing of purchase indents and maintenance of Lab Notebooks are also important activities of PPM division.

PPM Division is actively involved on the following activities:

(1) External Cash Flow (ECF): The institute undertakes projects funded by various external agencies. The details of funds received from these agencies were regularly recorded and monitored. Monthly statements of department wise ECF positions of the institute were prepared highlighting receipts from Govt Departments, Public and Private Organizations. Total ECF generated during 2013-14 was Rs 796.34 lakhs which comprised receipts from Govt Depts/ Ministries, Public Sector Industries and private sector organizations to the extent of 90.43%, 6.80% and 2.77% respectively. The Commercial Rupee Value of ECF was found to be Rs 76.18 lakhs being 6.80% of total ECF. ECF of the institute from different projects and services are shown below:

External Cash Flow

(Including Service Tax) (Rs in Lakh)

Sl No	Category	Govt	Indian Industry	*CPSE	**SPSE	Total
1	Collaborative	0.000	2.502	0.000	0.000	2.502
2	R&D Consultancy	0.000	2.905	0.000	39.226	42.131
3	Grant-in-aid	717.721	0.000	8.640	0.000	726.361
4	Premia	0.225	6.591	0.000	0.000	6.816
5	Sponsored R&D	0.000	0.000	0.000	0.000	0.000
6	Technical Service	2.210	10.035	1.971	4.310	18.526
	Total:	720.156	22.033	10.611	43.536	796.336

* CPSE : Central Public Sector Enterprise
**SPSE : State Public Sector Enterprise

The area wise ECF are as follows:

Areas	ECF(in Lakh)
Agro Technology	51.19
Biological Sciences	63.96
Chemical Sciences	74.44
Engineering Sciences	136.05
Extension Centre	12.99
Geo Science	329.50
Management Science	32.88
Material Science	95.34
Total	**796.34**

(2) Expenditure monitoring: The expenditure of all the projects were monitored as per the budget allocation and upload the details of receipt & expenditure in PPM portal so that the fund position of a given project is readily accessible by concerned PI and management for effective management. The Division helps to issue Utilization Certificate and Statement of Expenditure of the externally funded projects.

(3) Service Tax: The PPM Division regularly carries out activities for the payment of service tax accrued from the various services rendered by the institute on monthly basis. Total Service Tax realized during the year 2013-2014 (@12.36%) is Rs 7.57 Lakh.

(4) Project Status: Status of Project Contracted and Completed during 2013-2014 are as follows:

S. No.	Sources Project	Project Contracted		Project Completed	
		Contract Value (Rs in Lakh)	No. of Projects	Contract Value (Rs in Lakh)	No. of Projects
1.	Grants-in-Aid	1057.55	14	3634.09	18
2.	Collaborative	5.00	01		
3.	Consultancy	55.23	06	55.89	05
	Total	**1117.78**	**21**	**3689.98**	**23**

(5) Audit Queries: The division responds to various audit queries (ISO, Internal & External), Parliament queries and unstirred Rajya Sabha queries in relation to all type of projects. During the year 09 ISO, 01 internal (CSIR-Hq) and 18 external (CAG) audit queries were handled and replies were prepared.

(6) Contribution to Lab Reserve Fund: The division has taken initiative to transfer the overhead and Non-Refundable Balance amount of Rs 39.46 Lakhs from ongoing as well as closed Externally Funded Projects to LRF in the financial year 2013-2014.

(7) Research Utilization Data: Research Utilization Data deals with the revenue generated from the projects and other activities funded by external funding agencies undertaken by the institute. Yarly and quarterly reports were furnished to CSIR Headquarters regularly.

(8) Pipe line projects: Every research project is being processed through PPM division, from the initial stage of submission to a funding agency. The division has processed about 13 No. of projects during the year.

(9) PPM website: PPM division hosted **and maintained a website** for display of all the project related reports on-line. The PPM website is linked to the NEIST Intranet and at present displays reports on Projects-(Completed, on-going, in proposal stage), Research Utilization Data, External Cash Flow, Expenditure details of all ongoing funded and network projects, Service Tax, Organization Structure, Project Evaluation, Computer AMC, Employee List, Central Plan Scheme Monitoring System etc. Principal Investigators of projects can access and monitor on-line the expenditure incurred in their projects. For analysis of outcome of funded projects, the on-line form has been designed and the Principal Investigators are to fill it on completion of their projects. The reports available on-line have proved to be efficient technical support for the management and scientists.

(10) ERP System: CSIR has taken initiative to adopt Enterprise Resource Planning (ERP) system across all 38 CSIR institutes. CSIR-NEIST has constituted an ERP implementation team for successful implementation of ERP in the institute. PPM division is mainly involved in entering projects related data and mapping of NEIST staff with the roles of the staff, in CSIR Enterprise Transformation Portal.

(11) Annual Plan: Annual Plan 2013-14 document was prepared for NEIST, which contained information related to research work plan to be carried out during the year. The financial requirements for these projects, Plan and Non-Plan basis, were also identified and managed.

(12) Monthly/ Quarterly Performance Report: Monthly/ Quarterly Performance Report of NEIST contains information about the performance of the Institute on various parameters like papers, patents, development of technology, awards & appreciations received by scientists & staff members. Reports are regularly sent to CSIR Hq for their perusal. These reports also help the management in reviewing its own performance as a monitoring tool.

(13) Man-month distribution of projects: The manpower deployment in Network, in-house, Grant- in-aid, Sponsored and consultancy projects were analyzed and reviewed by division. Resource requirements and utilization were reviewed. “Manpower profile of CSIR-NEIST” document was brought out for management purpose.

(14) Miscellaneous activities:

- Lab Notebooks are indexed and maintained for future reference and intellectual property rights protection by the cell. During the year 87 nos. issued, 15 nos. returned & reissued.
- The Division actively associated with the celebration of the CSIR Foundation Day on 24 September, 2013 and organized an essay and quiz competition on science topics among the staff of CSIR-NEIST & their wards.
- Task assignment of staff members for 2013-2014.
- Management of Annual Maintenance Contract (AMC) of 293 nos of computers under AMC and 63 nos of computers under warranty.

S&T FACILITIES INSTALLED

At CSIR-NEIST, Jorhat

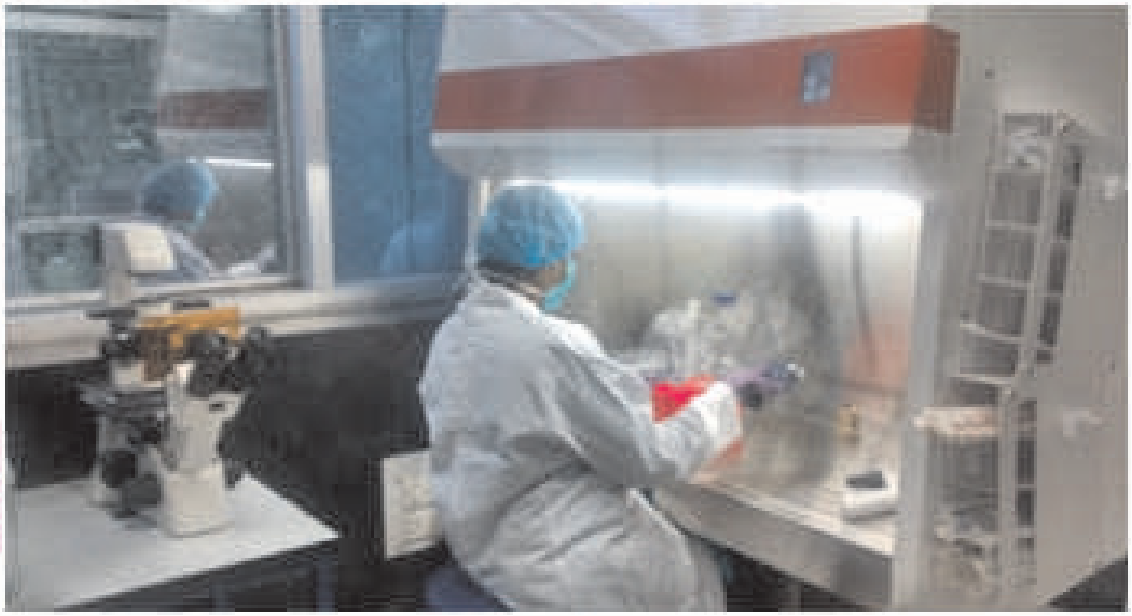
Natural Product Chemistry Division



New pharmacology lab has been established in Natural Product Chemistry Division with support from CSIR.



Facilities like RT-PCR, Cell viability analyzer, Gel Doc, Ultra centrifuge, probe sonicator, etc. are available.



Cell culture work is in progress to provide value addition to natural products through biochemical routes. The bio efficacy/ toxicity studies of different plant extracts and bioactive molecules are the major focus area of this lab.

Chemical Engineering

- Capillary Condensation Flow porometer

Coal Chemistry

- Simultaneous TGA-DTA-DSC system
- LTGK apparatus
- Desorption Canister
- ProtLog TM Weather Monitoring Station at Itanagar and Imphal.
- Low carbon emission Beehive Coke Oven
- Renovated pilot plant

Materials science

- Particle Size Analyzer (Model: MASTERSIZER 2000; Malvern, UK)
- Microwave Synthesis System (Model: CEM Discover® LabMateTM)
- Refrigerated Large Shaking Incubator (Model: LSI-2005RLN)
- High Pressure Reactor (Model: Parr®5500; Parr, USA)
- Melting Point Apparatus (Make: Buchi)

Petroleum & Natural Gas

- Copper corrosion testing unit – Japan
- Micro carbon residue tester – Stanhope Seta, UK

Analytical Chemistry Division

- Avanee III 500 MH_z FT-NMR (M/S Bruker, Germany)
- Ultimate 3000, HPLC (Dionex, USA)

General Engineering

Advanced Manufacturing Facility:





Advanced manufacturing facilities are created in the General Engineering Division. Non Conventional Manufacturing facilities like Computer Numerical Control (CNC) facilities (CNC Lathe and CNC Milling), CNC Wire EDM (Electro Discharged Machining) are installed for precision manufacturing of products designed and developed during the on going R&D works.

At BLI, Arunachal Pradesh

- Weather Observatory Station
- Modular **Biochemical Laboratory**

Events Organised

National Technology Day 2013



Chief Guest Dr G Thyagarajan, Former Director, CSIR-NEIST delivering the National Technology Day Lecture titled "Technology-polity nexus can stimulate big innovations: examples and experiences from India and abroad" on 10th may 2013

67th Independence Day



Dr R C Boruah, Acting Director, CSIR-NEIST addressing the gathering on 15th August 2013.

CSIR-NEIST observed State Mourning Day

At the instance of Government of Assam, the institute observed the State Mourning Day (Shok Diwas) on 16 August, 2013 along with the rest of the state in the memory of those killed in bomb blast on Independence Day (15th August, 2004) at Dhemaji under Lakhimpur district of Assam. A pledge taking function was held at Dr J N Baruah Auditorium in which the Dr R C Boruah, Acting Director, CSIR-NEIST administered the Shok Diwas pledge to members of the staff.

CSIR-NEIST observed Sadbhavana Diwas

The Institute observed 'Sadbhavana Diwas' on 19 August, 2013 along with the rest of the country. The day is observed every year to commemorate the Birth Anniversary of Late Prime Minister of India, Shri Rajiv Gandhi. Dr R C Boruah, Acting Director, CSIR-NEIST administered the Sadbhavana Diwas pledge to members of the staff.

71st CSIR Foundation Day



Chief Guest Prof Alak Kr Buragohain, VC, Dibrugarh University addressing the gathering during the 71st CSIR Foundation Day celebrated at NEIST on 24th September 2013

Hindi week celebrated



Chief Guest Dr Khirad Kumar Saikia, General Secretary, Assam Rashtra Bhasa Prachar Samiti, Guwahati addressing the gathering in the concluding function of the weeklong celebration of Hindi Week held during 9-16 September 2013

National Integration Pledge taken

On the occasion of Communal Harmony Campaign and Fund Raising Week organized every year, the members of staff led by the Director, CSIR-NEIST took National Integration pledge on 19 November, 2013. As a fund raising gesture, the communal harmony sticker flags were also distributed on sale to all the staff members.

Director, CSIR-NEIST addresses staff on New Year



Dr D Ramaiah, Director, CSIR-NEIST (second from left) delivering New Year's address. (from right) Sri Ajay Kumar, In-charge-Hindi cell and Dr R L Bezbaruah, Head- I&BD Division are seen translating the address in Hindi and Assamese respectively. Also seen on the dais is Dr R C Boruah, Outstanding Scientist (extreme left). Extending greetings to all for a Happy and Prosperous Year Dr Ramaiah declared 2014 as 'Year of Excellence' and appealed to all to maintain discipline and to strive for excellence in all their activities.

65th Republic Day



Dr D Ramaiah, Director, CSIR-NEIST is seen delivering the 65th Republic Day address. The celebration included Parade, unfurling of the flag followed by playing of National Anthem. Later various sport competitions were also held.

National Science Day 2014



Chief Guest Dr K M Bujarbaruah, Vice Chancellor, Assam Agricultural University, Jorhat delivering the National Science Day lecture on "Negating the impact of climate change in agriculture" in the celebration held on 28 February 2014. Seated on the dais is Dr R C Boruah, Outstanding Scientist & Director-in-charge.

International Women's Day 2014



Dr D Ramaiah, Director, CSIR-NEIST addressing the gathering on 10th March 2014. Also seen (from right) on the dais Guest of Honour Ms Krishna Gohain, Registrar, Assam Agricultural University; Chief Guest Prof Charu Lata Mahanta, Dean (R&D), Tezpur University and Coordinator of the program Mrs Lakhimi Borah.

53rd NEIST Foundation Day



Chief Guest Dr Ch Mohan Rao, Director, CSIR-CCMB, Hyderabad (right) releasing the CSIR-NEIST Highlights 2013-14 in presence of Dr D Ramaiah (centre), Director, CSIR-NEIST and Dr R C Boruah (left), Outstanding Scientist, CSIR-NEIST on 18th March 2014

Exhibitions Attended

Exhibition-cum-workshop



Mr Anjan Dutta (2nd from right), Hon'ble MLA, Amguri Constituency visiting CSIR-NEIST exhibition stall in the exhibition organised by NGOs M/s Asian Evergreen World and SEEDS at Amguri, Sivasagar during 9-10 April 2013.

Farmers' Day Exhibition

Dr Adhendu Dey (2nd from right in blazer), Hon'ble Minister for Irrigation & Soil Conservation, Govt. of Assam along with Prof K M Bujarbaruah, VC, Assam Agricultural University (AAU)– Jorhat and other officials interacting with CSIR-NEIST staff members at the stall in the exhibition organised by AAU, Jorhat held at Regional Agricultural University Centre, Titabor on 6 November 2013.



North East Farm & Food Tech exhibition



Visitors at CSIR-NEIST exhibition stall interacting with the exhibition team during the exhibition organised by Confederation of Indian Industry, Guwahati during 20-23 April 2013

Societal Activities

Training on mushroom cultivation





- A One-day training-cum-demonstration programmes was held at 151 No Niz Baligaon Primary School, Baligaon, Jorhat (Assam), on 8 April 2013, at CSIR-NEIST on 22 May 2013 and at Haridev Primary School under 44 no. Madhya Sarucharai Gaon Panchayat at Jadavpur, Jorhat on 31 July 2013. The trainings were held under the project titled "Self-empowerment by the women community of rural areas of west Jorhat (SC populated) through Organic Vegetable Gardening as well as production of popular food viz. Mushroom Cultivation" sponsored by DSIR, Govt. of India.
- Training-cum-demonstration on cultivation of edible Mushroom for 18 in-mates of juvenile home, Jorhat was organized on 5 July, 2013.
- Training on Mushroom cultivation was organized for 22 ST people from six different districts of Assam, besides two AcSIR Ph D students at CSIR-NEIST in association with the Institution for Culture and Rural Development, Baghchung, Jorhat during 5-7 August, 2013.
- Training cum demonstration programme on Mushroom cultivation was organized for 20 in-mates of juvenile home, Jorhat on 6 September, 2013.
- CSIR-NEIST Branch lab, Itanagar organized a training programme at its premises on Mushroom cultivation for the benefit of Pasighat locality, Arunachal Pradesh on 25 September, 2013.
- One-day training on setting up of Co-operative Mushroom Cropping house was organized on 25 November 2013, at Kuhumjugonia village under a DSIR, GOI sponsored project. The participants also prepared compact bags for the cultivation during the programme which saw active participation of the women Self Help Groups of Kuhumjugonia village.
- CSIR-NEIST branch lab at Itanagar organized a one day awareness programme on wild edible plants of Arunachal Pradesh on 16 December, 2013 at Yupia-II village, Papum Pare district. The programme focused on the conservation, promotion and sustainable utilization of the edible plants which are wildly available in the state and which has high nutritional values. Training on Mushroom cultivation was also held under CSIR 800 programme which was attended by 25 no. of participants.
- At the request of the North Eastern Small Scale Industries Association (NESSIA), Jorhat, training was organized at CSIR-NEIST campus during 16-18 December 2013 which was attended by 5 participants.
- One-day training was imparted to 3 officials of EME, Jorhat Station Workshop on 18 December 2013 at their Soraibahi campus.
- CSIR-NEIST branch lab at Itanagar organized a one day awareness programme on wild edible plants of Arunachal Pradesh on 8 January, 2014 at Pech village, Sagalee, Arunachal Pradesh in collaboration with Kamchilella Multi-purpose Co-operative Society Ltd., Sagalee. Around 65 people participated. Training on Mushroom cultivation was also held on the day.

Training on Natural Dye

A two day training programme on "Natural Dyeing" was held at the project site of New Sonowal area in Mariani of Jorhat district. The training was organized during 27-28 May 2013 under a grant-in-aid project titled "*Council of Science and Technology for Rural India (CSTRI) Centre*" being executed by CSIR-NEIST, Jorhat. The training was organized by CSTRI Centre in association with Society for North East Handmade Paper Development (associated NGO) and Clothing & Textile Department, Home Science College, Assam Agriculture University, Jorhat. Dr Pinaki Senguta, Chief Scientist, CSIR-NEIST attended as Chief Guest of the inaugural function and Dr. Abha Rani Phukon, Head, Garment & Textile Department, Home Science College, Assam Agriculture University, Jorhat was present as resource person.



(Left) Resource person Dr Abha Rani Phukon, Head, Garment & Textile Department, Home Science College, AAU, Jorhat delivering the lecture

Training on low cost agro based technologies

At the request of the Institution of Cultural and Rural Development (i-Card), Baghchung, a training programme on agro based rural technologies was conducted by CSIR-NEIST at i-Card premises on 2 September, 2013 in which about 90 educated unemployed youth and school drop outs participated. Dr Tridip Goswami, Head and Dr Dipul Kalita, both Scientist from CPP delivered lectures on "Possibilities of agro based rural technologies" and "A few potential technologies for North East based on indigenous raw material" respectively. A demonstration on processes and products developed by CSIR-NEIST followed the lectures.

CSTRI centre of CSIR-NEIST promotes weaving and textile products

To promote the rich ethnic handloom and textile products of the state, CSIR-NEIST's CSTRI centre organized a one-day Ethnic Fashion Show in the International Trade Fair, Jorhat on 4 January, 2014 under the DST, GOI sponsored project titled "*Setting up of Common Facility Center on weaving and textile product manufacturing*". The event was organized in association with the Society for North East Handmade Paper Development, an associated NGO under the project and the organizers of the 3rd International Trade Fair, Jorhat wherein Mr Gautam Baruah, renowned Fashion Designer & Senior Faculty, IIFT, New Delhi was present as the resource person.



Science motivation programmes



Participants attending the lecture delivered by Dr B G Unni, Chief Scientist, CSIR-NEIST in the programme organised by CSIR-NEIST branch laboratory, Itanagar on 02 August 2013



Dr R C Boruah, Acting Director, CSIR-NEIST addressing the participants during the programme organised by CSIR-NEIST branch laboratory, Itanagar on 11 September 2013



organised at CSIR-NEIST branch laboratory, Itanagar on 20 Participants with the organising team of the awareness programme September 2013



Participants with the organising team of the programme, at CSIR-NEIST, Jorhat on 29 November 2013. The programme was sponsored and catalysed by NCSTC, GOI, New Delhi.

PhD Awarded

S No	Name	Division	Title of the thesis	University	Year	Supervisor
1	Dr Ipsita Duarah	Biotechnology	Genetic diversity of phosphate solubilizing bacteria in water logged tea gardens and screening for their role as plant growth prompting rhizobacteria.	Gauhati University	April 2013	Dr HP Deka Boruah
2	Dr Juri Moni Borah	Natural Products Chemistry	An approach towards the Synthesis of Some New Steroid-Peptide Conjugates from 20-Oxopregnanes and Some other related Transformations.	Dibrugarh University	September 2013	Dr PK Choudhury
3	Dr Podma pollov Sarmah	Materials science	Synthesis and reactivity of metal nanocomposites and metal complexes of ruthenium rhodium and iridium containing P, N and O donor ligands.	Dibrugarh University	December 2013	Dr DK Dutta
4	Dr Mandakini Dutta	Medicinal Chemistry	Studies on azasteroids and their analogues utilizing newer synthetic methodologies	Dibrugarh University	December 2013	Dr RC Baruah
5	Dr Swarup Majumder	Medicinal Chemistry	Synthesis of some analogues of biologically important natural indoles and related heterocyclic compounds	Dibrugarh University	December 2013	Dr PJ Bhuyan
6	Dr Bishwajit Saikia	Natural Products Chemistry	Investigation towards partial and total synthesis of bioactive natural products with special emphasis on synthesis of *Artemisinin dimmers and oxylipin involving novel strategies*	Dibrugarh University	December 2013	Dr NC Barua
7	Dr Mridusmita Mishra	Materials science	Preparation of composite materials containing layered double hydroxide (LDHS) and their prospective application for the treatment of some environmentally harmful gases	Assam University	March 2014	Dr RL Goswamee
8	Dr Bimal Dutta	Medicinal, Aromatic & Economic Plant	Ethnobotany of the Deuris of Assam with special reference to Phytochemical survey of some Folklore Medicinal Plants	Gauhati University	Juine 2013	Dr SC Nath
9	Dr Rajib Biswas	Geo Science	Seismic Ambient Noise Analysis: It's application to evaluate the side characteristics of Shillong city	Dibrugarh University	August 2013	Dr Saurabh Baruah

Visit Abroad

Sl. No.	Name	Designation	Country visited	Purpose	Period	
					From	To
1	Dr SP Saikia	Scientist	Milan, Italy	For research work under the project entitled " Comparative studies on the physiological and biological aspects of adaptation and productivity in *Camelina sativa* L in different biogeographic region".	19.04.2013	29.04.2013
2	Dr Archana Moni Das	Scientist	Washington, Colombia, USA	For exposure trip under US Government International Visitor Leadership Programme on 'Women in Science'.	08-04-2013	26-04-2013
3	Dr Swapnali Hazarika	Scientist	Washington, Colombia, USA	For exposure trip under US Government International Visitor Leadership Programme on 'Women in Science'.	08-04-2013	26-04-2013
4	Dr Dipanwita Banik	Scientist	Royal Botanical Garden, London, U.K.	To work and study specimens deposited in Herbaria, type specimens and consult relevant literature on *Myristicaceae* family in relation to work in the GPP 262 project	07-04-2013	03-05-2013
5	Dr SB Wann	Principal Scientist	Khon Kaen, Thailand	For research work under the project entitled "*Comparative antimicrobial activity and molecular characterization of Clerodendrum species of Thailand & India*"	01-05-2013	15-05-2013
6	Dr BS Bhau	Senior Scientist	Khon Kaen, Thailand	For research work under the project entitled "*Comparative antimicrobial activity and molecular characterization of Clerodendrum species of Thailand & India*"	01-05-2013	15-05-2013
7	Dr TC Bora	Chief Scientist	Novy Svet, Crimea, Ukraine	To deliver an invited talk at the 4th Interdisciplinary Conference on "Biological active substances and materials: fundamental and applied problems of production and application"	27-05-2013	01-06-2013
8	Dr S Barua	Senior Principal Scientist	Shanghai, China	To participate as a member of Indian delegate at the Joint Indo - China Workshop on Earthquake Disaster Mitigation	16-09-2013	20-09-2013
9	Dr J Kalita	Scientist	MingDao University, Peetow, Taiwan	To deliver a talk as an invited speaker at the "International Conference on Agarwood (ICA), 2013"	27-09-2013	29-09-2013
10	Dr BS Bhau	Principal Scientist	Institute of Biomedical Chemistry, Moscow, Russia	For research work under DST(India) & RFBR(Russia) joint collaborative project entitled "Screen Printed Electrodes (SPEs) Functionalized with Organic -Inorganic Hybrid Nano-Composites for Bio-sensing Applications"	10-03-2014	23-03-2014
11	Dr R Khan	Senior Scientist	Institute of Biomedical Chemistry, Moscow, Russia	For research work under DST(India) & RFBR(Russia) joint collaborative project entitled "Screen Printed Electrodes (SPEs) Functionalized with Organic -Inorganic Hybrid Nano-Composites for Bio-sensing Applications"	10-03-2014	23-03-2014
12	Dr DK Dutta	Chief Scientist	Boreskov Institute of Catalysis, Russia	For rese arch work under DST(India) & RFBR(Russia) joint collaborative project entitled "Synthesis and Reactivity of Nanoporous Metal-Silica Nanocomposites: Novel Heterogeneous Catalysts for Selective Oxidation"	31-03-2014	13-04-2014
13	Dr L Saikia	Scientist	Boreskov Institute of Catalysis, Russia	For research work under DST(India) & RFBR(Russia) joint collaborative project entitled "Synthesis and Reactivity of Nanoporous Metal-Silica Nanocomposites: Novel Heterogeneous Catalysts for Selective Oxidation"	31-03-2014	13-04-2014

संस्थान में राजभाषा हिन्दी गतिविधियां
RAJBHASHA HINDI ACTIVITIES IN THE INSTITUTE

संस्थान में हिंदी कार्यशालाओं का नियमित आयोजन

राजभाषा नियम एवं सी.एस.आई.आर, मुख्यालय के दिशानिर्देश में संस्थान के वैज्ञानिकों, तकनीकी अधिकारियों, तकनीशियनों, प्रशासन के अधिकारियों एवं कर्मचारियों के लिए तिमाही हिंदी कार्यशाला का आयोजन किया जाता है । प्रभावी कार्यान्वयन की दृष्टि से समय - समय पर कार्य एवं पद की एकरूपता को ध्यान में रखकर समूह बनाकर कार्यशाला में प्रशिक्षण दिया जाता है । साथ ही 'टेबुल कार्यशाला' के अंतर्गत उनके कार्य टेबुल पर जाकर उन्हें हिंदी में कार्य करने के लिए व्यवहारिक रूप से प्रशिक्षित किया जाता है । वर्ष के दौरान निम्नलिखित कार्यशालाएँ आयोजित की गयी :

- 4 एवं 5 मार्च 2013 : नव-नियुक्त तकनीशियनों के लिए यह विशेष रूप से तैयार दो दिवसीय हिंदी कार्यशाला का आयोजन किया गया । परिवीक्षाधीन अवधि के दौरान हिंदी भाषा का प्रशिक्षण प्राप्त करना अनिवार्य होता है । इसलिए कार्यशाला के सभी सत्र प्रबोध/प्रवीण/प्राज्ञ परीक्षा में उत्तीर्णता के लिए तैयार किया गया था । वर्षा वन अनुसंधान संस्थान, जोरहाट के श्री शंकर शर्मा, विशेषज्ञ के रूप में प्रशिक्षण दिया ।
- 21, 22 एवं 23 मई 2013 : संस्थान में नव-नियुक्त तकनीशियनों के लिए तीन दिवसीय हिंदी कार्यशाला का आयोजन किया गया । इस वर्ग समूह में वैसे 30 तकनीशियन थे जिन्हें टेम्पररी स्टेटस से स्थायी बनाया गया । इनके लिए हिंदी सीखना एवं प्रशिक्षण लेना कठिन था, परंतु इन्हें उचित प्रशिक्षण दिया गया, राजभाषा हिंदी के प्रति उत्तरदायित्व को संज्ञान में लाया गया । परिणाम स्वरूप सभी हिंदी भाषा की प्रबोध परीक्षा उत्तीर्ण हुए ।
- 9 एवं 10 सितम्बर 2013 : राजभाषा हिंदी सप्ताह के दौरान यह कार्यशाला विशेष रूप से उन अधिकारियों के लिए आयोजित किया जाता है जो संस्थान के सभी प्रभागों / अनुभागों के राजभाषा प्रतिनिधि हैं । उनके लिए यह कार्यशाला बहुत उपयोगी सिद्ध होता है, वे राजभाषा नियम एवं कार्यकलापों में अद्यतन हो जाते हैं । यह मूल रूप से राजभाषा प्रभारी अजय कुमार द्वारा विभिन्न सत्रों में लिया गया ।
- 20 एवं 23 दिसम्बर 2013 : नव-नियुक्त वैज्ञानिक एवं रासायनिकी अभियांत्रिकी प्रभाग के वैज्ञानिकों के लिए यह कार्यशाला आयोजित किया गया । खासकर नव- नियुक्त को राजभाषा से संबंधित प्रावधानों, अनिवार्यता एवं उत्तरदायित्व को अवगत कराया गया । विभिन्न सत्रों के दौरान उन्हें आई.टी.टूल्स के माध्यम से कंप्यूटर / लैपटॉप पर हिंदी के आसान प्रयोग के बारें में प्रशिक्षित किया गया । यह प्रभारी राजभाषा अनुभाग द्वारा पावर प्वांयट पर आधारित सत्र था ।

हिंदी शिक्षण योजना द्वारा हिन्दी भाषा प्रशिक्षण पाठ्यक्रम केंद्र का संचालन

हिंदीतर भाषी अधिकारियों / कर्मचारियों के लिए निर्धारित स्तर के हिंदी भाषा पाठ्यक्रम प्रबोध / प्रवीण / प्राज्ञ परीक्षा पास करना अनिवार्य होता है । संस्थान में उक्त पाठ्यक्रम के प्रशिक्षण के लिए वर्ष 1997 में भारत सरकार, गृह मंत्रालय, राजभाषा विभाग, हिंदी शिक्षण योजना द्वारा संस्थान प्रबंधन के अधीन अंशकालिक हिन्दी भाषा प्रशिक्षण केंद्र स्थापित किया । विभाग द्वारा यह केंद्र स्थानीय सभी केंद्र सरकार के कार्यालयों के प्रशिक्षण हेतु भी संचालित किया गया । तदनुसार यह केंद्र स्थानीय केंद्र सरकार के कार्यालय, स्वायत्तशासी संस्थानों, राष्ट्रीयकृत बैंकों द्वारा नामित अधिकारियों / कर्मचारियों को वर्ष में दो सत्र के अंतर्गत नियमित/प्राइवेट तौर पर प्रशिक्षण हेतु नामांकित करते हैं । प्रशिक्षण के साथ - साथ उप-निदेशक (परीक्षा), नई दिल्ली के नियंत्रण में उक्त पाठ्यक्रमों के परीक्षा को भी संस्थान द्वारा संचालित किया जाता है । वर्ष के दौरान निम्नलिखित सत्र एवं परीक्षा आयोजित हुआ :

<u>जनवरी 2013 सत्र</u> : प्रबोध : 34 (उत्तीर्ण 34), प्रवीण : 32 (उत्तीर्ण 32), प्राज्ञ : 28 (उत्तीर्ण 28)

युनाईटेड बैंक ऑफ इंडिया, वर्षा वन अनुसंधान संस्थान, केंद्रीय मूगा एवं एरी अनुसंधान तथा प्रशिक्षण संस्थान , केंद्रीय सिल्क बोर्ड, इलाहाबाद बैंक, भारतीय स्टेट बैंक, केंद्रीय विद्यालय एवं ओ.एन.जी.सी. से प्रशिक्षण हेतु नियमित / प्राइवेट नामित किए गए तथा मई 2013 को आयोजित परीक्षा में भाग लिया । कुल प्रशिक्षित आकड़े दर्शाए गए हैं ।

<u>जुलाई 2013 सत्र</u> : प्रबोध : 47 (उत्तीर्ण 47), प्रवीण : 43 (उत्तीर्ण 43), प्राज्ञ : 36 (उत्तीर्ण 36)

बी.एस.एन.एल. सेंट्रल बैंक, युनाईटेड बैंक ऑफ इंडिया, केंद्रीय विद्यालय, ओ.एन.जी.सी., वर्षा वन अनुसंधान संस्थान एवं पंजाब नेशनल बैंक से प्रशिक्षण हेतु नियमित / प्राईवेट नामित किए गए तथा नवम्बर 2013 को आयोजित परीक्षा में भाग लिया । कुल प्रशिक्षित आकड़े दर्शाए गए हैं।

व्याख्यान प्रस्तुती/संगोष्ठी में सहभागिता/अन्य संस्थाओं कार्यालयों के हिंदी कार्यशाला एवं गतिविधियों में विशेषज्ञ

श्री अजय कुमार, प्रभारी राजभाषा अनुभाग एवं सचिव नगर राजभाषा कार्यान्वयन समिति, जोरहाट को निम्नलिखित केंद्र सरकार के कार्यालयों में राजभाषा हिंदी विशेषज्ञ/ संकाय सदस्य / मुख्य अतिथि के रूप में उल्लेखित तिथि को आमंत्रित किया गया एवं उन्होंने तदनुसार प्रस्तुती दी ।

1. केंद्रीय रेशम बोर्ड, क्षेत्रीय रेशम अनुसंधान केंद्र, वस्त्र मंत्रालय, भारत सरकार, रैरिया, जामुगुड़ी, जोरहाट

   27.05.2013 को अधिकारियों/कर्मचारियों के लिए आयोजित हिंदी कार्यशाला में विशेषज्ञ व्याख्यान के लिए आमंत्रित, 'कार्यालयीन कार्य में हिंदी का प्रयोग' विषय पर व्याख्यान प्रस्तुत किया ।

   10.12.2013 को हिंदी कार्यशाला में आमंत्रण : 'सरल एवं सहज हिंदी व्याकरण' विषय पर व्याख्यान प्रस्तुत किया ।

2. यूको बैंक, आंचलिक कार्यालय, जोरहाट

   30.08.2013 को जोरहाट के डी.आर.डी.ए. हॉल में परिवीक्षाधीन अधिकारियों के लिए आयोजित प्रशिक्षण में राजभाषा हिंदी विशेषज्ञ संकाय के रूप में व्याख्यान प्रस्तुती के लिए सहायक महाप्रबंधक ने आमंत्रित किया । पावर प्वांयट के माध्यम से इन्होनें राजभाषा हिंदी पर दो व्याख्यान प्रस्तुत किया ।

3. ऑयल एवं नेचुरल गैस कार्पोरेशन, जोरहाट

   06.12.2013 को ओ.एन.जी.सी. ऑफिसर्स महिला समिति (00MS) द्वारा संचालित क्षेत्रीय स्तर पर आयोजित भाषण प्रतियोगिता में निर्णायक की भुमिका के लिए आमंत्रित किया । पूर्व एवं पूर्वोत्तर के अन्य ओ.एन.जी.सी. कार्यालय से चयनित प्रतिभागियों को क्षेत्रीय स्तर पर श्रेष्ठ तीन को उल्लेखित विषय पर भाषण के लिए चयनित करने की भूमिका को निभाया ।

4. केंद्रीय विद्यालय, निस्ट, जोरहाट

   26 सितम्बर 2013 को आयोजित हिंदी पखवाड़ा के दौरान काव्य पाठ प्रतियोगिता के मुख्य अतिथि के रूप में प्राचार्य द्वारा आमंत्रित किया गया मुख्य अतिथि सह काव्य पाठ के निर्णायक की भुमिका के साथ व्याख्यान प्रस्तुत किया ।

5. भारतीय जीवन बीमा निगम, मंडल कार्यालय, जोरहाट

   15.07.2013 को भारतीय जीवन बीमा निगम के 21 क्षेत्रीय शाखाओं के अधिकारियों के लिए आयोजित हिंदी कार्यशाला में राजभाषा हिंदी के प्रयोग एवं प्रसार पर व्याख्यान के लिए आमंत्रित किया गया । पावर प्वांयट के माध्यम से इन्होने राजभाषा नियम, प्रयोग, उत्तर दायित्व, आई. टी. सुविधाओं पर व्याख्यान प्रस्तुत किया । इसे काफी सराहा गया ।

6. भारतीय स्टेट बैंक, ज्ञानार्जन केंद्र, जोरहाट

   भारतीय स्टेट बैंक के अधिकारियों/कर्मचारियों को नियमित रूप से बैंकिंग का प्रशिक्षण देने के लिए यह ज्ञानार्जन केंद्र स्थापित होता है, इसमें राजभाषा हिंदी के प्रशिक्षक संकाय के लिए इन्हें निम्नलिखित तिथियों को आमंत्रित किया गया एवं इन्होंने उल्लेखित विषय पर अपना व्याख्यान प्रस्तुत किया।

02 मई 2013	:	दैनिक कार्य में हिंदी व्याकरण
03 मई 2013	:	सामान्य हिंदी पत्राचार
04 नवम्बर 2013	:	हिंदी के प्रभावी आई.टी.टूल्स
05 नवम्बर 2013	:	हिंदी का मानकीकरण एवं संयुक्ताक्षर
26 दिसम्बर 2013	:	कंप्यूटर पर यूनिकोड
27 दिसम्बर 2013	:	हिंदी में बैंकिंग शब्दावली

पुरस्कार /प्रतिष्ठा/ सम्मान

निस्ट, जोरहाट को राजभाषा कार्यान्वयन के लिए राजभाषा बिभाग, भारत सरकार द्वारा पूर्वोत्तर में प्रथम पुरस्कार



पुरस्कार शिल्ड को प्रदर्शित करते हुए संस्थान के कार्यकारी निदेशक डॉ आर सी बरुआ (बाएँ) एवं श्री अजय कुमार, प्रभारी राजभाषा अनुभाग

उत्तर-पूर्व विज्ञान तथा प्रौद्योगिकी संस्थान, जोरहाट को पूर्वोत्तर भारत में स्थित केंद्र सरकार के कार्यालयों के बीच भारत सरकार द्वारा निर्धारित लक्ष्यों के अनुरूप राजभाषा हिंदी के कार्यान्वयन में सर्वश्रेष्ठ प्रदर्शन करने के लिए भारत सरकार, गृह मंत्रालय, राजभाषा विभाग ने वर्ष 2011-12 का प्रथम पुरस्कार प्रदान किया गया । उक्त पुरस्कार भारत सरकार द्वारा 18 अप्रैल 2013 को इंडियन म्यूजियम, आशुतोष बर्थ सेंटेनरी हॉल, कोलकाता में आयोजित पूर्व एवं पूर्वोत्तर क्षेत्र राजभाषा सम्मेलन में सचिव, भारत सरकार ने प्रदान किया । निस्ट, जोरहाट की ओर से पुरस्कार शिल्ड श्री अजय कुमार, प्रभारी राजभाषा अनुभाग ने प्राप्त किया । साथ ही श्री कुमार को राजभाषा अधिकारी के रूप में कार्यालय के राजभाषा कार्यान्वयन

में उसके बहतरीन योगदान के लिए एक प्रशस्ति पत्र प्रदान किया गया ।

ज्ञातव्य हो कि भारत के सभी केंद्र सरकार के कार्यालयों में काम-काज की भाषा अर्थात राजभाषा के रूप में देवनागरी में हिंदी को संवैधानिक दर्जा प्राप्त है, परंतु हिंदी के उपयुक्त ज्ञान के अभाव में अंग्रेजी को सहभाषा के रूप में कामकाज के लिए जारी रखा गया है । राजभाषा नीति के तहद कार्यालयों में कामकाज के रूप में कार्मिकों के बीच हिंदी ज्ञान को बढ़ाने एवं प्रयोग में उत्तरोत्तर विकास के लिए राजभाषा नियम का प्रावधान बनाया गया है, ताकि हिंदी को पूर्ण रूप से राजभाषा के रूप में इस्तेमाल किया जा सके । राजभाषा के इन प्रावधानों के प्रचालन के लिए सभी केंद्रीय कार्यालय कटिबद्ध होते हैं । इस क्षेत्र में बेहतर कार्य करने वाले कार्यालयों भारत सरकार प्रतिवर्ष राष्ट्रीय एवं क्षेत्रीय स्तर पर पुरूस्कृत करती है ।

संस्थान में राजभाषा हिन्दी दिवस / सप्ताह का आयोजन



राजभाषा सप्ताह के शुभारंभ पर मुख्य अतिथि के रूप में बोलते हुए श्री एम मनोहरन, प्राचार्य, केंद्रीय विद्यालय, निस्ट जोरहाट



हिंदी दिवस के अवसर अपना वक्तव्य रखते हुए कार्यकारी निदेशक, निस्ट डा. आर सी बरूआ



मुख्य अतिथि के रूप में हिंदी दिवस के अवसर अपना वक्तव्य रखते हुए असम राष्ट्रभाषा प्रचार समिति के मंत्री डा. खिरदा कुमार सैकिया



हिंदी दिवस के अवसर मंच पर विराजमान दायें असम राष्ट्रभाषा प्रचार समिति के मंत्री डा. खिरदा कुमार सैकिया, बीच में कार्यकारी निदेशक, निस्ट डा. आर सी बरूआ एवं बायें डा. डी प्रजापति मुख्य वैज्ञानिक

प्रत्येक वर्ष के भांति इस वर्ष भी सीएसआईआर-उत्तर-पूर्व विज्ञान तथा प्रौद्योगिकी संस्थान, जोरहाट ने राजभाषा हिंदी को कार्यालयीन कार्य में उत्तरोत्तर वृद्धि करने के लिए संस्थान में राजभाषा हिंदी सप्ताह का आयोजन किया एवं इसके विशाल सभागार में विभिन्न कार्यक्रमों के साथ 16 सितम्बर को हिंदी दिवस समारोह मनाया गया । समारोह के मुख्य अतिथि के रूप में डा. खिराद कुमार सैकिया, मंत्री, असम राष्ट्रभाषा प्रचार समिति, गुवाहाटी मंचासीन थे । अपने व्याख्यान में डा. सैकिया ने राष्ट्रभाषा एवं राजभाषा दोनों के रूप में हिंदी की आवश्यकता को वर्णित किया । दुनियां के विभिन्न विश्वविद्यालयों में चल रहे हिंदी पाठ्यक्रम का ब्यौरा प्रस्तुत किया एवं हिंदी के व्यावसायिक आवश्यकताओं

की ओर इंगित किया । संपर्क भाषा एवं जन भाषा के रूप में भी हिंदी के व्यापक प्रसार पर उन्होनें बल दिया । संस्थान के निदेशक एवं समारोह के सभापति डा. आर सी बरूआ नें सर्वप्रथम सभी स्टाफ सदस्यों को हिंदी दिवस की शुभकामना दी एवं विगत वर्ष 2011-12 के लिए संस्थान को भारत सरकार द्वारा प्राप्त पूर्वात्तर में प्रथम राजभाषा पुरस्कार का गौरव के साथ उल्लेख किया । तथापि अपने भाषण में संस्थान के सभी सदस्यों से हिंदी को प्रयोग में लाने पर बल दिया । संस्थान के बेहतर हिंदी गतिविधियों के कारण सरकार ने नगर राजभाषा कार्यान्वयन समिति एवं हिंदी शिक्षण योजना का दायित्व दिया है, इससे स्थानीय सभी केंद्रीय कार्यालयों को लाभ मिल रहा है । संस्थान में आयोजित हिंदी सप्ताह आयोजन का भी जिक्र किया और प्रतियोगिताओं के प्रतिभागियों एवं पुरस्कार प्राप्त करने वालों को बधाई दिया । अंत में उन्होनें कहा कि केंद्र सरकार के संस्थान होने के कारण यह सभी कार्मिकों का दायित्व है कि वे हिंदी की प्रगति में सहयोग करें ।

अपने स्वागत संबोधन में मुख्य वैज्ञानिक एवं राजभाषा कार्यान्वयन समिति के अध्यक्ष डा. डी प्रजापति ने उपस्थित सदस्यों का स्वागत किया एवं संस्थान में राजभाषा हिंदी गतिविधियों का उल्लेख करते हुए अपील किया कि सभी हिंदी में कार्य करने का प्रयास करें ।

कार्यक्रम के अंत में पुरस्कार वितरण समारोह का संचालन श्री अजय कुमार, प्रभारी राजभाषा ने किया । उन्होनें संस्थान में 9 से 16 सितम्बर के दौरान आयोजित राजभाषा हिंदी सप्ताह के अंतर्गत विभिन्न प्रकार के हिंदी प्रतियोगिताओं हिंदी श्रुत लेखन, हिंदी लेख लेखन, हिंदी प्रश्नोत्तरी के विजेताओं के नामों की घोषणा की और मुख्य अतिथि महोदय के कर कमलों से उन्हें पुरूस्कार एवं प्रमाणपत्र से सम्मानित किया गया । हिंदी शिक्षण योजना भारत सरकार के अंतर्गत प्रबोध/प्रवीण/प्राज्ञ हिंदी भाषा पाठ्यक्रम पास स्टाफ सदस्यों को प्रमाण पत्र प्रदान किया गया । अंत में श्रीमति पलाक्षी बरदलै, तकनीकी अधिकारी ने धन्यवाद ज्ञापित किया

निस्ट,राजभाषा कार्यान्वयन समिति (राकास), जोरहाट की बैठकें

प्रावधान के अनुसार संस्थान में प्रभावी राजभाषा कार्यान्वयन के लिए राजभाषा कार्यान्वयन समिति गठित है । नियमानुसार प्रत्येक तीन माह में बैठक आयोजित की जाती है एवं कार्यान्वयन की मोनिट्रिंग भी की जाती है । इस वित्तीय वर्ष में उल्लेखित तिथि 17/5/2013, 27/8/2013, 5/12/2013 एवं 20/3/2014 को बैठक आयोजित की गई एवं महत्वपूर्ण निर्णय लिए गए ।

नगर राजभाषा कार्यान्वयन समिति (नराकास), जोरहाट की बैठकें

नगर राजभाषा कार्यान्वयन समिति (नराकास), जोरहाट भारत सरकार, गृह मंत्रालय, राजभाषा विभाग, नई दिल्ली द्वारा बड़े बड़े शहरों में अवस्थित केंद्र सरकार के कार्यालयों में राजभाषा हिंदी के प्रयोग को सुनिश्चित करने के उद्येश्य नगर राजभाषा कार्यान्वयन समिति की स्थापना की जाती है । बड़े एवं सक्षम कार्यालय के प्रधान को अध्यक्ष नामित किया जाता है । स्थानीय सभी केंद्रीय कार्यालय इसके सदस्य होते हैं एवं प्रत्येक वर्ष दो बार इसकी बैठक आयोजित की जाती है ।

वर्ष 2009 में भारत सरकार ने नगर राजभाषा कार्यान्वयन समिति, जोरहाट का कार्यभार निदेशक, निस्ट, जोरहाट को सौंपा तथा सचिवीय कार्य हेतु श्री अजय कुमार, प्रभारी, राजभाषा, निस्ट, जोरहाट का नामित किया । स्थानीय केंद्रीय कार्यालय, सैन्य संगठन, वायु सेना, राष्ट्रीयकृत बैंक, स्वायत्तसेवी संस्थान, प्रतिष्ठान, परिषद समिति के सदस्य हैं जो नियमित आयोजित बैठक में राजभाषा हिंदी पर चर्चा के लिए भाग लेते हैं । वर्ष में दो बार आयोजित उक्त बैठक का विवरण:

7 जून 2013 : नगर राजभाषा कार्यान्वयन समिति, जोरहाट की 26वीं बैठक पूर्व निर्धारित तय कार्यक्रम के अनुसार अपराह्न 3.00 बजे आरंभ हुआ एवं कार्यक्रम का संचालन समिति के सचिव श्री अजय कुमार ने किया। समिति के अध्यक्ष डा. आर सी बरूआ, निदेशक, निस्ट, जोरहाट ने उपस्थित कार्यालय प्रधान एवं प्रतिनिधियों का हार्दिक स्वागत किया गया । भारत सरकार, राजभाषा विभाग के प्रतिनिधि स्वरूप पधारे अतिथि अनुसंधान अधिकारी श्री बदरी यादव का फुलाम गमोछा से स्वागत किया गया । उपस्थित कार्यालयों ने अपना परिचय दिया । जोरहाट में गठित कुछ नये केंद्रीय कार्यालय के प्रतिनिधियों यथा कॉर्पोरेशन बैंक, देना बैंक, कर्मचारी भविष्य निधि के अधिकारियों ने भाग लिया । राजभाषा हिंदी का कार्यालयों में प्रगति पर चर्चा के दौरान सभी कार्यालयों ने अपने-अपने प्रयास, प्रोत्साहन गतिविधियां एवं आने वाली समस्याओं को समिति के सामने रखा । सचिव ने टिप्पणी करते हुए, बेहतर प्रयास करने एवं समस्याओं के समाधान का आश्वासन दिया । बैठक में ओ एन जी सी के उप महा प्रबंधक श्री ई हुसनैन, श्री एस एस सिंघला एवं प्रबंधक राजभाषा श्री आर बी पोखरियाल, केंद्रीय रिजर्व पुलिस बल के द्वितीय कमान अधिकारी श्री पी के तिवारी, केंद्रीय मूगा एवं एरी अनुसंधान के निदेशक डा. के गिरधर, क्षेत्रीय रेशम प्रशिक्षण केंद्र के प्रधान डा टी के विश्वास , यूको बैंक के अंचल प्रबंधक श्री रवि भूषण सहाय, सेंट्रल बैंक ऑफ इंडिया के सहायक महाप्रबंधक श्री वी पी सिंह, दूरदर्शन प्रसारण केंद्र के उपनिदेशक श्री पवन तुली एवं केंद्रीय औद्येगिक सुरक्षा बल, नेशनल ब्यूरो ऑफ सॉयल सर्वे एण्ड लेंड यूज प्लानिंग, युनाईटेड बैंक आफ, भारतीय स्टेट बैंक, भरतीय जीवन बीमा निगम, आयकर विभाग, बी एस एन एल, एन एस एस ओ, कर्मचारी भविष्य निधि, कॉर्पोरेशन बैंक, देना बैंक के प्रतिनिधियों ने भाग लिया ।

जोरहाट नगर में अवस्थित केंद्रीय कार्यालयों के बीच वर्ष 2012 के दौरान राजभाषा हिंदी के बेहतर कार्य संपादन के लिए राजभाषा पुरस्कार भी प्रदान किया गया । यह पुरस्कार तिमाही प्रगति रिपोर्ट एवं उनके हिंदी गतिविधियों के आधार पर निश्चित किया जाता है । इस प्रकार प्रत्येक वर्ष के लिए श्रेष्ठ कार्यालय को पुरूस्कृत करने का सरकार द्वारा प्रावधान किया गया है । उक्त वर्ष के लिए जोरहाट के सेंट्रल बैंक ऑफ इंडिया, क्षेत्रीय कार्यालय, ओ एन जी सी, क्षेत्रीय रेशम अनुसंधान केंद्र एवं भारतीय स्टेट बैंक के हिंदी अधिकारी को प्रदान किया गया ।

केंद्र सरकार के सभी कार्यालय ऑनलाईन कार्य प्रणाली का अपना रही है, काफी कार्यालयों ने इसे पूरा कर लिया है । इसी के मद्देनजर राजभाषा विभाग ने भी अपनी प्रणाली को ऑनलाईन कर रही है, इसलिए हिंदी के विकास संबंधी रिपार्ट के आकलन एवं प्रेषण के लिए प्रत्येक कार्यालय को पंजीकृत होने की आवश्यकता है । ऑनलाईन पंजीकृत होंने से संबंधित विषय " राजभाषा विभाग:वेब आधारित सूचना प्रबंधन प्रणाली" पर श्री अजय कुमार ने पावर प्वांयट पर व्याख्यान प्रस्तुत किया ।

समिति के सदस्य कार्यालयों के सहयोग से तैयार छमाही पत्र "अनुनाद" ई-पत्रिका का विमोचन किया गया । यह पत्रिका प्रिंट फॉर्म एवं आनलाईन दोनों रूप में एक साथ आरंभ किया गया है । कार्यालय के हिंदीतर भाषी अधिकारियों एवं कर्मचारियों के हिंदी में तैयार रचनाओं को प्रोत्साहित करना एवं राजभाषा हिंदी के प्रयोग को बढ़ावा देना इसका मूल उद्देश्य है । राजभाषा विभाग के श्री बदरी यादव ने इस प्रयास को सराहनीय बताया एवं अपने संबोधन में नराकास, जोरहाट के कार्य प्रणाली को उपयोगी बताया एवं निस्ट, जोरहाट को धन्यवाद दिया । अध्यक्ष, नराकास सह कार्यकारी निदेशक, निस्ट, जोरहाट डा. आर सी बरूआ ने सभी कार्यालयों को सच्चाई के साथ अपने कार्यालय में राजभाषा हिंदी के प्रयोग करने पर बल दिया । अंत में सेंट्रल बैंक के राजभाषा अधिकारी श्री रोशन पांडेय ने अपने वक्तव्य के साथ धन्यवाद ज्ञापित किया ।





25 मार्च 2014 : नगर राजभाषा कार्यान्वयन समिति, जोरहाट की 27 वीं बैठक मंगलवार 25 मार्च 2014 को भारत सरकार, राजभाषा विभाग के प्रभारी उप निदेशक श्री एस एल एस पूर्ति के उपस्थिती एवं डा. डी रमैया, नव नियुक्त निदेशक, निस्ट, जोरहाट की अध्यक्षता में तय कार्यक्रम के अनुसार अपराह्न 3.00 बजे आरंभ हुआ एवं कार्यक्रम का संचालन समिति के सचिव श्री अजय कुमार ने किया। समिति के अध्यक्ष डा. डी रमैया ने उपस्थित कार्यालय प्रधान एवं प्रतिनिधियों का हार्दिक स्वागत किया गया । भारत सरकार, राजभाषा विभाग के प्रतिनिधि स्वरूप पधारे अतिथि प्रभारी उप निदेशक श्री एस एल एस पूर्ति को फुलाम गमोछा से स्वागत किया गया । उपस्थित कार्यालयों ने अपना परिचय दिया । राजभाषा हिंदी का कार्यालयों में प्रगति पर चर्चा के दौरान सभी कार्यालयों ने अपने-अपने प्रयास, प्रोत्साहन गतिविधियां एवं आने वाली समस्याओं को समिति के सामने रखा । सचिव ने टिप्पणी करते हुए, उनके बेहतर प्रयास को सराहा एवं समस्याओं के समाधान का आश्वासन दिया । उप निदेशक ने भी उनकी बात को सरकार तक पहुँचने का वादा किया । बैठक में जोरहाट एयरपोर्ट निदेशक ने भाग लिया एवं अपने विचार समिति के समक्ष प्रस्तुत किया । केंद्रीय रिजर्व पुलिस बल के कमांडेंट श्री नेल्सन वसुमतारी ने अपने कार्यालय में हिन्दी के विस्तृत प्रयोग का विवरण दिया । बी एस एन एल के उप महा प्रबन्धक श्री आर के हजारिका ने हिन्दी के प्रति प्रतिबद्धता को दोहराया । दूरदर्शन प्रसारण केंद्र के उपनिदेशक श्री पवन तुली , केंद्रीय औद्योगिक सुरक्षा बल से सहायक कमांडेंट श्री राजीव कूल्हरी, भारतीय सेन 41 सव एरिया से सूबेदार एल पी शर्मा, सेंट्रल बैंक औफ इंडिया के राजभाषा अधिकारी श्री रोशन पांडे, भारतीय स्टेट बैंक जोरहाट उत्तर के राजभाषा अधिकारी सुश्री रूबी कुमारी, भारतीय जीवन बीमा निगम के सहायक प्रशासनिक अधिकारी श्री भृगु कुमार बोरा, यूनाइटेड बैंक के राजभाषा अधिकारी श्री संजय गोंड, यूको बैंक के राजभाषा अधिकारी श्री उदीप कुमार वर्मा ने भी अपने विचार समिति में रखा । केंद्रीय मूगा एवं एरी अनुसंधान, चाय बोर्ड, भारतीय खाद्य निगम, डाक विभाग, नेशनल इन्शुरेंस, बैंक ऑफ महाराष्ट्र के प्रतिनिधि ने भी भाग लिया एवं अपने कार्यालय के हिन्दी प्रगति को प्रस्तुत किया ।

अपने मार्गदर्शन के दौरान उप निदेशक श्री पूर्ति ने कार्यालयों से "राजभाषा विभाग:वेब आधारित सूचना प्रबंधन प्रणाली" को अपनाने का अनुरोध किया साथ ही कार्यान्वयन कार्य राजभाषा नियम के अनुरूप करें ताकि लक्ष्य पूरा किया जा सके । कार्यालयों में राजभाषा हिन्दी के बेहतर कार्यान्वयन के लिए समित के अंतर्गत एक उपसमिति बनाने का निर्णय लिया गया जो समय समय पर कार्यालयों में जाकर हिन्दी में प्रगति को देखेंगे । इससे कार्यालय को सहयोग मिलेगा और निरीक्षण भी होगा । समिति के सदस्य कार्यालयों के सहयोग से तैयार छमाही पत्र "अनुनाद" ई-पत्रिका के द्वितीय अंक का विमोचन किया गया । पत्रिका प्रकाशन पर सदस्यों ने संतुष्टि प्रकट की । हिंदीतर भाषी के लेख, कविता आदि का इस पत्रिका में प्रकाशन उनके लिए प्रोत्साहन स्वरूप है । समिति के अध्यक्ष डा. डी रमैया ने अपने अध्यक्षीय सम्बोधन में हिन्दी के विकास पर संतोष व्यक्त किया एवं बेहतर कार्य करने का अनुरोध किया । अंत में भारतीय स्टेट बैंक के राजभाषा अधिकारी श्री ललित सीसोदिया ने अपने वक्तव्य के साथ धन्यवाद ज्ञापित किया ।

Award

CSIR-NEIST bagged CSIR Technology Award for 4th time in a row



Team from CSIR-NEIST and Visva-Bharati receiving the award for the newly developed low cost herbal formulation "Anti-Arthritis" from Hon'ble S&T Minister Shri S Jaipal Reddy (seen sitting) at the 71st CSIR Foundation Day celebration held at New Delhi on 26 September, 2013.

Anti-arthritis' – at a glance

Pharmacological studies

ELISA was done against TNF α, interleukin 6, c-reactive protein, matrix metallo proteinase 9. In arthritic mice, level of TNF α, interleukin 1β, inteleukin 6, mmp 9, c-reactive protein has been increased in respect to control and after drug treatment the level has been decreased.

Clinical studies

Total of 51 patients were examined clinically and the effect of 'Anti-Arthritis' in different cytokines of arthritic inflammation was observed. Blood samples were collected with prior consent from each of the patients prior to application of formulation and after three months in which cytokine levels were observed. Biochemical parameters like ESR, Rheumatoid factor etc, as well as clinical parameters started improving in those patients.

Toxicological studies

Ten days drug treated mice (5µl/day/25g BW) were dissected along with the control and no adverse effect could be detected in histological study of liver, kidney, intestine and muscle; urine and stool did not show detectable difference between control and treated mice. Liver functioning marker enzymes, SGOT and SGPT also had no significant alteration in control and treated mice suggesting that the product has no adverse effect under the present treatment regime.

Unique features

- Broad spectrum activity – it is highly effective for treating arthritis, inflammation or any associated problems of arthritis
- The active ingredients are derived from edible plant sources
- No adverse effects were observed
- Formulation is externally applied on affected joints
- Low cost and affordable drug

Achievement Awards for implementation of ERP



Shri Jyotimoy Bhuyan, SO(Gen.) & Coordinator (ERP) and Shri Naveen Kr. Sharma, SO (F&A) are chosen as Project Champions for their exemplary performance in implementation of ERP in this laboratory and received individual Medallion and Citation from Director General of CSIR. This award is given to only few labs of CSIR who has successfully adopted and implemented ERP system in their labs within short period of time. The ERP is an automated system which will replace the manual office system into a paperless system and will bring efficiency and transparency in office activities.

Honours and Recognition

Dr R C Boruah, Outstanding Scientist nominated as Chairperson of AICTE-NEQIP Scheme in HRH Prince of Wales Institute of Engineering and Technology, Jorhat, Govt of Assam.

Dr T C Borah, Chief Scientist, nominated as a Member of Research Advisory Committee of CMER & TI, Lahdoigarh, Jorhat

Mr Probin Baruah, PTO, nominated as Member of AICTE-NEQIP Scheme in HRH Prince of Wales Institute of Engineering and Technology, Jorhat, Govt of Assam.

Mr Paresh Saikia, STO, invited by Lalit Kala Akademi, National Academy of Art, Govt of India, New Delhi, to a National Art Camp and participated during 25-29 March, 2013 held at Shimla

Visitors

Assam Chief Minister Shri Tarun Gogoi visited CSIR-NEIST, Jorhat



Dr D Ramaiah, Director CSIR-NEIST (right) apprising the Hon'ble Chief Minister Shri Tarun Gogoi (left) about research activities and achievements of the institute.



Hon'ble Chief Minister Shri Tarun Gogoi (Centre) with Dr D Ramaiah, Director, CSIR-NEIST (on his right) and Dr T Goswami, head, CPP Division (on his left) during laboratory visit

On the last day of 2013, Hon'ble Chief Minister of Assam Shri Tarun Gogoi visited CSIR-NEIST, Jorhat. Shri Gogoi expressed extreme happiness over two of the CSIR-NEIST low cost affordable herbal ointments namely '*Anti-arthritis*' and '*Fungi-destruct*'. The Chief Minister visited round the institute and showed keen interest in the current R&D and societal activities.

His Excellency, Shri Ranjit Shekhar Mooshahary, Governor of Meghalaya visited CSIR-NEIST



His Excellency, Shri Ranjit Shekhar Mooshahary (2nd from right), Governor of Meghalaya, at the Interactive meeting held. Dr R C Boruah, Acting Director, CSIR-NEIST is seen at his left.



Shri Mooshahary visiting round the institute. He visited the institute on 01 April 2013.

Personnel

DIRECTOR (w.e.f. 09.10.13)

Dr D Ramaiah

ACTING DIRECTOR (upto 08.10.13)

Dr RC Boruah

Director's Secretariat

S. No.	Name	Designation	S. No.	Name	Designation
1	Mr N C Patra	PS	2	Ms Purnima Hazarika	Sr Steno
3	Mr P K Bordoloi	Driver	4	Mr Dinaram Baruah	Security Guard
5	Mr Bipin Dutta	Lab Attnd.	6	Mr Mantu Sarmah	Lab Attnd.

AGROTECHNOLOGY

Medicinal, Aromatic & Economic Plant

Dr N C Baruah, Chief Scientist, Area Coordinator

S. No.	Name	Designation	S. No.	Name	Designation
1	Dr P R Bhattacharyya	Ch. Sc. & Head	2	Dr S C Nath	Ch. Sc.
3	Dr P Baruah	Ch. Sc.	4	Dr (Mrs) Mina Barthakur	Sr. Principal Sc.
5	Dr B S Bhau	Principal Sc.	6	Dr S P Saikia	Scientist
7	Dr M Bhuyan	Scientist	8	Dr Mohan Lal	Scientist
9	Dr A K Bordoloi	Principal T.O.	10	Mrs J Hazarika	Principal T.O.
11	Mrs PJD Bhuyan	Sr.T.O.	12	Dr (Mrs) K Dutta	T.O.
13	Mrs R Kotoky	T.O.	14	Mr S Chanda	T.O.
15	Mr H Lekhak	T.O.	16	Mr N N Bora	Sr Technician
17	Mr Nogen Borah	Lab Astt.	18	Mr Phatik Bora	Lab Astt.
19	Mr S N Kalita	Lab Astt.	20	Mr Mahendra Gogoi	Lab Astt.
21	Mr Baba Saikia	Lab Astt.	22	Mr Dineswar Saikia	Lab Astt.
23	Mr Ramu naik	Lab Astt.	24	Mr Jiten Ch Maharang	Lab Astt.
25	Mr Deben Kalita	Lab Astt.	26	Mr Bhola Naik	Lab Astt.
27	Mr Nomal Dutta	Lab Astt.	28	Mr Debajit Sharma	Group D
29	Mr Pradip Das	Group D	30	Mr Sushil Gayan	Group D

Floriculture

S. No.	Name	Designation	S. No.	Name	Designation
1	Dr Dipul Kalita	Scientist	2	Mr Suren Bora	Sr. Technichian
3	Mr P Saikia	Lab. Astt.	4	Mr Hiteswar Saikia	Lab. Astt.
5	Mr Naren Saikia	Lab. Astt.	6	Mr Bhogeswar Gogoi	Lab. Astt.
7	Mr Bipul Saikia	Lab. Attnd.	8	Mr Lakheswar Hazarika	Lab. Attnd.
9	Mr Dimbeswar Dutta	Lab. Attnd.	10	Mr Naren Gogoi	Lab. Attnd.

BIOLOGICAL SCIENCES

Dr BG Unni, Chief Scientist, Area Coordinator

Biotechnology

S. No.	Name	Designation	S. No.	Name	Designation
1	Dr T C Bora	Ch. Sc. & Head	2	Dr S B Wann	Principal Sc.
3	Dr H P Dekabaruah	Principal Sc.	4	Dr Ratul Saikia	Sr. Scientist
5	Dr M Khongsai	Scientist	6	Dr Jatin Kalita	Scientist
7	Dr Anil K Singh	Scientist	8	Mr A K Sarmah	Principal T.O.
9	Mr A C Kakoty	Sr. T.O.	10	Ms Archana Yadav	T.O.
11	Ms Polakshi Bordoloi	T.O.	12	Mr Tapan bora	Group D

CHEMICAL SCIENCES

Dr RC Boruah, Outstanding Scientist, Area Coordinator

Analytical Chemistry

S. No.	Name	Designation	S. No.	Name	Designation
1	Dr Prabhat Katoky	Ch. Sc. & Head	2	Dr R K Boruah	Ch. Scientist
3	Dr Raju Khan	Sr. Scientist	4	Dr P J Saikia	Scientist
5	Mrs L Borah	Principal T.O.	6	Mr O P Sahu	Principal T.O.
7	Mr P P Khound	T.O.	8	Mrs Ankana Phukan	Tech. Astt.
9	Mr D K Phukan	Sr. Technician	10	Mr J M Baruah	Technician
11	Mr Chandra K Pathak	Lab Astt.	12	Mr Debajit Sharma	Lab Attnd.

Medicinal Chemistry

S. No.	Name	Designation	S. No.	Name	Designation
1	Dr Dipak Prajapati	Ch.Sc. & Head	2	Dr Pulak J Bhuyan	Principal Sc.
3	Dr Pranjal Gogoi	Scientist	4	Dr Sanjib Gogoi	Scientist
5	Dr Harsha N Borah	Principal T.O.	6	Mr Kushal Ch Lekhok	Sr. T.O.
7	Mr Makhon Bora	Lab Astt.	8	Mr Jiten Ch. Sadar	Group D

Natural Products Chemistry

S. No.	Name	Designation	S. No.	Name	Designation
1	Dr N C Barua	Ch. Sc. & Head	2	Dr P K Chowdhury	Ch. Scientist
3	Dr M J Bordoloi	Sr. Principal Sc.	4	Dr D K Dutta	Sr. Scientist
5	Dr Archana M Das	Scientist	6	Dr Gokul Baishya	Scientist
7	Dr UM Dhanalekshmi	Scientist	8	Dr Jyotirmoy Ghosh	Scientist
9	Ms Pritismita Borah	Tech. Astt.	10	Mrs Rumi Borah	Technician
11	Mr B C Borah	Lab Attnd.	12	Mr Romen saikia	Group D

Synthetic Organic Chemistry

S. No.	Name	Designation	S. No.	Name	Designation
1	Dr Dilip Konwar	Ch. Sc. & Head	2	Dr A Goswami	Ch. Scientist
3	Dr Pallab Pahari	Scientist	4	Mr R N Das	T. O.
5	Mr Manas J Borah	Tech. Astt.	6	Mr Debeswar Borah	Tech. Astt.

PROJECTS

Projects Undertaken

S. No	PI & Title	Funding Agency	Contract Value (₹ in Lakhs)
1	Dr Dipul Kalita Development of green composites by utilizing agricultural waste for building materials, construction, furniture and other applications	Sathguru Management Consultant Pvt Ltd, Hyderabad	5.0
2	Mr Sanjay Deori Soil investigation for recycling treatment plant at Numaligarh Refinery, Numaligarh Refinery Ltd, Golaghat, Assam	Numaligarh Refinery Limited	8.06
3	Mr Sanjay Deori Performance evaluation report on PMGSY, state roads and NH-52 constructed by Bitchem Cold Mix	M/s Bitchem Asphalt Technologies Ltd, Guwahati, Assam	2.31
4	Dr H P Deka Boruah Consultancy fee on installation of manufacturing unit for production of TP-16 biofertilizer	M/s Amrit Organic Bio Organic Fertilizer	1.21
5	Dr BP Baruah Gradation (annual) of NE Indian Coals	Coal India Ltd.(North Eastern Coalfields)	1.95
6	Dr SP Saikia Detailed project report for the proposed composite forest farming at Malisa Tea Garden area, Tirap Dist, AP.	Mr Samman Lowang Rajkumar , 12 Mile Pansumthong, Dist Tirap, AP.	1.68
7	Dr Ranju Duarah Micro Earthquake Studies for the Lower Kapili Hydro Electric Project (120mw), Assam	Assam Power Generation Corporation Limited ,Bijuli Bhawan , Paltan Bazaar, Guwahati ,Assam	40.0
8	Dr Dipak Kumar Dutta Potential Rhodium complexes of functionalized phosphines and nitrogen donor ligands : Synthesis, reactivity and catalytic carbonylation of alcohols	Min of Science & Technology	34.5
9	Dr Pulok J Bhuyan Sustainable chemistry in the synthesis of some novel functionalized coumarines and assay for their potential biological activity	Min of Science & Technology	30.1
10	Dr SC Nath Economic and biogeographic evaluation of the *Cinnnamomum* Speciecs in some selected parts of India through morphological, chemical and molecular biology studies	Min of Science & Technology	54.8
11	Dr Sonali Roy Correlation of cellular thiol balance and oxidative/hypoxic apoptosis in liver damage : Regulatory mechanism underlying denovo glutathione synthesis medicated by gcl gene expression	Min of Science & Technology	25.0

12	Dr Jatin Kalita Motivational programme for talented school students	Min of Science & Technology	13.74
13	Mr Dipankar Neog Setting up of A Common facility centre (CFC) on Weaving and Textile Product manufacturing	Min of Science & Technology	127.69
14	Sri Sanjoy Deori Performance evaluation of river Brahmputra bed materials for use in construction of road embankment, sub-grade and sub-base .	Min of Science & Technology	23.75
15	Dr SB Wann Induction of synthemic resistance through root associated bacteria in Pathouli (*Pogostemon cablin* Benth.) and management of nematode	Min of Science & Technology	12.00
16	Dr (Mrs) Archana Moni Das Sustainable and biodegradable hybrid nanocomposites as bio – integrated materials for advanced functional applications	Min of Science & Technology	27.50
17	Dr Lakshi Saikia Synthesis and reactivity of Nanoporous Metal silica Composities Novel Heterogeneous Catalysts for selective Oxidation.	Min of Science & Technology	16.34
18	Dr R Duara M 8.7 Shillong 1897 Earthquake Scenario	National Disaster Management Authority, Govt. of India, New Delhi.	620.35
19	Dr Raju Khan Screen Printed Electrodes Functionalized with Organic – Inorganic Hybrid Nano – composites for Bio-sensing Applications	Min of Science & Technology	19.14
20	Dr BG Unni Isolation and characterization of antifungal peptides from Muga Silkworm *Antherae assamensis* Helfer	Min of Science & Technology	10.8
21	Dr Ratul Saikia DNA Fingerprinting of Ligoncellulose degrading Microbes isolated from protected forest areas of Assam and Mizoram	Min of Science & Technology	41.83

Projects Completed

S. No	PI & Title	Funding Agency	Contract Value (₹ in Lakhs)
1	Dr Mantu Bhuyan Butterfly population studies in NRL Butterfly valley	Numaligarh Refinery Limited	28.55
2	Mr Dipankar Neog Preparation of detail project reort (DPR) CFC on knife manufacturing cluster at karanga, Jorhat, Assam	Ministry of Micro, small & Medium Enterprise, Diphu	1.09

3	Dr Jatin Kalita Techno Economical studies of six Technologies under Coir Board in North Eastern States and organization of two seminars	Ministry of Micro, small & Medium Enterprise	22.81
4	Dr P Barkakati Determination of Modulus of Soil Sub-grade Reaction at Runway Extension for Air Force Station, Jorhat	Air Force	1.12
5	Sri Sanjay Deori Performance Evaluation Report on PMGSY, State Roads and NH-52 constructed by Bitchem Cold Mix	M/s Bitchem Asphalt Technologies Ltd., Guwahati, Assam	2.31
6	Dr Ratul Saikia Microbial Diversity and Identification – Application of Microorganisms in Agriculture and Allied Sectors (AMAAS)	National Bureau of Agriculturally Important Microorganisms (NBAIM), Indian Council of Agricultural Res	58.61
7	Mr Dipankar Neog Setting up of Non-leather footwear training cum at Tezpur, Assam	Min of HRD, New Delhi	70.0
8	Dr L Nath Financial assistance to NEIST, Jorhat towards equipments, Computer Lab. Space for 58 Under Graduate Colleges affiliated to NER University under NER FIRST Package	DST, New Delhi	293.0
9	Dr PR Bhattacharyya Identification of location specific ginger and turmeric varieties, quality planting materials production, insect-pests and disease management, chemical profiling and development of value added product	DST, New Delhi	1.67
10	Dr (Mrs) Archana Moni Das Synthesis of some versatile steroidal molecules: approach to synthesis of hybrid molecules including nine membered D-ring steroids and chemeric 7a – substituted derivatives.	Min of Science & Technology	12.15
11	Dr (Mrs) Puja khare Emissions from coal based industries – Development of predictive models (EE-42).	Central Mine Planning & Design Institute Limited	82.46
12	Dr HB Singh Herbal Garden inside kangla Fort, Imphal, Manipur	Department of Archaeology, Govt. of Manipur	6.16
13	Mr PK Goswami/ Dr PK Chowdhury New advances in the integrated management of food processing waste in India and Europe: use of sustainable technologies for the exploitation of by-products into new foods and feeds.	Min of Science & Technology	243.21

14	Dr Saurabh Baruah Modelling and estimation of strong ground motion parameters aimed at seismic risk reduction. (Indo –Russian joint project)	Min of Science & Tech nology	8.16
15	Dr (Mrs) A Goswami Development of a low cost process for fluoride contaminated water specific to NE Region for public	Min of Environment & Forests	15.38
16	Dr P Sengupta Planned development of protocols for utilization of protocols for brick manufacture after analysis of geo-consequence	Min of Science & Technology	24.71
17	Dr HP Dekaboruah Development of Formulations of microbial Bionoculants with plant growth promoting and Biocontrol Activities for application in rice cultivation in Manipur and Assam.	Min of Science & Technology	28.15
18	Mr PK Goswami/Dr A Goswami Development of economic process for the drying of Umorok Chilli and Turmeric and their quality evaluation with stability	Min of Food Processing Industries	31.04
19	Dr Dipul Kalita Synthesis of novel composite material using coir fiber for engineering application on various bamboo and cane articles.	Ministry of Micro, small & Medium Enterprise	17.21
20	Dr Dipul Kalita To develop a process of non – glossy borer resistant polymeric composition suitable for application on various bamboo and cane articles.	Min of Science & Technology	9.93
21	Dr Mantu Bhuyan Studies on bio-ecology of *Helopeltis theivora* and development of a forecasting model of its incidence for effective management	Min of Science & Technology	37.66
22	Dr RC Borah Development of an Atmospheric Fluidized bed combustion process for High Sulphur content North Eastern Region coals of India with higher Efficiency and Zero Green house gas emission.	Min of Environment & Forests	39.69
23	Mrs Pramila Majumdar Intensive training workshop on science communication.	Min of Science & Technology	2.8

24	Dr NC Barua Novel DPP IV inhibitors for the treatment of Diabetes.	CSIR Hq, New Delhi	111.06
25	Dr D Prajapati Synthesis of novel Pyrimidine derivatives of biological significance based on inter and intramolecular cycleddition strategy	DST, New Delhi	15.29

Projects Ongoing

S. No	PI & Title	Funding Agency	Contract Value (₹ in Lakhs)
1	Dr Dipul Kalita Development of green composites by utilizing agricultural waste for building materials, construction, furniture and other applications	Sathguru Management Consultant Pvt. Ltd, Hyderabad	5.00
2	Sri Sanjay Deori Soil Investigation for Recycling Treatment Plant at Numaligarh Refinery, Numaligarh Refinery Ltd, Golaghat, Assam	Numaligarh Refinery Limited	8.06
3	Dr HP Deka Boruah Consultancy fee on installation of manufacturing unit for production of TP-16 biofertilizer	M/s Amrit Organic Bio Organic Fertilizer	1.21
4	Dr BP Baruah Gradation (annual) of NE Indian Coals	Coal India Ltd., (North Eastern Coalfields), Margherita	1.95
5	Dr Ranju Duarah Micro Earthquake Studies for the Lower Kapili Hydro Electric Project (120MW) , Assam	Assam Power Generation Corporation Limited , Guwahati , Assam	40.0
6	Dr R Duarah On line/ real time seismic network for disaster mitigation in ne india.	North Eastern Council, Shillong	42.6
7	Dr RL Bezbaruah Creation of Bioinformatics infrastructure facility (BiF) for the promotion of biology teaching through bioinformatics (BTBI) a scheme of BTISnet.	DBT, Bioinformatics Division, New Delhi	35.89
8	Dr Dipankar Neog Technopreneur Promotion Programe (TePP) outreach Centre (TUC) – (11 FYP). Promoting innovations in individuals, Startups and MSMES (PRISM)-(12-FYP).	Min. of Science & Technology, DSIR, New Delhi	26.24

9	Dr Dipankar Neog Council of Science and Technology for Rural India Centre at NEIST, Jorhat (CSTRI Cen tre-NEIST).	Min. of Science & Technology	40.02
10	Dr (Mrs) Jonalee Goswami Synthesis of some biological potential steroidal heterocycles by structural modifications.	Min. of Science & Technology	20.80
11	Dr RL Bezbaruah Online Access Facility of Library Resources (OAFLR) for Secondary Schools on North Eastern States of India.	Min. of Science & Technology	8.45
12	Dr RL Bezbaruah Establishment of Institutional Biotech Hubs (IBThubs) by DBT under special programme for North Eastern States of India.	Biotech Consortium India Limited	39.0
13	Dr (Mrs) Archana Moni Das Utilisation of plant and waste materials of North East India to a value added product : Environment Friendly Technology	North East Council	22.25
14	Dr BP Baruah Development of technology to produce clean coal from high ash and high sulphur Indian Coal.	Min. of Steel, New Delhi	193.76
15	Dr BS Bhau Development of Molecular markers for evaluation of popular Genetic Structure of the *Aquilaria malaccensis* in Northeast India: Implications for its use and Conservation.	Min of Science & Technology	45.93
16	Dr HP Dekabaruah Application of carbon sequestration in the terrestrial eco-system of Assam for long term sustainability.	Min of Science & Technology	63.44
17	Dr MJ Bordoloi Pharmacological study and molecular characterization of some endangered plants of NE India with reference to their adaptogenic activity.	Min of Science & Technology	15.65
18	Dr Ratul Saikia Genetic diversity of antimicrobial agents producing streptomyces isolated from protected Forest Area of Assam and Arunachal Pradesh	Min of Science & Technology	28.76
19	Dr PR Bhattacharyya Biotech Interventions on Selected Medicinal & Aromatic Plants (MAP) of NER for their effective utilization	Min of Science & Technology	78.4

20	Dr BS Bhau Yield enhancement strategies for production of therapeutic compounds by cell and tissue cultures of *Tinospora cordifolia* (wild.) Miers exHook. F. & Thoms.	Min of Science & Technology	12.97
21	Dr Gakul Baishya Domino prins cyclization reactions: Synthesis of noval highly functionalized tetrahydropyran piperidine derivatives	Min of Science & Technology	24.2
22	Dr RM Devi Active tectonic and paleoseismic studies, using geophysical parameters, along the mountain frontal part of Eastern Syntaxial Bend, Lower Dibang Valley and Lohit Dist, Arunachal Himalaya.	Min of Science & Technology	20.00
23	Dr TC Borah Screening and molecular characterization of microbial pathogen diversity of Staphylococci and development of diagnostic test for rapid detection.	Min of Science & Technology	54.7
24	Dr BP Baruah Development of feasibility assessment model for adaptation of underground Coal gasification technology in the North – East region of India.	Min of Communication & Information	111.32
25	Dr (Ms) Dipanwita Banik A study on Taxonomy and Ethnobotany with an emphasis to biochemical parameters of the family Myristicaceae R. Br. In North East India.	Min of Science & Technology	16.16
26	Dr MJ Bordoloi Chemical investigation of Species of Sea Stars (family Asterminidae) from Vietnam waters in search of Bioactive molecules.	Min of Science & Technology	3.36
27	Dr MJ Bordoloi Identification of bioactive compound from medicinal plants effective against multi-drug resistant *Escherichia coli*.	Min of Science & Technology	12.72
28	Dr Ratul Saikia DNA Fingerprinting of Endophytic Actinomycetes Isolated from Protected Forest Areas of Assam and Mizoram.	Min of Science & Technology	37.15
29	Dr Lakshi Saikia Hierarchical porous solid as catalysts and catalytic support.	Min of Science & Technology	25.5

30	Dr (Mrs) M Borthakur Self empowerment by the women community of the rural areas of west Jorhat (Sc populated) through organic vegetable gardening as well production of popular food viz. Mushroom cultivation.	Min of Science & Technology, D SIR, Govt of India, New Delhi.	12.0
31	Dr Manash R Das Solution chemistry approach for Synthesis of metal nanoparticles on the graphene nanosheets.	Min of Science & Technology	24.5
32	Dr TC Borah Detoxification of mustard seed based product through fermentation process based on north east traditional practices and their value addition	Min of Science & Technology	23.13
33	Dr SP Saikia Studies on drought resistance strategy in seedling of Teak (*Tectona grandis*) species and selection of improved genotype for forest management.	Min of Science & Technology	35.94
34	Dr Saurabh Baruah Literature Survey of Available Earthquake Hazard Assessment studies related to North Eastern Region.	Assam State Disaster Management Authority	17.8
35	Mr Chandan Tamuli Exploration utilization of wild edible plants consumed by ST people of Arunachal Pradesh for socio economic development of the state.	Min of Science & Technology	15.22
36	Dr Saurabh Baruah Seismic vulnerability Assessment of Major Cities in North –Eastern India.	North East Council	184.25
37	Dr (Mrs) Swapnali Hazarika Development of Molecular Gate Membrane for CO_2 Separation and Green Emission Control.	Min of Science & Technology	33.31
38	Dr SB Wann Comparative antimicrobial activity and molecular characterization of *Clerodendrum* species of Thailand & India.	Min of Science & Technology	8.85
39	Dr Dipak Kumar Dutta Potential Rhodium complexes of functionalized phosphines and nitrogen donor ligands: Synthesis, reactivity and catalyst carbonylation of alcohols	Min of Science & Technology	34.5
40	Dr Pulok J Bhuyan Sustainable Chemistry in the synthesis of some novel functionalized coumarines and assay for their potential biological activity	Min. of Science & Technology	30.1

41	Dr SC Nath Economic and bio geographic evaluation of the *Cinnamomum* Species in some selected parts of India through morphological, chemical and molecular biology studies	Min. of Science & Technology	54.8
42	Dr Sonali Roy Correlation of cellular thiol balance and oxidative/hypoxic apoptosis in liver damage: Regulatory mechanism underlying denovo glutathione synthesis mediated by gcl gene expression	Min. of Science & Technology	2.5
43	Dr Jatin Kalita Motivational programme for talented school students	Min. of Science & Technology	13.74
44	Mr Dipankar Neog Setting up of A Common Facility Centre (CFC) on Weaving and Textile product manufacturing	Min. of Science & Technology	127.69
45	Dr Sanjay Deori Performance evaluation of river Brahmputra bed materials for use in construction of road embankment, sub-grade and sub-base	Min. of Science & Technology	23.75
46	Dr SB Wann Induction of systemic resistance through root associated bacteria in Pathouli (*Pogostemon cablin* Benth.) and management of nematode	Min. of Science & Technology	12.0
47	Dr (Mrs) Archana Moni Das Sustainable and biodegradable hybrid nanocomposites as bio-integrated materials for advanced functional applications	Min. of Science & Technology	27.5
48	Dr Lakshi Saikia Synthesis and reactivity of Nanoporous Metal-Silica Composities-Novel Heterogenious Catalysts for selective Oxidation	Min. of Science & Technology	16.34
49	Dr R Duarah M 8.7 Shillong 1897 Earthquake Scenario	National Disaster Management Authority, Gove. of India, New Delhi	620.35
50	Dr Raju Khan Screen Printed Electrodes Functionalized with Organic- Inorganic Hybrid Nano-Composites for Bio-Sensing Applications	Min. of Science & Technology	19.14
51	Dr BG Unni Isolation and characterization of antifungal peptides from Muga Silkworm *Antherae assamensis* Helfer	Min. of Science & Technology	10.8
52	Dr Ratul Saikia DNA Fingerprinting of Lignocellulose degrading microbes isolated from protected forest areas of Assam and Mizoram	Min. of Science & Technology	41.83

Process developed

1	Process Knowhow for the Herbal anti-asthmatic formulation
2	TP-16 Bio-fertilizer for sustainable crop yield
3	A Domestic Stove-cum-Charcoal making unit

Process released to the industry

S. No.	Know-how	Party
1	Herbal anti-asthmatic formulation	M/s Sarada Clinics Private Limited, Kolkata
2	TP-16 biofertiliser for sustainable crop yield	M/s Amrit Organics Fertilizer Plant, Dibrugarh
3	Mushroom spawn production technology	Smt Bapi Malakar, W/o Lt Ajay Malakar, C/o Seema Talukdar, Dibrugarh
4	Herbal incense sticks with mosquito repellent properties	M/s Sukanta Self Help Group, Jiramia, R D Block, West Tripura

Marketing rights of products transferred

S. No.	Product	Party
1	Fungi-Destruct	M/s Sarada Clinics Pvt. Ltd., Kolkata
		M/s OMICS Pharma Pvt Ltd, Ahmedabad
2	Anti-Arthritis	M/s OMICS Pharma Pvt Ltd, Ahmedabad
		Mr Joyanta Kumar Saikia, Proprietor, M/s Triveni Enterprise, Jorhat

PATENTS

Granted Abroad

Title : Process for the preparation of 4-(4-hydroxyphenyl) butan-2-one using solid acid clay catalyst
Patent No : 8471068 (US)
Inventors : Dutta Dipak Kumar, Pathak Madan Gopal
Date of grant : 25/06/2013

Title : Simultaneous method for the preparation of a mixture of 3-acetoxy-17-acetamido-16-formyl-androst-5,17-diene and 3-acetoxy-2'-chloro-5-androsteno[17,16-β]pyridine
Patent No : 8513226 (US)
Inventors : Romesh Chandra Boruah, Moyurima Borthakur, Madan Gopal Barthakur, Paruchuri Gangadhar Rao, Sudip Kumar Kar, Annalakshmi Chinniah, Suchandra Goswami, Pratap Kumar Das
Date of grant : 20/08/2013

Title : Method for the preparation of 17-acetamido-3-acetoxy-16-formyl-androst-5, 17-diene and 3-acetoxy-2'-chloro-5-androsteno[17,16- β]pyridine
Patent No : **ZL200980118933 (CN)**
Inventors : (Romesh Chandra Boruah, Moyurima Borthakur, Madan Gopal Barthakur, Paruchuri Gangadhar Rao, Sudip Kumar Kar), Annalakshmi Chinniah, Suchandra Goswami, Pratap Kumar Das
Date of grant : 12/03/2014

Title : Pyridin-2yl sulfanyl acid esters and process for the preparation thereof
Patent No : **8680288 (US)**
Inventors : Sarma Jadab Chandra, Bora Dilip Chandra, Rao Paruchuri Gangadhar, Ghosh Balaram, Balwani Sakshi
Date of grant : **25/03/2014**

Granted in India

Title : Novel rhodium carbonyl based ligand catalyst and a process forthe preparation thereof
Patent No : 256409
Inventors : Dutta Dipak Kumar, Chutia Pratap, Sharma Manab, Kumari Nandini
Date of grant : 12/06/2013

Title : An improved process for the production of 4- hydroxy-butan-2-one
Patent No : 257326
Inventors : Dilip Konwar, Pranjal Gogoi, Dipak Kumar Dutta
Date of grant : 24/09/2013

Filed Abroad

Title : A novel series of 1,2,3-triazole containing artemisinin derived dimers with potent anticancer activities
Application No: 13/985527 (US)
Inventors : Bishwajit Saikia, Nabin Chandra Barua, Partha Pratim Saikia, Abhishek Goswami, Paruchuri Gangadhar Rao, Ajit Kumar Saxena, Nitasha Suri
Filing Date : 14/08/2013

Title : A process for reducing chloronitrobenzene catalyzed by platinum-nanoparticles stabilized on modified montmorillonite clay
Application No : PCT/IN2013/000698 (WO)
Inventors : Dutta Dipak Kumar, Dutta Dipanka
Filing Date : 18/11/2013

Title : A process for the preparation of oxidic nano sheets coated monolithic catalysts useful for the treatment of toxic N_2O gas
Application No : PCT/IN2013/000713 (WO)
Inventors : Rajib Lochan Goswamee, Mridusmita Mishra, Anil Kumar Sarma Baruah
Filing Date : 23/11/2013

Title : **S**upported mixed metal oxidic nano sheets coated ceramic monolithic reactor suitable for the adsorption of toxic sulphur bearing gases-method of their preparation and application
Application No : 14/147246 (US)
Inventors : Mridusmita Mishra, Rajib Lochan Goswamee
Filing Date : 03/01/2014

Filed in India

Title : A process for reducing chloronitrobenzene catalyzed by platinum-nanoparticles stabilized on modified montmorillonite clay
Application No : 2183DEL2013
Inventors : Dutta Dipak Kumar, Dutta Dipanka
Filing Date : 23/07/2013

Title : A process for the preparation of resin coated bauxite proppants
Application No : 3607DEL2013
Inventors : Dipak Kumar Dutta, Pinaki Sengupta, Kokil Saikia, Podma Pollov Sarmah, Ankana Phukan
Filing Date : 30/12/2013

Title : A stove cum charcoal making unit
Application No : 3829DEL2013
Inventors : Jayanta Jyoti Bora, Dipankar Neog, Subodh Chandra Kalita, Ajoy Borkotoky
Filing Date : 31/12/2013

Title : Plant based mosquito repellent incense sticks.
Application No : 0529DEL2014
Inventors : Mantu Bhuyan, Sanjoy Kumar Chanda, Jiten Mech, Pranab Ram Bhattacharyya
Filing Date : 25/02/2014

Papers Published

Book Chapters

1. DOMMARAJU Y, PRAJAPATI D, : Ionic liquids - an effective green media for cyclization and multi component reactions for the synthesis of N-heterocycles, In- Recent Research in Organic Chemistry, Published by Transworld Research Network, Trivandrum, 2012 p-33-110
2. DEBNATH RAJAL, SARMA RUPAK KUMAR, SAIKIA R, YADAV A, BORA T C : Metagenomics : a hunting expedition in microbial diversity, In- Molecular Biology of Bacteria, ed by R K Gaur and H K Gautam, Nova Science Publisher, 2013(chapter-2), p-19-30
3. DAS MANASH R, SHARMA PONCHAMI, BORA SARAT CH, SZUNERITS SABINE AND BOUKHERROUB RABHA- Metal Nano Particles/Graphene based composit material - synthesis and application, book title - Innovative Graphene Technologies : development, characterization and ivaluation, volume 1, Rapra-Smithers Publication UK 2013 P -2232-274 (Chapter 7)
4. DUTTA D K, Hand book of functional Nanomaterials- Chapter Title - Metal Nano particles for catalytic applications Nova Science Publishers, Inc. USA. (Accepted).

In Proceedings of Seminars/ workshop

1. ZHIMO I ILIKA, BHATTACHARYYA SUJIT : Recent Developments in Traditional Knowledge protection vis-a-vis the case study of Turmeric Patent, In-Souvenir of National Workshop on Innovating India held during 25-26 Nov., NIT-Silchar, 2013 p-29
2. SAIKIA S P, MAPELLI S, PECCHIA P, MUDOI K D, GOGOI A : Non food oilseed plant as an alternative resource for biofuel production, In-Climate Change and Himalaya, ed by J. Sundaresan et al., Scientific Publishers, India , 2013 p-94-117
3. SAIKIA S P, MAPELLI S, PECCHIA P, MUDOI K D, GOGOI A : Non food oilseed plant as an alternative resource for biofuel , In- Book of Abstract, International Conference on Climate Change and the Himalayas: Current Status and Future Perspective (ICCCH-2013), CSIR-NISCAIR, New Delhi, 28-31 October, 2013 p-77-78
4. CHETIA RUNJUN, SAIKIA BINOY K, DUTTA DILEEP K, BARUAH B P : Chemical Beneficiation of High Sulphur North-East Indian Coals by Alkaline Oxidation, In- Proceedings of the XIII International Seminar on Mineral Processing Technology (MPT-2013), CSIR-IMMT, Bhubaneswar, 2013, p-281-286
5. SAIKIA BINOY K, BARUAH B P : Investigation on Nano-Mineralogy of Indian Coals and Coal Fly Ashes, In-Proceedings of the XIII International Seminar on Mineral Processing Technology (MPT-2013), CSIR-IMMT, Bhubaneswar, 2013, p-3-6
6. MAHANTA BANASHREE, SAIKIA BINOY K, DUTTA ARJU MONI, SAIKIA PRASENJIT, BARUAH B P : Studies on the Effect of Coal Beneficiation on Ash Fusion Temperatures, In- Proceedings of the XIII International Seminar on Mineral Processing Technology (MPT-2013), CSIR-IMMT, Bhubaneswar, 2013, p-334-337
7. DUTTA ARJU MONI, SAIKIA BINOY K, SAIKIA LAKSHI, BARUAH B P : Beneficiation of Low Rank North East Indian Coals by Ultrasonication in Ionic Liquids: A Green Approach, In- Proceedings of the XIII International Seminar on Mineral Processing Technology (MPT-2013), CSIR-IMMT, Bhubaneswar, 2013, p-338-343
8. GOGOI ANIMESH, SAIKIA S P, DUTTA MUDOI K, BHATTACHERJEE P R, SARMAH G, SARMAH R K : Comparative evaluation of physicochemical properties of *Jatropa carcus* L. for high yield and adaptibility in Assam environment, In- Book of Abstract of International Conference on harnessing natural resources for sustainable development : Global trends, held at Cotton College, Guwahati, Jan 29-31, 2014, (Abstract No. OP-8), p-64

9. DUTTA MUDOI K, SARMAH D K, NATH S C, BORTHAKUR M : Plant tissue culture as an appropriate tools for conservation of endangered species *Nepenthes khasiana* : a case study, In- Book of Abstract of International Conference on harnessing natural resources for sustainable development : Global trends, held at Cotton College, Guwahati, Jan 29-31, 2014, (Abstract No. OP-9), p-241
10. DUARAH APARAJITA, BORTHAKUR M P, BHATTACHERJEE P R : Tissue culture studies on *Acorus calamus* : a valuable endangered medicinal herb, In- Book of Abstract of International Conference on harnessing natural resources for sustainable development : Global trends, held at Cotton College, Guwahati, Jan 29-31, 2014, (Abstract No. OP-2), p-234
11. DAS INDUMONI, KONWAR D, HAZARIKA S : A novel synthesis of zero generation dendrimer using catalyst : optiomization of structure by DFT, In-Book of abstract, National Seminar on recent trends of research in science and technology, Assam Science Society, held at Cotton College State University, Guwahati, 29th March, 2014 p-68-69
12. BARUAH KUNDAN, BHATTACHARYYA PRADIP KUMAR, HAZARIKA S : Adsorption and permeation of butanol from dilute aqueous solution using NF membrane, In-Book of abstract, National Seminar on recent trends of research in science and technology, Assam Science Society, held at Cotton College State University, Guwahati, 29th March, 2014 p-72-73
13. GOHAIN P P, BARUAH S D, KAKATI R: Biodiesel production from tea seed oil, In- Proceedings of 7th *International symposium on feedstock recycling of polymeric materials (7th ISFR 2013)", New Delhi, October 23-26, 2013, Abstract No. PCB-12, p-82.*
14. ASSANVO EDJA F, KONWAR DILIP, BARUAH SHASHI D: Thermal Analysis of Poly(Ricinodendron Heudelotii oil-co-Methyl methacrylate), In- Proceedings of Nineteenth Symposium & Workshop on Thermal Analysis (THERMANS – 2013), Homi Bhabha National Institute, Mumbai, December 19-23, 2013, Abstract No. M-15 (Oral Presentation 2).
15. ASSANVO EDJA F, KONWAR DILIP, BARUAH SHASHI D: Synthesis of Hybrid Latexes of Acrylate and *Ricinondendron Heudelotii* (RH) Oil and its Alkyd via Miniemulsion Polymerization", In- Proceedings of "Nature Inspired Initiatives in Chemical Trends (*NIICT-2014*), CSIR-Indian Institute of Technology, Hyderabad, March 2-5, 2014, p-18.
16. DAS PRANJAL P, SAIKIA PRAKASH J, BARUAH SHASHI D: Preparation and Characterization of Poly(ε-caprolactone) Microspheres by Solvent Evaporation Method", *In- Proceedings of Sixth National Conference on "Recent Advances in Polymer Technology (RAPT 2014)" University Institute of Chemical Technology, North Maharashtra University, Jalgaon, March 21-22, 2014.*
17. SAIKIA PRAKASH J, BARUAH SHASHI D: *"Synthesis of Well Defined Poly(n-hexadecyl methacrylate) via ATRP and Reverse ATRP Catalyzed by Tris(2,2□-bipyridine)iron(III) Complexes" by Prakash J. Saikia and Shashi D. Baruah, Oeral Presentation and Proceedings of Sixth National Conference on "Recent Advances in Polymer Technology (RAPT 2014)" University Institute of Chemical Technology, North Maharashtra University, Jalgaon, March 21-22, 2014.*
18. BHARALI PANCHALI, BORTHAKUR SOMIRAN, HAZARIKA S : Effect of additives on morphology and permeability of dendrimer membrane, In-Book of abstract, National Seminar on recent trends of research in science and technology, Assam Science Society, held at Cotton College State University, Guwahati, 29th March, 2014 p-76-77

National Journals

1. SARMAH M K, BORTHAKUR A, DUTTA A : Pyrolysis of petroleum asphaltenes from different geological origins and use of methylnaphthalenes and methylphenanthrenes as maturity indicators for asphaltenes, *Bulletin of Materials Science*, 2013, 36(2), p-311-317

2. SHARMA SANGEETA, SARMA JOGENDRA NATH : Drainage Analysis in a Part of the Brahmaputra Valley in Sivasagar District, Assam, India, to Detect the Role of Neotectonic Activity, *Journal of the Indian Society of Remote Sensing*, 2013, 41(4), p-895-904
3. BARUAH B P, SHARMA ARPITA, SAIKIA BINOY K : Petro-chemical investigation of some perhydrous Indian coals, *Journal of the Geological Society of India*, 2013, 81(5), p-713-18
4. BORTHAKUR SUSANTA KUMAR, BORUAH P, GOSWAMI B N : [4+2] Cycloaddition reaction: Synthesis and antifungal activities of 2-substituted 1,2,4-triazolo[3,2-c][1,3,5]thiadiazine-3,3-dioxides, *Journal of the Indian Chemical Society*, 2013, 9(7), p-1005-1008
5. PAYUM TEMIN, DAS A K, SHANKAR RAMA, TAMULY C, HAZARIKA MOUSHUMI : Folk use and antioxidant potential determination of *Zanthoxylum rhetsa* DC. Shoot -A highly utilized hot spice folk vegetable of Arunachal Pradesh, India, *International Journal of Pharmaceutical Science Research*, 2013, 4(12), p-4597-4602
6. SAIKIA B K, SHARMA A, KHOUND K, BARUAH B P : Solid state 13C-NMR spectroscopy of some oligocene coals of Assam and Nagaland, *J Geological Society of India*, 2013, 82(3), p-295-298
7. SHARMA ARPITA, BARUAH B P : Coal as source of energy and its environmental impact, *J Environmental Science Society*, 2013, 1(1), p-1-4
8. KALITA JATIN : Importance of environmental education for students and teachers, *J Environmental Science Society*, 2013, 1(1), p-12-14
9. SAIKIA ANANYA, SAIKIA BINOY KUMAR : National environmental awareness (NEAC), *J Environmental Science Society*, 2013, 1(1), p-15-19
10. SAIKIA JYOTILIMA : Climate change, melting of Himalayas and impacts on North East India, *J Environmental Science Society*, 2013, 1(1), p-20-22
11. CHETIA RUNJUN : Environmental impact of coke oven industries in NER India, *J Environmental Science Society*, 2013, 1(1), p-23-25
12. BASUMATARI DIPAK, DEORI SANJAY : The necessity of energy efficiency building, *J Environmental Science Society*, 2013, 1(1), p-26-28
13. SAIKIA PRASENJIT : Indoor air pollution from solid fuel combustion : the silent killer *J Environmental Science Society*, 2013, 1(1), p-29-36
14. GOGOI ARUNDHOTI, DAS TONKESWAR : Coal combustion residue from thermal power plant, *J Environmental Science Society*, 2013, 1(1), p-37-43
15. KALITA DIPUL : Natural dyes for the green environment *J Environmental Science Society*, 2013, 1(1), p-44-48
16. BAYON G K : Critical problems and their solution for hilly road pavement with particular reference to NH-52(a) - a new avenue, International J Civil, Structural, *Environmental and Infrastructure Engineering Research and Development*, 2013, 3(4), p-47-58
17. DAS TONKESWAR, SAIKIA BINOY KUMAR, BARUAH B P : Feasibility studies for isolation of humic acid from coal of Mongchen Coalfield, Nagaland, *J Indian Chemical Society*, 2013, 90(11), p-2007-2014
18. SAIKIA S P, GOGOI ANIMESH, LEKHOK HIMANGSHU, HANDIQUE NABANITA, DUTTA MUDOI K : Organic farming for effective sustainable agriculture in India, *J Environmental Science Society*, 2013, 1(2), p-14-22
19. CHANDA SANJOY KUMAR, SARMA BITOPAN, BHATTACHARYYA P R, BHUYAN MANTU : Is global warming responsible for outbreak of *Spilosoma obliqua*. Walker (Arctiidae : Lepidoptra) in Assam, *J Environmental Science Society*, 2013, 1(2), p-23-26

20. BHATTACHARYYA P R, BARUAH A, BORKOTOKI A : Deterioration of natural silk fibre due to oil field pollution, *J Environmental Science Society*, 2013, 1(2), p-27-30

21. NEOG KARTIK, AHMED G U, UNNI B G, DUTTA P, GOGOI D K, GIRIDHAR K : Variation in biological composition of different host plant of muga silk worm, *Antherea assamensis* HELFER, *Sericologia*, 2013, 53(3), p-1-11

22. GOGOI A, HAZARIKA P, KONWAR D, BORUAH R K : Synthesis and structural reports of $C_{12}H_2ON0_4$, *Asian Journal of Chemistry*, 2013, 25(3), p-1755-1756

In International Journals

1. WANG Q, DAS M R, LI M, BOUKHERROUB R, SZUNERITS S : Voltammetric detection of l-dopa and carbidopa on graphene modified glassy carbon interfaces, *Bioelectrochemistry*, 2013, 93 p-15-22

2. SHARMA PONCHAMI, BORA M M, BORTHAKUR S, RAO P G, DUTTA N N : Separation of norbixin from *Bixa orellana* seed raw dye by Aliquat-336, *Environmental Progress and Sustainable Energy*, 2013, 32(1), p-134-138

3. YADAV A K, GAUTAM C R, GAUTAM ARVIND, MISHRA V K : Structural and crystallization behavior of (Ba,Sr)TiO_3 borosilicate glasses, *Phase Transition*, 2013, 86(10), p-1000-1016

4. GOSWAMI PROGYASHREE, TALUKDAR MADHUMITA, BORA T C, PHUKAN PRODEEP, SARMA J C : Chlorotrimethylsilane catalyzed synthesis of 1,3-diphenyl-2-propenones and their antimicrobial activities, *Comptes Rendus Chimie*, 2013, 16(5), p-442-450

5. TAMULY CHANDAN, HAZARIKA MOUSHUMI, BORA JAYANTA, GAJUREL P R : Antioxidant activities and phenolic content of *Piper wallichii* (Miq.) Hand.-Mazz., *International Journal of Food Properties*, 2014, 17 p-309-320

6. TAMULY C, HAZARIKA MOUSHUMI, BORDOLOI M J, DAS M R : Photocatalytic activity of Ag nanoparticles synthesized by using *Piper pedicellatum* C.DC. fruits, *Materials Letters*, 2013, 102-103 p-1-4

7. BARUAH SANTANU, BARUAH S, KAYAL J R : State of tectonic stress in Northeast India and adjoining south Asia region: An appraisal, *Bulletin of the Seismological Society of America*, 2013, 103(2A), p-894-910

8. BEZBORUAH P, GOGOI P, GOGOI J, BORUAH R C : KF/Al2O3/PEG-400: An Efficient Catalytic System for the Fiesselmann-Type Synthesis of Thiophene Derivatives, *Synthesis*, 2013, 45(10), p-1341-1348

9. DEVI THONGAM JOYMATI , SAIKIA BISHWAJIT, BARUA N C : A stereocontrolled route to d-ribo-phytosphingosine and sphinganine from an achiral secondary homoallylic alcohol using Sharpless kinetic resolution, *Tetrahedron*, 2013, 69(19), p-3817-3822

10. RADHAPYARI KEISHAM, KOTOKY P, DAS M R, KHAN RAJU : Graphene-polyanilinen anocomposite based biosensor for detection of antimalarial drug artesunate in pharmaceutical formulation and biological fluids, *Talanta*, 2013, 111 p-47-53

11. SAIKIA BINOY K, SARMAH MRIDUSMITA, KHARE PUJA, BARUAH B P : Investigation on inorganic constituents in Indian coal and emission characteristics of the particulates (PM2.5 and PM10), *Energy Exploration & Exploitation*, 2013, 31(2), p-287-315

12. BAISHYA GAKUL, SARMAH BARNALI, HAZARIKA NABAJYOTI : An Environmentally Benign Synthesis of Octahydro-2H-chromen-4-ols via Modified Montmorillonite K10 Catalyzed Prins Cyclization Reaction, *Synlett*, 2013, 24(9), p-1137-1141

13. ADEBAYO E A, OLOKE J K, YADAV A, BAROOAH M, BORA T C : Improving yield performance of Pleurotuspulmonarius through hyphal anastomosis fusion of dikaryons, *World Journal of Microbiology and Biotechnology*, 2013, 29 p-1029-1037

14. BAYON GAKUL K : Riverbank scours and its sciences - reveal from the study of flood problems pertaining to mighty river Brahmaputra, International Journal of Civil, Structural, *Environmental and Infrastructure Engineering Research and Development*, 2013, 3(1), p-79-98

15. YADAV V, BARUAH B P, KHARE P : Comparative study of thermal properties of bio-coal from aromatic spent with low rank sub-bituminous coals, *Bioresource Technology*, 2013, 137 p-376-385

16. SHARMA SANGEETA, BARUAH S, SAHU O P, BORA P K, DUARAH R : Low b-value prior to the Indo-Myanmar subduction zone earthquakes and precursory swarm before the May 1995 M 6.3 earthquake**,** *Journal of Asian Earth Sciences*, 2013, 73 p-176-183

17. BISWAS RAJIB, BARUAH S, BORA DIPOK KUMAR : Influence of attenuation and site on microearthquakes' spectra in Shillong region, of northeast, India: A case study, *Acta Geophysica*, 2013, 61(4), p-886-904

18. DUTTA MUDOI K, SAIKIA S P, GOSWAMI ADRITA, GOGOI ANIMESH, BORA DEBASHISH, BORTHAKUR M P : Micropropagation of important bamboos: A review, *African Journal of Biotechnology***,** 2013, 12(20), p-2770-2785

19. BURAGOHAIN PORI, SAIKIA PARTHA PROTIM, BARUA N C : A solvent-free method for the direct synthesis of Cbz-protected β-amino ketones using triphenylphosphine dibromide, *Tetrahedron Letters*, 2013, 54(27), p-3562-3564

20. BARUAH BARSHA, MISHRA MRIDUSMITA, BHATTACHARJEE CHIRA R, NIHALANI MOOL C, MISHRA SANTOSH K, BARUAH S D, PHUKAN PARAN, GOSWAMEE R L : The effect of particle size of clay on the viscosity build up property of mixed metal hydroxides (MMH) in the low solid-drilling mud compositions, *Applied Clay Science*, 2013, 80-8 p-169-175

21. GOSWAMIA ABHISHEK, SAIKIA PARTHA P, SAIKIA BISHWAJIT, BARUA N C, SAXENA AJIT K, SURI NITASHA, SHARMA MADHUNIKA, BAISHYA GAKUL : Synthesis of a novel series of highly functionalized Baylis-Hillman adducts of artemisinin with potent anticancer activity, *Tetrahedron Letters*, 2013, 54(32), p-4221-4224

22. DAS SARMA SAIKAT, PAHARI PALLAB, HAZARIKA SWAPNALI, HAZARIKA PARASA, BORAH MANASH JYOTI, KONWAR D : Aluminium(III) chloride hexahydrate: an efficient and versatile reagent in organic synthesis , *ARKIVOC*, 2013(i), p-243-263

23. SHARMA PONCHAMI, DARABDHARA GITASHREE, REDDY TALLAPAREDDY MURALIKRISHNA, BORAH ASHWINI, BEZBORUAH PRANJAL, GOGOI PRANJAL, HUSSAIN NAJRUL, SENGUPTA P, DAS M R : Synthesis, characterization and catalytic application of Au NPs-reduced graphene oxide composites material: An eco-friendly approach, *Catalysis Communication*, 2013, 40 p-139-144

24. SARMAH M M, BHUYAN D, PRAJAPATI D : An Efficient and Facile Synthesis of Iminoquinazolinedione Derivatives by Solid-State Diels-Alder Reaction under Catalyst-Free Conditions, *Synlett*, 2013, 24(13), p-1667-1670

25. GOGOI P, BEZBORUAH P, BORUAH R C : Ligand-free suzuki cross-coupling reactions: Application to β-halo-α, β -unsaturated aldehydes, *European Journal of Organic Chemistry*, 2013, (23), p-5032-5035

26. TAMULY C, HAZARIKA M, BORDOLOI M : Biosynthesis of Au nanoparticles by *Gymnocladus assamicus* and its catalytic activity, *Materials Letters*, 2013, 108 p-276-279

27. DUARAH A, GOSWAMI A, BORA T C, TALUKDAR M, GOGOI B K : Erratum to: Enantioconvergent Biohydrolysis of Racemic Styrene Oxide to R-phenyl-1, 2-ethanediol by a Newly Isolated Filamentous Fungus *Aspergillus tubingensis* TF1, *Applied Biochemistry and Biotechnology*, 2013, 170(8), p-1965-1973

28. PAYUM TEMIN, DAS A K, RAMASHANKAR R, TAMULY C, HAZARIKA M : Ethnobotany and antioxidant

determination of *Phobe cooperiana* fruit - a highly utilized wild fruit in Arunachal Pradesh, India, *International Journal of Pharmaceutical Sciences and Research*, 2013, 4(8), p-3196-3201

29. DEVARAPALLI R R, KASHID R V, DESHMUKH A B, SHARMA PONCHAMI, DAS M R, MORE M A, SHELKE M V : High efficiency electron field emission from protruded graphene oxide nanosheets supported on sharp silicon nanowires, *J Materials Chemistry C*, 2013, C1(33), p-5040-5046
30. SAIKIA BINOY K, KAKATI NILAKSHI, KHOUND KAKOLI, BARUAH B P : Chemical kinetics of oxidative desulphurisation of Indian coals, International J Oil, *Gas and Coal Technology*, 2013, 6(6), p-720-727
31. SINGH S P, GOGOI D, BEZBARUAH R L, BORDOLOI M J, BARUA N C : Virtual screening on potential neuraminidase inhibitors of influenza A virus H^1N^1, *Drug Invention Today*, 2013, 5(3), p-241-245
32. TAMULY C, HAZARIKA M, DEBNATH R, SAIKIA R, BORDOLOI M J, BORAH J, DAS M R : Effect of CTAB in biosynthesis of Au-nanoparticles using *Gymnocladus assamicus* and its biological evaluation, *Materials Letters*, 2013, 113 p-103-106
33. ERTELEVA OLGA, APTIKAEV FELIX, BARUAH S, BARUAH SANTANU, DEB SAJAL K, KAYAL J R : Seismic treatment for a maximal credible earthquake in Guwahati city area of northeast India region, *Natural Hazards*, 2014, 70(1), p-733-753
34. DEBNATH RAJAL, SAIKIA R, SARMA RUPAK K, YADAV A, BORA T C, HANDIQUE PRATAP J : Psychrotolerant antifungal Streptomyces isolated from Tawang, India and the shift in chitinase gene family, *Extremophiles*, 2013, 17(6), p-1045-1059
35. DEVI THONGAM JOYMATI, SAIKIA BISHWAJIT, BARUA N C : First stereoselective total synthesis of triumfettamide, *Tetrahedron*, 2013, 69(45), p-9457-9462
36. SHEKARRAO K, NATH D, KAISHAP P P, GOGOI S, BORUAH R C : Palladium-catalyzed multi-component synthesis of steroidal A- and D-ring fused 5,6-disubstituted pyridines under microwave irradiation, *Steroids*, 2013, 78(11), p-1126-1133
37. BORAH BIBEK J, BORAH SUBRAT J, SAIKIA KOKIL, DUTTA D K : Efficient Suzuki-Miyaura coupling reaction in water: Stabilized Pdo-Montmorillonite clay composites catalyzed reaction, *Applied Catalysis. A General*, 2014, 469 p-350-56
38. GOGOI P, BEZBORUAH P, GOGOI JUNALI, BORUAH R C : ipso-Hydroxylation of arylboronic acids and boronate esters by using sodium chlorite as an oxidant in water, *European Journal of Organic Chemistry*, 2013, 32 p-7291-7294
39. OLA I O, UNNI B G, OLOKE J K, BORDOLOI A K : Morphological, ultrastructural and molecular variability studies of wild and mutant strains of edible Pleurotus species using growth yield, scanning electron microscopy and random amplified polymorphic DNA polymerase chain reaction (RAPD-PCR), *African Journal of Microbiology Research*, 2013, 7(43), p-5057-5065
40. SAIKIA KOKIL, DEB BISWAJIT, DUTTA D K : Synthesis of cationic rhodium(I) and iridium(I) carbonyl complexes of tetradentate $P/(CH_2CH_2PPh_2)_3$ ligand: An implication of steric inhibition and catalytic hydroformylation reaction, *J Molecular Catalysis A: Chemical*, 2014, 381 p-188-193
41. SARMAH PODMA POLLOV, DUTTA D K : Stabilized Rhº-nanoparticles-Montmorillonite clay composite: Synthesis and Catalytic Transfer Hydrogenation reaction, *Applied Catalysis A General*., 2014, 470 p--355-360
42. BORAH PALLABY, NAIDU P SEETHAM, MAZUMDER SWARUP, BHUYAN P J : An efficient one-pot three component reaction for the synthesis of novel functionalized pyrano [3,2-c] coumarins catalyzed by Na_2CO_3 in aqueous medium, *RSC Advances*, 2013, 3 p-20450

43. GOGOI JUNALI, GOGOI PRANJAL, BEZBARUAH PRANJAL, BORUAH R C : Microwave-assisted Pd-catalyzed synthesis of fused steroidal and non-steroidal pyrimidines from â-halo-á,â-unsaturated aldehydes, *Tetrahedron Letters*, 2013, 54 p-7136-7139
44. OLIVEIRA M L S, MAROSTEGA F, TAFFAREL S R, SAIKIA BINOY KUMAR, WAANDERS FB, DABOIT K, BARUAH B P, SILVA L F O : Nano-mineralogical investigation of coal and fly ashes from coal-based captive power plant (India): An introduction of occupational health hazards, *Science of Total Environment*, 2014, 46-469(January), p-1128-1137
45. BORAH P, BHUYAN P J : Synthesis of some novel spiro substituted pyrido[2,3-c]coumarins by exploring 'tertiary amino effect' reaction strategy, *Tetrahedron Letters*, 2013, 54 p-6949-6951
46. MAJUMDER S, SHARMA M, BHUYAN P J : Microwave promoted diastereoselective synthesis of dihydroindeno[1,2-b]furans via one-pot three-component reaction in solvent-free conditions, *Tetrahedron Letters*, 2013, 54 p-6868-6870
47. BISWAS RAJIB, BARUAH S, BORA D K, KALITA A, BARUAH S : The Effects of Attenuation and Site on the Spectra of Microearthquakes in the Shillong Region of Northeast India, *Pure and Applied Geophysics*, 2013, 170(11), p-1833-1848
48. SHARMA PONCHAMI, HUSSAIN NAJRUL, BORAH DIPANKAR J, DAS M R : Kinetics and adsorption behavior of the methyl blue at the graphene oxide / reduced graphene oxide nanosheet - water interface : a comparative study, *J Chemical Engineering Data*, 2013, 58 p-3477-3488
49. TAMULY C, DUTTA P P, BORDOLOI M, BORA JAYANTA : Antifungal and antioxidant pyrrole derivative from *Piper pedicellatum*, *Natural Product Communications*, 2013, 8(10), p-1451-1454
50. DUTTA S, MORANG P, NISHANTH KUMAR S, DILEEP KUMAR B S : Fusarial wilt control and growth promotion of pigeon pea through bioactive metabolites produced by two plant growth promoting rhizobacteria, *World Journal of Microbiology and Biotechnology*, 2014, 30(3), p-1111-1121
51. FELLAHI Q, SARMA RUPAK K, DAS M R, SAIKIA R, MARCON LIONEL, COFFINIER YANNICK, HADJERSI TOUFIK, MAAMACHE MUSTAPHA, BOUKHERROUB RABAH : The antimicrobial effect of silicon nanowires decorated with silver and copper nanoparticles, *Nanotechnology*, 2013, 24(49), p-495101(7pp)
52. ADARSH N, SHANMUGASUNDARAM M, RAMAIAH D : Efficient reaction based colorimetric probe for sensitive detection, quantification, and on-site analysis of nitrite ions in natural water resources, *Analytical Chemistry*, 2013, 85(21), p-10008-10012
53. SARMA JYOTIRMOY, MAHIUDDIN S : Comparative adsorption involving ortho- and para-hydroxybenzoic acids in mixed-adsorbate mode onto ?-alumina surface: Effect of molecular structure, *J Environmental Chemical Engineering*, 2014, 2 p-90-99
54. SAIKIA BINOY K, WARD COLIN R, OLIVEIRA MARCOS L S, HOWER JAMES C, BARUAH B P, BRAGAC MARCEL, SILVA LUIS F : Geochemistry and nano-mineralogy of two medium-sulfur northeast Indian coals, *International Journal of Coal Geology*, 2014, 121(January), p-24-36
55. KAKATI DWIPEN, BARUA N C : Total synthesis and assignment of the absolute stereochemistry of xanthoangelol J: development of a highly efficient method for Claisen-Schmidt condensation, *Tetrahedron*, 2014, 70(3), p-637-642
56. KHAN RAJU, SAINI K K, DHAYAL MARSHAL : High Sensitivity Electrochemical Immunosensor Based on Plasma Modified TiO_2 / Chitosan for Ochratoxin-A Detection, *Advanced Electrochemistry*, 2014, 1(2), p-1-5
57. BURAGOHAIN PORI, SAIKIA BISHWAJIT, SURINENI NARESH, BARUA N C, SAXENA AJIT K, SURI NITASHA : Synthesis of a novel series of artemisinin dimers with potent anticancer activity involving Sonogashira cross-coupling reaction, *Bioorganic Medicinal Chemistry Letters*, 2014, 24 p-237-239

58. MAJUMDER SWARUP, BORAH PALLABI, BHUYAN P J : An efficient and regioselective one-pot multi-component synthesis of pyrimido[4,5-d]pyrimidine derivatives in water, *Tetrahedron Letters*, 2014, 55(6), p-1168-1170

59. ADEBAYO E A, OLOKE J K, AZEEZ M A, OMOMOWO I O, BORA T C : Assessment of the genetic diversity among ten genotypes of Pleurotus (oyster mushroom) using nutrient and mineral compositions, *Scientia Horticulturae*, 2014, 166 p-59-64

60. BORAH BIBEK JYOTI, BORAH SUBRAT JYOTI, SAIKIA LAKSHI, DUTTA D K : Efficient One-pot Three-Components Coupling Reactions Catalyzed by Cuo-nano-particles stabilized on Modified Montmorillonite Clay, *Catalysis Science Technology*, 2014, 4 p-1047-1054

61. BHUYAN DIGANTA, MALAKAR BANAJIT, ARBUJ SUDHIR S, SAIKIA LAKSHI : Flower shaped homocentric pencil like ZnO nanorod bundles : synthesis, characterization and study of their photocatalytic activity, *RSC Advances*, 2014, 4 p-8256-8259

62. BHUYAN DEBAJYOTI, SARMA RUPAM, DOMMARAJUA YUVARAJ, PRAJAPATI D : Catalyst- and solvent-free, pot, atom and step economic synthesis of etrahydroquinazolines by an aza-Diels-Alder reaction strategy, *Green Chemistry*, 2014, 16 p-1158-62

63. NAIDU P SEETHAM, BHUYAN P J : A novel one-pot three-component reaction for the synthesis of 5-arylamino-pyrrolo[2,3-d]pyrimidines under microwave irradiation, *RSC Advances*, 2014, 4 p-9942-9945

64. KAKATI DWIPEN, BARUA N C : Total synthesis and assignment of the absolute stereochemistry of xanthoangelol J: Development of a highly efficient method for Claisen-Schmidt condensation Dedicated to Late (Dr.) Jadab C. Sarma on his 55th birthday on first May 2013, *Tetrahedron*, 2014, 70(3), p-637-642

65. RAJESH NIMMAKURI, SARMA RUPAM, PRAJAPATI D : Microwave-promoted regio- and stereoselective vinylation of heterocyclic thiols, *RSC Advances*, 2014, 4 p-7834-7837

66. YENN R, BORAH M, DEKA BORUAH H P, SARMA ROY A, BARUAH R, SAIKIA N, SAHU O P, TAMULI A K : Phytoremediation of Abandoned Crude Oil Contaminated Drill Sites of Assam with the Aid of a Hydrocarbon-Degrading Bacterial Formulation, *International Journal of Phytoremediation*, 2014, 16(9), p-909-925

67. DEBNATH R, SARMA R K, SAIKIA R, YADAV A, BORA T C : Metagenomics: A hunting expedition in microbial diversity (Chapter) , *Molecular Biology of Bacteria*, 2013, p-19-30

68. SAIKIA BINOY K, DUTTA ARJU M, BARUAH B P : Feasibility studies of de-sulfurization and de-ashing of low grade medium to high sulfur coals by low energy ultrasonication, *Fuel*, 2014, 123 p-12-18

69. KAISHAP PARTHA PRATIM, SHEKARRAO KOMMURI, SAIKIA PALLABI, GOGOI SANJIB, BORUAH R C : A facile synthesis of benzo[b][1,4]thiazepine derivatives by palladium acetate catalyzed reaction, *Tetrahedron Letters*, 2014, 55(11), p-1927-1930

70. TAMULY CHANDAN, HAZARIKA MOUSHUMI, DAS JADUMONI, BORDOLOI M J, BORAH DIPANKAR J, DAS M R : Bio-derived CuO nanoparticles for the photocatalytic treatment of dyes, *Materials Letters*, 2014, 123 p-202-205

71. BARUAH KUNDAN, HAZARIKA S : Separation of acetic acid from dilute aqueous solution by nano filtration membrane, *J Applied Polymer Science*, 2014, 131(15), p-40537

72. AMIN KARISHMA S, JAGADEESH SHANKAR, BAISHYA GAKUL, RAO P G, BARUA N C, BHATTACHARYA SAMIR, BANERJEE PARTHA P : A Naturally Derived Small Molecule Disrupts Ligand-Dependent and Ligand-Independent Androgen Receptor Signaling in Human Prostate Cancer Cells, *Molecular Cancer Therapeutics*, 2014, 13, p-341

73. SAIKIA BINOY KUMAR, KHOUND KAKOLI, BARUAH B P : Extractive de-sulfurization and de-ashing of high sulfur coals by oxidation with ionic liquids**,** *Energy Conservation and Management*, 2014, 81 p-298-305

74. SAIKIA S P, GOSWAMI ADRITA, GOSWAMI A, MUDOI K D, GOGOI A, KOTOKY R, LEKHOK HIMANGSHU, HANDIQUE NABANITA : Effect of 2,4-D treatment and Azospirillum inoculation on growth of *Cymbopogon winterianus*, *African Journal of Microbiology Research*, 2014, 8(9), p-955-960

75. SARMAH M M, BHUYAN D, PRAJAPATI D : Microwave promoted efficient synthesis of benzo[h]quinolines by solvent free three component imino-Diles-Alder under one pot conditions, *Synlett*, 2013, 24(17), p-2245-2248

76. DUARAH A, GOSWAMI A, BORA TC, TALUKDAR M, GOGOI BK : Enantioconvergent Biohydrolysis of Racemic Styrene Oxide to R-phenyl-1,2-ethanediol by a New Isolated Filamentous Fungus *Aspergillus tubingensis* TF1 (vol 170, pg 1965, 2013), *Applied Biochemistry and Biotechnology*, 2013, 171(1), p-261

77. AMIN K, JAGADEESH S, BARUA N, BHATTACHARYA S, BANERJEE PP : A novel natural product disrupts androgen receptor signaling in prostate cancer cells, *Cancer Research*, 2013, 73 (8), p-Suppl.1

78. SARMAH M M, PRAJAPATI D, HU W H : Synthesis of Novel and complex Tetrahydroquinazolinedione and Dihydropyrido[2,3-d]pyrimidine Derivatives via a One-Pot [4+2]-Cycloadddition Strategy, *Synlett*, 2013, 24(4), p-471-474

79. SAIKIA PRAKASH J, BARUAH SHASHI D: Synthesis of well-defined poly(*n*-hexadecyl methacrylate) via ATRP and reverse ATRP catalyzed by tris(2,2□-bipyridine)iron(III, *Polymer Bulletin, 2013, 70(12), 3291-3303*

80. P PHUKON, K RADHAPYARI, B K KONWAR, RAJU KHAN**,** "National Polyhydroxyalkanoate-Gold Nanocomposite Based Biosensor for Detection of Antimalarial Drug Artemisinin", *Materials Science and Engineering C* 37 (2014) 314-320

81. KEISHAM RADHAPYARI, RAJU KHAN**,** "Amperometric Immuno-sensor for Detection of Toxin Aflatoxin B1 based on Polyaninline Probe Modified with Mc-IgGs-a-AFB1 Antibodies" *Advances Nanomaterial Letters* (2014), inpress, 10.5185/amlett.2014.05562.

82. PRAKASH J. SAIKIA * AND SHASHI D. BARUAH, " Controlled radical polymerization of n- hexadecyl methacrylate medicated by tris (2,2'-bipyridine) iron (III) complexes" Polymer Bulletin, Germany, 3291-3303, 10.1007/s00289-2013-1022-0

Visitors

Assam Chief Minister Shri Tarun Gogoi visited CSIR-NEIST, Jorhat



Dr D Ramaiah, Director CSIR-NEIST (right) apprising the Hon'ble Chief Minister Shri Tarun Gogoi (left) about research activities and achievements of the institute.



Hon'ble Chief Minister Shri Tarun Gogoi (Centre) with Dr D Ramaiah, Director, CSIR-NEIST (on his right) and Dr T Goswami, head, CPP Division (on his left) during laboratory visit

On the last day of 2013, Hon'ble Chief Minister of Assam Shri Tarun Gogoi visited CSIR-NEIST, Jorhat. Shri Gogoi expressed extreme happiness over two of the CSIR-NEIST low cost affordable herbal ointments namely '*Anti-arthritis*' and '*Fungi-destruct*'. The Chief Minister visited round the institute and showed keen interest in the current R&D and societal activities.

His Excellency, Shri Ranjit Shekhar Mooshahary, Governor of Meghalaya visited CSIR-NEIST



His Excellency, Shri Ranjit Shekhar Mooshahary (2nd from right), Governor of Meghalaya, at the Interactive meeting held. Dr R C Boruah, Acting Director, CSIR-NEIST is seen at his left.



Shri Mooshahary visiting round the institute. He visited the institute on 01 April 2013.

Personnel

DIRECTOR (w.e.f. 09.10.13)

Dr D Ramaiah

ACTING DIRECTOR (upto 08.10.13)

Dr RC Boruah

Director's Secretariat

S. No.	Name	Designation	S. No.	Name	Designation
1	Mr N C Patra	PS	2	Ms Purnima Hazarika	Sr Steno
3	Mr P K Bordoloi	Driver	4	Mr Dinaram Baruah	Security Guard
5	Mr Bipin Dutta	Lab Attnd.	6	Mr Mantu Sarmah	Lab Attnd.

AGROTECHNOLOGY

Medicinal, Aromatic & Economic Plant

Dr N C Baruah, Chief Scientist, Area Coordinator

S. No.	Name	Designation	S. No.	Name	Designation
1	Dr P R Bhattacharyya	Ch. Sc. & Head	2	Dr S C Nath	Ch. Sc.
3	Dr P Baruah	Ch. Sc.	4	Dr (Mrs) Mina Barthakur	Sr. Principal Sc.
5	Dr B S Bhau	Principal Sc.	6	Dr S P Saikia	Scientist
7	Dr M Bhuyan	Scientist	8	Dr Mohan Lal	Scientist
9	Dr A K Bordoloi	Principal T.O.	10	Mrs J Hazarika	Principal T.O.
11	Mr M Rahman	Sr.T.O.	12	Dr (Mrs) K Dutta	T.O.
13	Mrs R Kotoky	T.O.	14	Mr S Chanda	T.O.
15	Mr H Lekhak	T.O.	16	Mr N N Bora	Sr Technician
17	Mr Nogen Borah	Lab Astt.	18	Mr Phatik Bora	Lab Astt.
19	Mr S N Kalita	Lab Astt.	20	Mr Mahendra Gogoi	Lab Astt.
21	Mr Baba Saikia	Lab Astt.	22	Mr Dineswar Saikia	Lab Astt.
23	Mr Ramu naik	Lab Astt.	24	Mr Jiten Ch Maharang	Lab Astt.
25	Mr Deben Kalita	Lab Astt.	26	Mr Bhola Naik	Lab Astt.
27	Mr Nomal Dutta	Lab Astt.	28	Mr Debajit Sharma	Group D
29	Mr Pradip Das	Group D	30	Mr Sushil Gayan	Group D
31	Mrs PJD Bhuyan	Sr.T.O.			

Floriculture

S. No.	Name	Designation	S. No.	Name	Designation
1	Dr Dipul Kalita	Scientist	2	Mr Suren Bora	Sr. Technichian
3	Mr P Saikia	Lab. Astt.	4	Mr Hiteswar Saikia	Lab. Astt.
5	Mr Naren Saikia	Lab. Astt.	6	Mr Bhogeswar Gogoi	Lab. Astt.
7	Mr Bipul Saikia	Lab. Attnd.	8	Mr Lakheswar Hazarika	Lab. Attnd.
9	Mr Dimbeswar Dutta	Lab. Attnd.	10	Mr Naren Gogoi	Lab. Attnd.

BIOLOGICAL SCIENCES

Dr BG Unni, Chief Scientist, Area Coordinator

Biotechnology

S. No.	Name	Designation	S. No.	Name	Designation
1	Dr T C Bora	Ch. Sc. & Head	2	Dr S B Wann	Principal Sc.
3	Dr H P Dekabaruah	Principal Sc.	4	Dr Ratul Saikia	Sr. Scientist
5	Dr M Khongsai	Scientist	6	Dr Jatin Kalita	Scientist
7	Dr Anil K Singh	Scientist	8	Mr A K Sarmah	Principal T.O.
9	Mr A C Kakoty	Sr. T.O.	10	Ms Archana Yadav	T.O.
11	Ms Polakshi Bordoloi	T.O.	12	Mr Tapan bora	Group D

CHEMICAL SCIENCES

Dr RC Boruah, Outstanding Scientist, Area Coordinator

Analytical Chemistry

S. No.	Name	Designation	S. No.	Name	Designation
1	Dr Prabhat Katoky	Ch. Sc. & Head	2	Dr R K Boruah	Ch. Scientist
3	Dr Raju Khan	Sr. Scientist	4	Dr P J Saikia	Scientist
5	Mrs L Borah	Principal T.O.	6	Mr O P Sahu	Principal T.O.
7	Mr P P Khound	T.O.	8	Mrs Ankana Phukan	Tech. Astt.
9	Mr D K Phukan	Sr. Technician	10	Mr J M Baruah	Technician
11	Mr Chandra K Pathak	Lab Astt.	12	Mr Debajit Sharma	Lab Attnd.

Medicinal Chemistry

S. No.	Name	Designation	S. No.	Name	Designation
1	Dr R C Boruah	Outstanding Scientist	2	Dr Dipak Prajapati	Ch.Sc. & Head
3	Dr Pulak J Bhuyan	Principal Sc.	4	Dr Pranjal Gogoi	Scientist
5	Dr Sanjib Gogoi	Scientist	6	Dr Harsha N Borah	Principal T.O.
7	Mr Kushal Ch Lekhok	Sr. T.O.	8	Mr Makhon Bora	Lab Astt.
			9	Mr Jiten Ch. Sadar	Group D

Natural Products Chemistry

S. No.	Name	Designation	S. No.	Name	Designation
1	Dr N C Barua	Ch. Sc. & Head	2	Dr P K Chowdhury	Ch. Scientist
3	Dr M J Bordoloi	Sr. Principal Sc.	4	Dr D K Dutta	Sr. Scientist
5	Dr Archana M Das	Scientist	6	Dr Gokul Baishya	Scientist
7	Dr UM Dhanalekshmi	Scientist	8	Dr Jyotirmoy Ghosh	Scientist
9	Ms Pritismita Borah	Tech. Astt.	10	Mrs Rumi Borah	Technician
11	Mr B C Borah	Lab Attnd.	12	Mr Romen saikia	Group D

Synthetic Organic Chemistry

S. No.	Name	Designation	S. No.	Name	Designation
1	Dr Dilip Konwar	Ch. Sc. & Head	2	Dr A Goswami	Ch. Scientist
3	Dr Pallab Pahari	Scientist	4	Mr R N Das	T.O.
5	Mr Manas J Borah	Tech. Astt.	6	Mr Debeswar Borah	Tech. Astt.

Petroleum & Natural Gas

S. No.	Name	Designation	S. No.	Name	Designation
1	Dr S D Baruah	Ch. Sc. & Head	2	Dr A Borthakur	Sr. Principal Sc.
3	Mr A Gautam	Scientist	4	Mr N C Laskar	Principal T.O.
5	Mr A Sarmah	Sr T. O.	6	Mr R C Bohra	Tech. Ast t.
7	Mr L Phukan	Technician	8	Mr R K Baruah	Lab Astt.

ENGINEERING SCIENCES

Applied Civil Engineering

S. No	Name	Designation	S. No	Name	Designation
1	Mr Sanjay Deori	Sr. Sc. & Head	2	Mr Tapas Das	Sr. Scientist
3	Mr Dipak Basumatari	Scientist	4	Mrs Anjumoni Bharali	Principal T.O.
5	Mr Nibir Pran Borah	Tech. Astt.	6	Mr Rajib Das	Tech. Astt.
7	Ms Ranju Borah	Sr. Technician	8	Mr Tileswar Das	Lab Astt.
9	Mr Prafulla Ch. Kalita	Lab Astt.	10	Mr Lobo Bora	Lab Attnd.

Chemical Engineering

S.No	Name	Designation	S.No	Name	Designation
1	Dr P Barkakati	Ch. Sc. & Head	2	Dr (Mrs) A Goswami	Sr.Principal Sc.
3	Dr (Mrs)S Hazarika	Scientist	4	Mr Bipul Das	Scientist
5	Dr M M Bora	Principal T.O.	6	Mr S Borthakur	Sr.T.O.
7	MrTobiul H Ahmed	Tech. Astt.	8	Mr R C Dutta	Lab Attnd.

General Engineering

S. No	Name	Designation	S. No	Name	Designation
1	Mr S C Kalita	Sr Principal Sc. & Head	2	Mr Jayanta J Bora	Principal Sc.
3	Mr Dipankar Neog	Scientist	4	Mr Basanta Sarma	Sr. T.O.
5	Mr Ajay Borkatoky	Sr. T.O.	6	Mr Ashok Kalita	Tech. Astt.

Workshop

S. No	Name	Designation	S. No	Name	Designation
1	MrRameshwar Saikia	Sr. Technician	2	Mr Mondip Baruah	Sr. Technician
3	Mr Tuledhar Bora	Technician	4	Mr Manas Hazarika	Technician
5	Mr Manas Shyam	Technician	6	Ms Archana Changmai	Technician
7	Mr Bimal Ch Dutta	Lab Astt.	8	Mr Domai Rohi Das	Lab Astt.
9	Mr Robin Ch Bhuyan	Lab Astt.	10	Mr Atul Borah	Lab Astt.
11	Mr Arup Neog	Lab Astt.			

Electrical

S. No	Name	Designation	S. No	Name	Designation
1	Mr Dilip Mahanta	Sr. T. O.	2	Mr Makhon Borah	T. O.
3	Mr M C Borah	Technician	4	Mr Lalit Chutia	Technician
5	Mr Somenath Borah	Technician	6	Mr Arun Kalita	Technician
7	Mr Ananta Kr Baruah	Technician	8	Mr Moheswar Ligira	Technician
9	Mr Siba Kanta Borah	HAG			

Glass Blowing

S. No	Name	Designation
1	Mr Chiranjeeb Bora	Technician

Refrigeration & Air Conditioning

S. No	Name	Designation
1	Mr Jintu Bora	Sr Technician

Vehicle Section

S. No	Name	Designation	S. No	Name	Designation
1	Mr B N D Phukan	Sr.Technician	2	Mr B C Bora	Sr.Technician
3	Mr Arun Sarma	Sr.Technician	4	Mr Sondhar Neog	Sr.Technician
5	Mr Dhaneswar Bora	Sr.Technician	6	Mr Aju Gowala	Sr.Technician
7	Mr Chandradhar Tamuli	Lab Astt.	8	Mr Sarat Ch Boruah	Lab Assistant
9	Mr Thaneswar Koch	Lab Attendant	10	Mr Pumkanta Bora	Lab Attendant
11	Mr Hemanta Sonowal	Driver	12	Mr Poresh Ch Borah	Driver
13	Mr Rupeawar Chetia	Driver	14	Mr Mr Jadav Dutta	HAG

Instrumentation

S. No	Name	Designation	S. No	Name	Designation
1.	Mr Khirod Buragohain	Scientist & Head	2.	Mr Panchanan Baruah	Principal T.O.
3.	Mr Nilim Kr. Neog	Principal T. O.	4.	Mr Prasad Hazarika	Sr. Technician
5.	Mr Jagat Borah	Technician	6.	Mr Chandan Boruah	Technician
7.	Mr Ananda Saikia	Group I			

Civil Engineering

S. No	Name	Designation	S. No	Name	Designation
1.	Mr Vaskar Rajkhowa	Sr. T.O.	2.	Mrs Jonali Saikia	T.O.
3.	Mr M K Das	T. O.	4.	Mr Mukesh Kr Agarwal	Tech. Assistant
5.	Mr Nakul Saikia	Technician	6.	Mr Gurucharan Rahi Das	Lab Astt.
7.	Mr Rohit Borah	Group I			

Laboratory Maintenance

S. No	Name	Designation	S. No	Name	Designation
1.	Mr Rajat Saikia	Group D	2.	Mr Lilaram Gondhia	Lab Attnd.
3.	Mr Mohesh Basfore	Sweeper	4.	Mr Sagar Balmiki	Sweeper
5.	Ms Panpati Basfore	Sweeper			

Lake& Main Pump House

S. No	Name	Designation	S. No	Name	Designation
1.	Mr Nogen Ch Bora	Technician	2.	Mr Rajendra Nath Bora	Technician
3.	Mr Mathura Soud	Lab Astt.	4.	Mr Krishna Hazarika	Lab Astt.
5.	Mr Rameswar Das	Lab Attnd.	6.	Mr Rakhal Nayak	Lab Attnd.
7.	Mr Jiten Ch Baruah	Lab Attnd.	8.	Mr Pradip Ch Saikia	Non Tech

GEOSCIENCES

Dr R Duarah, Chief Scientist, Area Coordinator

Geoscience

S. No	Name	Designation	S. No	Name	Designation
1	Dr Saurabh Baruah	Sr. Principal Sc. & Head	2	Dr P K Borah	SrPrincipal Sc.
3	Dr Manoj K Phukan	Scientist	4	Ms Sangeeta Sarma	Scientist

5	Mr Bijit K Chaudhury	Scientist	6	Dr Santanu Baruah	Scientist
7	Mr Gobin Ch Borah	Principal T.O.	8	Mr Mukul Borkataky	Principal T.O.
9	Mr K C Deori	Principal T.O.	10	Mr Bharat Buragohain	T.O.
11	Mr Pabitra P Sarma	T.O.	12	Mr Paresh Kalita	T.O.
13	Mr Pradip Dutta	T.O.	14	Mr S M Bhattacharyya	Tech. Astt.
15	Mr Ajit Kr Hazarika	Sr. Technician	16	Mr Ram Kumar Bora	Sr. Technician
16	Mr Ram Kumar Bora	Sr. Technician	17	Mr Dilip Kr Pathak	Sr. Technician
18	Mr Arup Saikia	Technician	19	Mr Manoj Das	Lab Astt.

MATERIALS SCIENCES

Dr Pinaki Sengupta, Area Coordinator

Materials Science

S. No	Name	Designation	S. No	Name	Designation
1	Dr Pinaki Sengupta	Ch. Sc. & Head	2	Dr Sekh Mahiuddin	Ch. Sc.
3	Dr Dipak Kr Dutta	Ch. Sc.	4	Dr R L Goswamee	Sr.Principal Sc.
5	Dr Manash R Das	Scientist	6	Dr Lakshi Saikia	Scientist
7	Mr Dipok Kr Bordoloi	Principal T.O.	8	Dr Bibek Jyoti Borah	Tech. Astt.
9	Mr Priyam Jyoti Bora	Technician	10	Mr Paran Jyoti Kalita	Technician
11	Mr Moneswar Saikia	Lab Attnd.	12	Mr Nogen Gogoi	Lab Attnd.
13	Mr Krishna Pr Sharma	Group C			

Cellulose Pulp & Paper

S. No	Name	Designation	S. No	Name	Designation
1	Dr Tridip Goswami	Principal Sc. & Head	2	Dr Dipul Kalita	Scientist
3	Mr Dipanka Dutta	Tech. Astt.	4	Ms Puspa Kumari Das	Technician
5	Mr Deben Kalita	Lab Astt.	6	Mr Debeshwar Bora	Lab Astt.

Coal Chemistry

S. No	Name	Designation	S. No	Name	Designation
1	Dr B P Baruah	Principal Sc. & Head	2	Dr B K Saikia	Scientist
3	Dr P Saikia	Scientist	4	Dr U N Gupta	Scientist
5	Mr D K Dutta	Sr. T. O.	6	Mr T Das	Tech. Astt.
7	Mr H C Dutta	Sr. Technician	8	Mr P Handique	Technician
9	Mr A Borah	Technician	10	Mr P K Borah	Lab Astt.
11	Mr R Borchetia	Group C	12	Mr B Neog	Group C
13	Mr D Talukdar	Group C	14	Mr K Kalita	Group C
15	Mr B Saikia	Lab Attnd.			

MANAGEMENT SCIENCES

Dr R C Boruah, Outstanding Scientist, Area Coordinator

Human Resource Development

S. No	Name	Designation	S. No	Name	Designation
1.	Dr L Nath	Ch. Sc. & Head	2.	Mr J J Mahanta	Scientist
3.	Mr Partha Paul	Scientist	4.	Ms Kuin Baruah	Sr. T.O.
5.	Mr Boloram Gayan	Lab Attnd.	6.	Mr Rishi Mahanta	Group C

Information & Business Development

S. No	Name	Designation	S. No	Name	Designation
1.	Dr R L Bezbaruah	Sr. Principal Sc. & Head	2.	Ms I Ilika Zhimo	Scientist
3.	Dr Dipanwita Banik	Scientist	4.	Mrs Pramila Majumdar	Scientist
5.	Mr Probin Baruah	Principal T.O.	6.	Mr Paresh Saikia	Sr.T.O.
7.	Mr P Kalita	Lab Attnd.	8.	Mr Rajit Gogoi	Lab Attnd.

Planning and Project Monitoring

S. No	Name	Designation	S. No	Name	Designation
1	Dr MC Kakati	Ch. Sc. & Head	2	Ms A Sengupta	Sr. Principal Sc.
3	Ms Kalyani Medhi	Scientist	4	Mr Rajib Deka	Scientist
5	Mr Debabrata Das	Scientist	6	Mr Madhujya Saikia	T.O.
7	Mr Bipul Baruah	Non Tech	8	Mr Atul Gayan	Lab Attnd.

INFRASTRUCTURE

Knowledge Resource Centre & Information & Computer Technology

S. No	Name	Designation	S. No	Name	Designation
1	Dr P K Barooah	Principal T.O.	2	Mr D Bhattacherjee	Tech As tt.
3	Mr Prodip Hazarika	Sr.Technician	4	Mr J Saikia	Technician
5	Mr Makhan Ch Borah	Lab Astt.	6	Mr Vokil Singh	Lab Astt.
7	Mr Jogen Sarmah	Lab Astt.	8	Mr Chandra Borah	Lab Attnd.
9	Mrs Protima Bora	Group D	10	Mr Biren Dash	Group D

Clinical Centre

S. No	Name	Designation	S. No	Name	Designation
1	Dr P K Baruah	Principal T.O.	2	Dr Thaneswar Borah	Sr. T.O.
3	Mr Romesh Bharali	Sr. T.O.	4	Mr Bipin Borah	Sr. Technician
5	Ms Minu Prava Pegu	Sr. Technician	6	Mr Suchan Ch Das	Sr. Technician
7	Ms Rinki Kalwar	Technician	8	Mrs N Niangmuanching	Technician
9	Mr Dibyajyoti Ozah	Technician	10	Mr Robin Baruah	Lab. Attendant

Laboratory Maintenance

S. No	Name	Designation	S. No	Name	Designation
1.	Mr Rajat Saikia	Group D	2.	Mr Lilaram Gondhia	Lab Attnd.
3.	Mr Mohesh Basfore	Sweeper	4.	Mr Sagar Balmiki	Sweeper
5.	Ms Panpati Basfore	Sweeper			

EXTENSION CENTERS

Branch Laboratory, Itanagar

S. No	Name	Designation	S. No	Name	Designation
1	Mr Chandan Tamuly	Sc. In-charge	2	Dr BC Baruah	Sr. T.O.
3	Mr J Bora	Sr. T.O.	4	Mr Amar Jyoti Gogoi	Tech. Astt.
5	Mr M Hazarika	Tech. Astt.	6	Mr H P Rai	Technician
7	Mr Tame Rajen	Group D	8	Mr Punya Yaro	Group D
9	Mr Tapi Tacho	Group D			

Branch Laboratory, Imphal

S. No	Name	Designation	S. No	Name	Designation
1	Dr HB Singh	Principal Sc. In-charge	2	Mr S Thokchom	Tech. Astt.
3	Ms N Abem Devi	Tech. Astt.	4	Ms C Buansing	Technician
5	Mr K Kumar Singh	Astt. Gr III	6	Mr S Binudhar Singh	Driver
7	Mr S Binudhar Singh	Driver	8	Mr Kh Ibochou Singh	Gr D
9	Mr M Thambou Singh	Lab Attnd.			

ISO:9001 SECRETARIAT

S. No	Name	Designation	S. No	Name	Designation
1	Dr P Sengupta	Chief Sc. & MR	2	Mr Amrit Saikia	Sr. Steno.
3	Mr Nageswar Singh	Lab Attnd.			

ADMINISTRATION

AO'S Office

S. No	Name	Designation	S. No	Name	Designation
1	Mr Vikram Singh	Admn. Officer	2	Mr Prakash Bordoloi	Sr. Steno.
3	Ms Radhika Chetri	Receptionist	4	Ms Minakshi Das	Group C
5	Mr Prodip Hazarika	Lab Attnd.			

Establishment

S. No	Name	Designation	S. No	Name	Designation
1	Mr N C Bora	S. O.	2	Mr Apul Phukan	Assistant
3	Mr B Mahriili Osanah	Assistant	4	Mr Prasanna kr Dutta	Sr. Technician
5	Mr Purna K Hazarika	Assistant	6	Mr Ratul Saikia	Assistant
7	Mr Ranjan Borah	Lab Attnd.	8	Mrs Hemokanti Kalita	Group C

General Section

S. No	Name	Designation	S. No	Name	Designation
1	Mr Santosh Kumar	S.O.	2	Mr Promod Goswami	Assistant
3	Mr P Goswami	Sr. Technician	4	Mr Naba Kumar Dutta	Group C
5	Mrs K Suseela Das	Lab Astt.	6	Mr Dulal Ch Sarmah	Lab Attnd.

Official Language Section

S. No	Name	Designation	S. No	Name	Designation
1	Ajay Kumar		2	Mrs Rita Patgiri	Assistant

Recruitment & Assessment Cell

S. No	Name	Designation	S. No	Name	Designation
1	Mr J L Khongsai	S. O.	2	Mr Lakheshwar Das	PS
3	Mr Ajit Chandra Dutta	Assistant	4	Mr Tulshi Dutta	Sr. Technician
5	Mr Dilip Dutta	Lab Attnd.	6	Mr Kiron Saikia	Lab Attnd.

Cash Section

S. No	Name	Designation	S. No	Name	Designation
1	Mr Dulal Sarmah	Assistant	2	Mr Rajani Pachani	S/G

Bill Section

S. No	Name	Designation	S. No	Name	Designation
1	Mr Jyotimoy Bhuyan	S.O. & DDO	2	Mrs Satya Prova Das	S.O.
3	Mr H Kr Borthakur	Assistant	4	Mr Nandeswar Das	Assistant
5	Mr Kunja Beha	Assistant	6	Mr Jogadhar Gayan	Sr. Technician
7	Mrs Suchitra Dutta	Group C	8	Mr Krishna Kanta Bora	Group C

Vigilance

S. No	Name	Designation	S. No	Name	Designation
1	Mr Bijoy Sarmah	Group C			

Canteen

S. No	Name	Designation	S. No	Name	Designation
1	Mr B Karmakar	Cook	2	Mr Amal Chandra Borah	Drafty
3	Mr Narayan Kurmi	Sweeper	4	Mr Durga Karmakar	Bearer
5	Mr Bipul Saikia	Bearer			

Finance and Accounts

S. No	Name	Designation	S. No	Name	Designation
1	Mr R S Sharma	F & AO	2	Mr Parag Patar	F & AO
3	Mr Priyam Mukherjee	S.O.	4	Mr Naveen Kr Sharma	S. O.
5	Ms Niroda Bora	Sr. Steno.	6	Mr Probin Kr Phukan	Assistant
7	Mr Probin Saikia	Assistant	8	Mr Arun Kumar Rajwar	Assistant
9	Mr Ajit Goswami	Assistant	10	Mr Khirud Phukon	Assistant
11	Late Rajat Ch Tamuly	Assistant	12	Mr Rabadhar Gayan	Sr. Technician
13	Mr Biren Borthakur	Lab Attnd.	14	Mr Arun Bora	Lab Attnd.
15	Mr Loknath Baruah	Lab Attnd.			

Stores and Purchase

S. No	Name	Designation	S. No	Name	Designation
1	Mr N S Prasad	S & P O	2	Mr Laljasei Misao	S. O.
3	Mr Prashad Chetri	S. O.	4	Mr Babul Saikia	Assistant
5	Mr Paresh Phukan	Assistant	6	Mr Prafulla Borah	Assistant
7	Mr John Ngaihte	Assistant	8	Mr Pradip Borah	Assistant
9	Mr Chandra D Dutta	Assistant	10	Ms Aleya Rahman	Sr. Technician
11	Ms Anjali Hati Baruah	Group C	12	Mr Puneswar Borah	Group C

Retired Staff

S. No	Name	Designation	Date of retirement
1	Mr Kamakhya Puzari	Sr Technical Officer	30.04.13
2	Dr Pratap Ch Sarmah	Sr Principal Scientist	31.05.13
3	Dr Promod Ch Neog	Chief Scientist	30.06.13
4	Mr Profulla Ch Borah	Assistant (G)	31.07.13
5	Mr J C Chetia	Private Secretary	31.08.13
6	Mr Bolen Gogoi	Peon	31.08.13
7	Mr Gonesh Ch Phukan	Lab Attendant	31.08.13
8	Mr Arun Ch Saikia	Sr Technician	30.09.13
9	Mr Rebadhar Gayan	Sr Technician	30.09.13
10	Mr Prafulla Ch Borah	Sr Technical Officer	30.09.13
11	Lt Kago Hinda	Watchman	31.10.13
12	Mrs Satya Prova Das	SO(G)	31.12.13
13	Mr Sarat Ch Baruah	Laboratory Assistant	31.12.13
14	Mr Nondeswar Das	Assistant (G)	31.12.13
15	Mr Nirmal Ch Gogoi	Sr Principal Scientist	31.12.13
16	Mr Ananta Kr Sarmah	Principal Technical Officer	31.01.14
17	Mr Bipin Ch Das	Lab Assistant	31.01.14
18	Mr Mohesh Basfor	Sweeper	31.01.14
19	Mr J C Baruah	Private Secretary	28.02.14