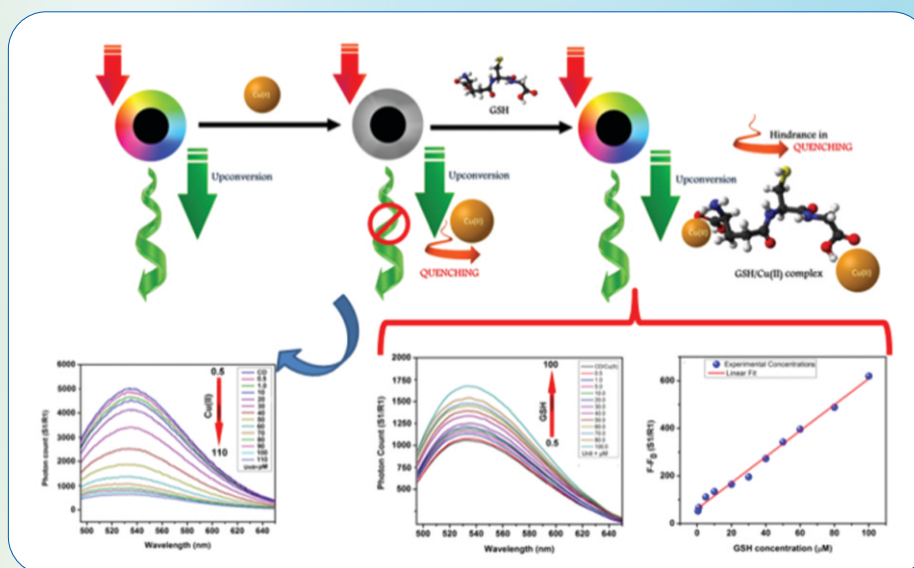


- ❖ A carbon dot based upconversion sensing platform was designed for selective estimation of GSH. Cu(II) has been utilized to quench upconversion emission of carbon dots. In presence of GSH, quenched emission is restored courtesy to prominent and selective complexation between GSH and Cu<sup>2+</sup> thereby providing quantitative estimation of GSH.



**Project Title:** Sustainable and biodegradable hybrid nano-composites as bio-integrated materials for advanced functional applications

**Project No:** GPP-286

**Funding Agency:** SERB-Department of Science & Technology (DST), Govt. of India

**PI & Members:** Dr Archana Moni Das (PI)

#### Objectives:

- ❖ Extraction of fiber from selected fiber bearing plants and insects of North East India using different methods for preparation of starting materials;
- ❖ Develop nano composite scaffolds and crosslink biodegradable polymers using natural polymer;
- ❖ Characterization of the synthesized products.

#### Salient Achievements:

- ❖ Synthesis of cellulose impregnated copper nanoparticles as an efficient heterogeneous catalyst for CeN coupling reactions under mild conditions



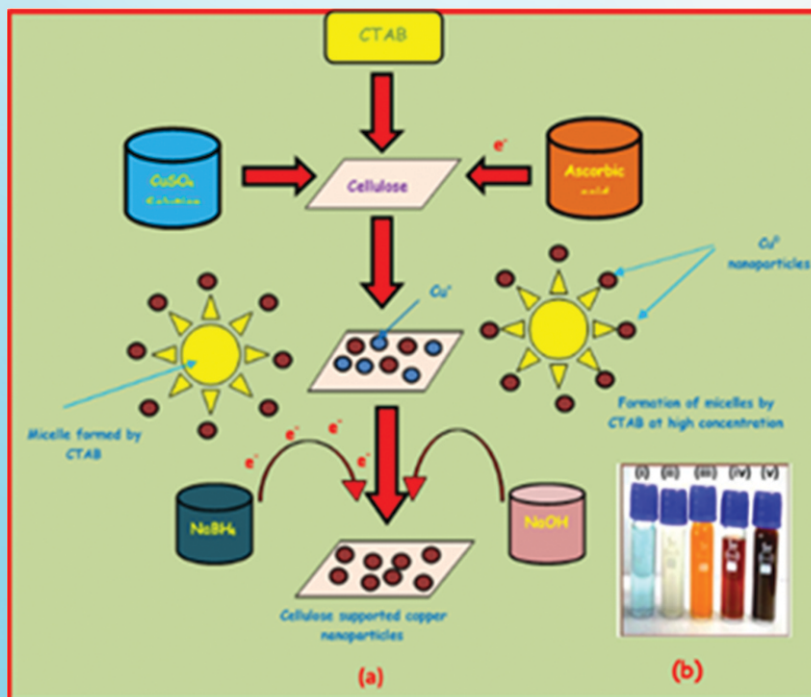
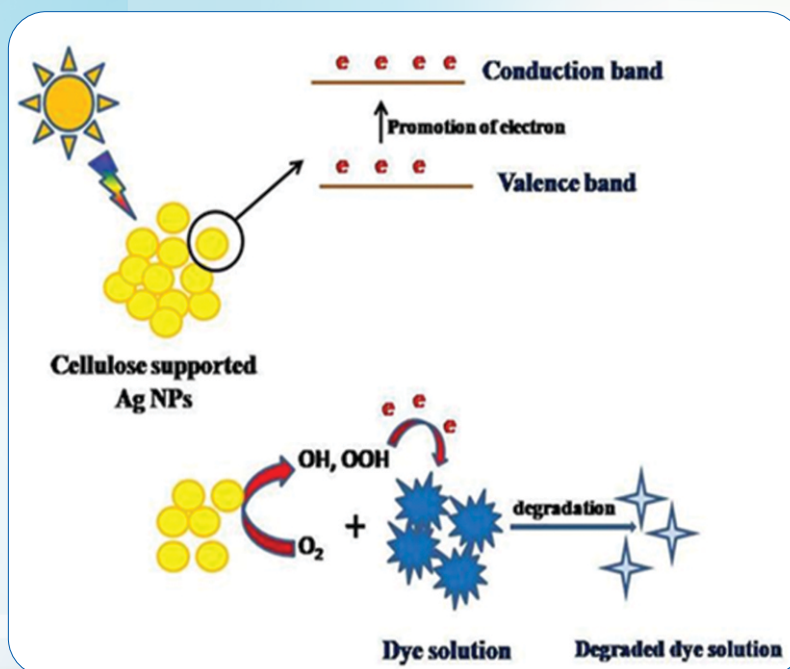


Fig: Scheme : (a) Synthesis of the cellulose supported copper nanoparticles and (b) The change in colour of the solution after addition of reagents {(i) copper sulphate, (ii) CTAB, (iii) ascorbic acid and NaOH, (iv)  $\text{NaBH}_4$  and (v) after storing for two days}.

- ❖ Green synthesis of silver nanoparticles supported on cellulose and their catalytic application in scavenging of organic dyes.



Scheme : Mechanism of dye degradation in presence of cellulose supported silver nanoparticles.

**Project Title:** Synthetic studies towards Spirocyclic Natural Products

**Project No:** GPP-299 (DST)

**PI & Members:** Dr Pallab Pahari (PI)

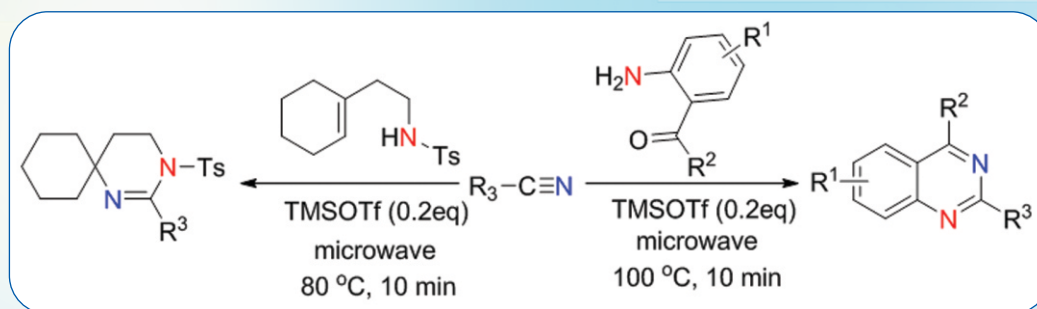
**Funding Agency:** SERB-Department of Science & Technology (DST), Govt. of India

**Objectives:**

- ❖ To develop synthetic methodologies for the regio- and stereoselective construction of spirocyclic backbone including 1-azaspirocycles.
- ❖ Application of the methodologies for the total synthesis of few important spirocyclic natural products.
- ❖ Synthesis of analogs of different biologically and industrially important spirocyclic compounds

**Salient Achievements**

- ❖ Developed a novel synthetic methodology through which a series of quinazoline, quinazolinone, and 1,3-diazaspiro[5.5]undec-1-ene derivatives have been synthesized. The method involves a Lewis acid catalyzed activation of both aliphatic and aromatic nitriles using a single step, solvent less, and transition metal free reaction condition. An amidine is expected to form as intermediate which undergoes intramolecular cyclization in a one pot reaction sequence. The reaction is carried out under microwave irradiation employing trimethylsilyltrifluoromethane sulfonate (TMSOTf) as catalyst and nitriles as nitrogen source with the respective partners.



**Project Title:** Transition metal catalyzed C-H bond activation and functionalization for the synthesis of N, O, P and S containing heterocycles

**Project No:** GPP-303 (DST)

**PI & Members:** Dr Sanjib Gogoi (PI)

**Funding Agency:** SERB-Department of Science & Technology, Govt. of India

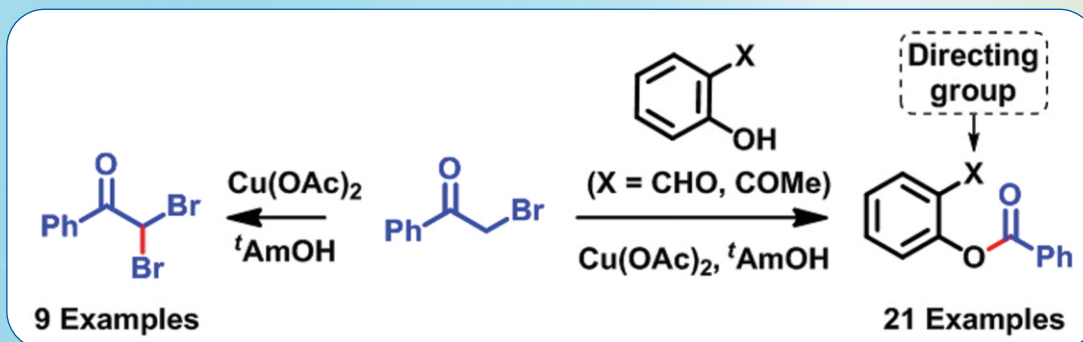
**Objectives:**

- ❖ To develop new C-H activation and functionalization reactions for efficient synthesis of biologically important heterocycles

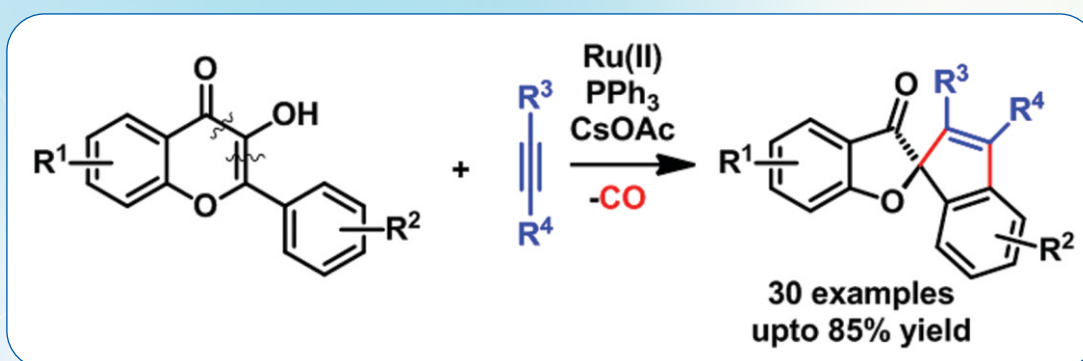


### Salient Achievements:

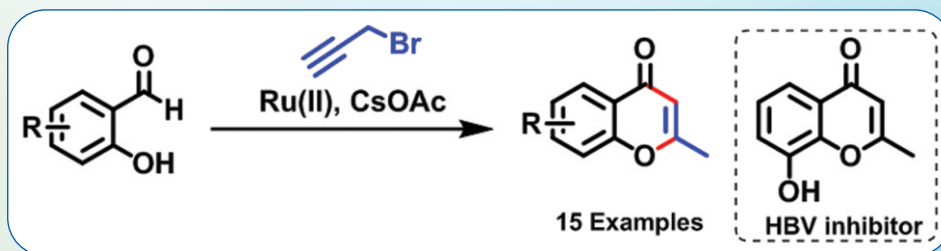
- A new directing group assisted method for the synthesis of aryl esters is developed. In this Cu(II)-mediated reaction, 2-formylphenols and 2-acetylphenols are easily converted to the aryl esters by treatment with a new aroylating agent 2-bromoacetophenone. In addition, a new external bromine free method for the synthesis of important synthons 2,2-dibromoacetophenones from 2-bromoacetophenones is developed. *Chem. Commun.* 2017, 53, 9133-9135



- The first decarbonylative insertion of alkyne through C-H/C-C activation of six membered compounds is reported. This Ru-catalyzed reaction of 3-hydroxy-2-phenyl-chromones with alkynes works most efficiently in the presence of ligand PPh<sub>3</sub> to provide spiro-indenebenzofuranones. Unlike the previously reported metal-catalyzed decarbonylative annulation reactions, in the present decarbonylative annulation reaction, the annulation occurs before extrusion of carbon monoxide. *Angew. Chem., Int. Ed.* 2018, 57, 456



- A new method for the annulation reaction of salicylaldehydes with propargyl bromide is described. This Ru(II) catalyzed annulation reaction provides 2-methylchromones which are the substructure of many biologically active natural products. This annulation reaction could be further extended for the synthesis of 2-methyl furan fused compounds.



**Project Title:** Design of a Photoresponsive Chitosan Nanogel to regulate CXCR4 signalling through slow release of SDF-1 $\alpha$  in the infarcted myocardium

**Project No:** GPP-307(DST)

**PI & Members:** Dr G Krishnamoorthy (PI)

**Funding Agency:** SERB-Department of Science & Technology (DST), Govt. of India

**Salient Achievements:**

- ❖ Prepared photoresponsive nanogel with significant photostability with increased fluorescence lifetime with highly biocompatible.

**Project Title:** Green, sustainable and flash chemistry using flow microreactors

**Project No:** GPP-313 (DST)

**PI & Members:** Dr Ram Awatar Maurya (PI)

**Funding Agency:** Department of Science & Technology (DST), Govt. of India

**Objectives:**

- ❖ Flash generation and reaction of *o*-bromo(heteroaryl)lithium without (hetero)aryne formation using a flow microreactor
- ❖ Investigation of enantioselective synthesis using pack-bed flow microreactors
- ❖ Investigation of new photochemical reactions in flow microreactors

**Salient Achievements:**

- ❖ Developed a visible light driven, high yielding, proficient, synthetic strategy to access 2-aminobenzofurans. The striking features of the method include harvesting visible light energy without any external photocatalyst, and the use of natural sunlight to access complex benzofurans in high yields. It involves visible light triggered decomposition of  $\alpha$ -azidochalcones into 2*H*-azirines that undergo intramolecular trapping with the neighboring hydroxyl group. In the presence of catalytic *p*-TSA, the aziridines underwent efficient ring opening, 1,2-acyl migration, and isomerization to yield 2-aminobenzofurans. Further exploration of this method over  $\alpha$ -azidochalcones containing thiol and amino groups (instead of hydroxyl group) to build benzothiophenes and indoles is under investigation. The results of the study were published in high impact international journals (**Organic Letters** **2017**, 19, 5364-5367).





**Project Title:** Development of novel NIR absorbing sensitizers and their nano-conjugates for the multi-model cancer imaging and therapy

**Project No:** GPP-319

**Funding Agency:** Department of Biotechnology (DBT), Govt. of India

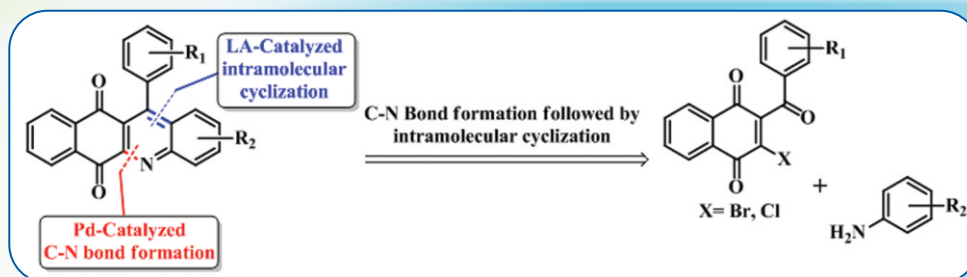
**PI & Members:** Dr Pranjal Gogoi (PI)

### Objectives:

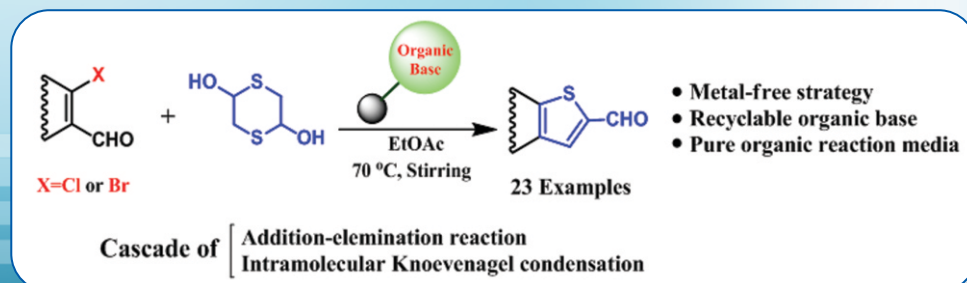
- ❖ Design, synthesis and characterization of novel theranostic agents for cancers based on BODIPY dyes
- ❖ Design, synthesis and characterization of the sensitizers based on core modified aza-BODIPY dyes for photodynamic therapy
- ❖ Synthesis and characterization of porphyrin and chlorin based PDT sensitizers

### Salient Achievements:

- ❖ A synthetic strategy has been developed for the synthesis of 1-azaanthraquinones. This synthetic protocol consists of sequential Pd-catalyzed carbon-nitrogen bond formation followed by Lewis acid catalyzed intramolecular cyclization. The Pd-catalyzed aminated intermediate was isolated and characterized. This sequential reactions strategy provides a wide range of 1-azaanthraquinones with good yields. *J. Org. Chem.* 2017, **82**, 8309–8316



- ❖ A metal-free cascade reaction strategy has been developed for the synthesis of novel polycyclic 2-formylthiophenes from -halo-, -unsaturated aldehydes and 1,4-dithiane-2,5-diol. Recyclable polymer supported organic base was used to perform the reaction process. This synthetic protocol was applied to synthesize several novel polycyclic thiophenes including steroidal D-ring annelated thiophene. Our synthetic strategy provides high yield of thiophenes, avoids tedious work-up procedure and minimizes the formation of waste. *Org. Biomol. Chem.*, 2017, **15**, 6470–6473





**Project Title:** Nanobot: A Mechanical-Drug Technology Based Dendritic Drugs for Cancer Treatment

**Project No:** GPP-320

**Funding Agency:** SERB-Department of Science & Technology (DST), Govt. of India

**PI & Members:** Dr Subrata Ghosh (PI), Mr A Singhanian (PA)

#### Objectives:

- ❖ Supramolecular drug is an emerging area of research. Engineering of supramolecules is a potential to create molecules with proper designing and programming to deliver certain predicted activities. It can be the activities for chemical reaction or some physical interaction via energy transfer properties. For creating such a molecule we can use the knowledge of symmetry, self-assembly, molecular dynamics and nano-technology. A programmed arrangement of molecules in a framework can produce a complete molecular architecture that is potential to generate artificial intelligence in the system. Our aim is to create such standalone molecular device for targeting cancer tissues in the human body to neutralize their activity from their root cause by bloodless surgery.

#### Salient Achievements:

- ❖ Nanobot is a supramolecular molecular composition which is designed with an objective that this type of molecular composition would create important bioactivities. The nanobot are supposed to evolve artificial intelligence that might be useful as anti-cancer drugs. During the above stated period of time we have completed the synthesis of the new version nanobot molecule which is successfully characterized by various spectroscopic techniques like NMR, IR, Fluorescence etc. Then it is used to investigate the potential *in-vitro* and *in-vivo* bioactivities as per the chemical biology protocols to find out the drug activity, which is the basic goal of the project as per the prediction. In the first experimental instance it is found that the synthesised nanobot have a potential anti-cancer property by selectively targeting breast cancer cell lines. More studies are under progress. Some purification complications were resolved to achieve the better purity of the product. Further progresses are on.

## ENGINEERING SCIENCES & TECHNOLOGY DIVISION

**Engineering Sciences & Technology Division** has three groups and provides engineering inputs and services to different R&D projects of the Institute. The Applied Civil Engineering Group, Chemical Engineering Group and General Engineering Group.

**Chemical Engineering Group** provides a broad spectrum of engineering inputs to the other research and development groups at CSIR-NEIST. The group has expertise in coupled research of Applied and Basic research for generation of knowledge base, know-how and know-why. The group is involved in industry oriented research in the area of Separation and Purification Technology, Reaction Calorimetry, Food & Nutraceuticals and Reaction Engineering & Catalysis. Membrane Technology is one of the priority research area of the group. Transport phenomena in solid/liquid membrane based separation, catalytic membrane reactors, controlled transport in microcapsule membrane of stimuli responsive smart polymeric micro gel, facilitated transport in gas and liquid phases through host-guest chemistry are the basic/applied R&D work of the group. Membrane based Technology for separation of Biomolecules from natural feedstock, Racemic Resolution, Gas separation etc. are the priority research work for Translational research from the group. Engineering analysis of chemical reaction systems i.e. reaction-diffusion phenomena in heterogeneous catalysed reactions, Design and Scale up studies of bioprocesses, Reaction calorimetry, development of process for food & nutraceuticals etc. are also the current activities of the group

**General Engineering Group** has the expertise in the field of product and process equipment design and fabrication, CAD, CFD simulation, CNC programming & simulation, destructive testing of engineering materials and TEFR preparation. The group is involved in multidisciplinary research and innovative technology development apart from support services for R&D and infrastructural in the form design & development, fabrication, repair & maintenance through workshop, pilot plant and also to look after maintenance of office vehicles and air-conditioning units.

**Applied Civil Engineering Group** is committed to research & development, technical consultancy, testing and evaluation of building and road materials. The main areas of research include geotechnical and transportation engineering and have expertise in geo-technical and transportation engineering. This group is presently involved in R&D work for stabilization of Brahmaputra river bed materials for use in road construction and modular brick for building structures. The group also renders technical consultancy services for soil investigation and evaluation of roads, and testing and evaluation services for road & building materials including soil, cement, concrete, aggregates, brick and other construction materials. The department had contributed towards R&D activities in development of ferro-cement products, low cost housing techniques, light roofing sheets, water filter candles from paddy husk and also in the sector of structural engineering.



## A) National Collaboration

### (i) Fast Track Translation (FTT) Projects

**Project Title:** Membrane Based Process for Commercial Production of Biomolecules

**Project No:** MLP-1003

**Funding Agency:** CSIR, New Delhi

**PI & Members:** Dr Swapnali Hazarika (PI), Mr S Borthakur (Co-PI), Dr M M Bora (Co-PI), Mr J J Bora, Mr R K Lingam, Dr P G Ingole, Mr D Das

#### Objectives:

- ❖ Development of membrane based technology for commercial production of oxyresveratrol and natural dyes from plant species.

#### Salient Achievements:

An indigenously developed membrane based process had developed for extraction, separation and purification of Oxyresveratrol which has been upgraded to get highly pure oxyresveratrol (99%). Oxyresveratrol (2, 3', 4, 5'-tetrahydroxystilbene) is an important organic compound and it has ever-growing demand as an anti-aging, cardio-protective, anti-cancerous and its use for treatment of tape-worm infestation. Neuroprotective effects of oxyresveratrol against neurodegradation in Alzheimer's disease have also been referred in recent advances on nutrition and prevention of Alzheimer's disease. The compound has been used as a starting material for synthesis of organic compounds like trans-2-methoxy-4,3',5'- trihydroxystilbene, trans-2,3'-dimethoxy-4, 5'-dihydroxystilbene, trans-4,3'-dimethoxy-2,5'-dihydroxystilbene, trans-2,4,3',5'-tetramethoxystilbene, cis-2,4,3',5'-tetramethoxystilbene, 2,4,3',5'-tetra hydroxylbibenzyl, 2,4,3',5'-tetramethoxybibenzyl etc. Successfully run the scaled up model for production of Oxyresveratrol and verified the product with Quality control measures. Measured the cost benefit analysis and prepared the knowhow package for production of 2 kg product/batch process.

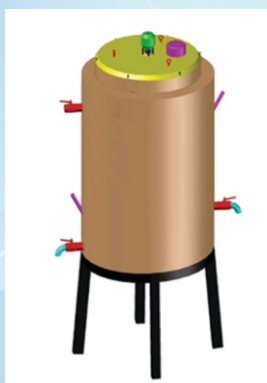


Fig 8: Extraction unit



Fig 9: Membrane module



Fig 10: NEIST Oxyresveratrol

**Project Title:** Modular Bricks from River Brahmaputra Bed Sand

**Project No:** MLP-1004

**Funding Agency:** CSIR, New Delhi

**PI & Members:** Mr Sanjay Deori (PI), Mr D Basumatari, Mr D Neog

**Objectives:**

- ❖ Preliminary identification of different locations for collection of materials from Brahmaputra river bed during its course from Eastern to Western stream in the state of Assam.
- ❖ Collection of materials from Brahmaputra river bed at different selected location.
- ❖ Characterization of collected materials from Brahmaputra river bed.
- ❖ Chemical and Micro-structural analysis of collected river bed materials.
- ❖ Development of methodology for composition of collected river bed materials with cement, lime and chemical additives for mix design of modular bricks.
- ❖ Development of Methodology for manufacturing modular bricks for different sizes and shapes and interlocking block.
- ❖ Field trials of modular bricks using in construction of building structures, boundary wall and foundation.
- ❖ Preparation of specification and design guidelines for use of Brahmaputra river bed materials in manufacturing modular bricks.

**Salient Achievements:**

- ❖ Collection of Brahmaputra river bed materials from Nimatighat, Kokilamukh & Spur No.8.
- ❖ Characterization of collected materials from Brahmaputra river bed.
- ❖ Preparation of design mix for collected river bed materials with cement for manufacturing modular bricks.
- ❖ Partial field trials of modular bricks using in construction of building structures, boundary wall and foundation completed.
- ❖ Establishment mini demonstration plant.

**(ii) Mission Mode Projects**

**Project Title:** Development of Novel Process for Production of Pregabalin

**Project No:** HCP-0011

**Funding Agency:** CSIR, New Delhi

**PI & Members:** Dr Swapnali Hazarika, Dr G Baishya, Dr P G Ingole, Dr Gogoi, Mr J J Bora, Mr R K Lingam, Dr M M Bora, Mr S Borthakur

**Objectives:**

- ❖ Development of novel process for production of Pregabalin using membrane



### Salient Achievements:

- ❖ We have optimized the process conditions for synthesis of RS( $\pm$ )-3-aminomethyl-5-methyl hexanoic acid. The process conditions for preparation of membrane have been optimized. To study the membrane performance, work has been initiated using commercial Pregabalin for separation of R and S isomers.

### (ii) Skill Development Projects

**Project Title:** Skill Development Training Program of CSIR – NEIST, Jorhat

**Project No:** NWP-100

**Funding Agency:** CSIR, New Delhi

**PI & Members:** Mr Dipankar Neog, Mr JJ Bora. Mr D Das

### Objectives:

- ❖ Under CSIR-Integrated Skill Initiative, CSIR-NEIST has started a **Skill Development Training Programme** with basic training and advanced training courses since 1st of April 2017. The basic training are in the trades of welding, fitting, plumbing (intake 20 nos. each per batch), glass blowing (intake 10 nos. per batch) and weaving (intake 40 nos. per batch). The advanced courses are in the trades of advanced welding and CNC turning & machining (intake 10 nos. each per batch). The training programme for the 4th batch of the basic course and 3rd batch of the advanced course is going on.

### Salient Achievements:

- ❖ A total of 181 students have successfully completed the Skill Development Training Programme. Out of all the on-going training programs, employment (self) from the weaving training is around 90 to 95% and for the rest of the training programs 75 to 80% candidates getting employment or they are self employed.
- ❖ The woman weavers who have successfully completed the basic training on weaving using jacquard looms are provided the financial links through IDBI, Canara Bank, AGBB etc. to start the commercial production. The production is cluster based production. From our earlier activities of CSIR-800 we have created a brand name called **Muhura** through our associated NGO SNEHPAD, The first product targeted is **Gamucha**. Our weavers have now started producing through the same brand name. It is also to be mentioned that efforts have been made to make the weaving product commercially disseminated through the Govt. of India e-portal **Rastriyo Mahila Kosh**. Recently, 109 nos. of our trained weavers have been provided loan by NABARD under Joint Liability Group (JLG) scheme (19 groups were formed). The loan was disbursed by IDBI bank, Jorhat Branch. The loan amount is @1, 25,000 per JLGs.
- ❖ From the trades of welding and fitting, 55% trainees have joined in some of the local fabrication shops and 2 nos. of trainees have joined the advanced training course at CSIR-NEIST, Jorhat.

- ❖ From the trade of plumbing 90% trainees have started as commercial plumbers.
- ❖ One trainee from glass blowing trade has joined Tezpur University on contractual basis and 2 trainees are self employed.
- ❖ One successful trainee has joined in BSNL, Assam Circle and one trainee has joined in automobile dealer in Sibsagar, Assam.
- ❖ 2 successful trainees of CNC have started working in a private ITI.
- ❖ The trainees of Advanced welding have started their own small setup.
- ❖ We are planning to organize job providers meet.
- ❖ In recent future, for placement the respective Sector Skill Councils will provide the necessary guidance and linkages.

### (iii) In-house, Grant in aid & Consultancy Projects

**Project Title:** Engineering Intervention for Value Addition to Natural Resources of NER through Process Intensification, Design, Simulation, New Methodologies for Construction Materials

**Work Package-I:** Processing and Treatment of Natural and Industrial Resources for value addition.

**Project No:** OLP-2004

**Funding Agency:** CSIR, New Delhi

**PI & Members:** Dr Subodh Chandra Kalita (PI), Dr S Hazarika ©-PI), Mr B Das, Dr A Namdeo, Mr R K Lingam, Mr P G Ingole, Mr J S Verma, Mr M M Bora, Mr S Borthakur, Mr T H Ahmed

#### Objectives:

- ❖ Design and Development of Hybrid Separation Processes for value added products through Process Intensification Study.
- ❖ Underutilized natural resources to the value added product(s) through Reaction engineering and catalytic studies.
- ❖ Treatment of industrial waste water and value addition.

#### Salient Achievements:

- ❖ **Work on Nanoparticle incorporated membrane for removal of dyes from process effluent:** A simple and efficient method for synthesis of nanoparticle incorporated membrane has been developed. The performance of the hydrophilic membrane has been evaluated for separation of Crystal Violet and salt rejection.

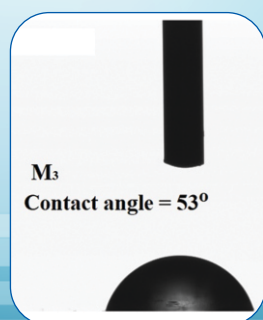


Fig: Pictograph of contact angles

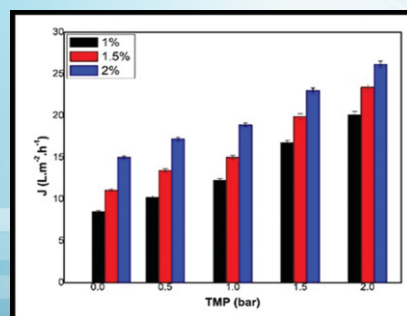
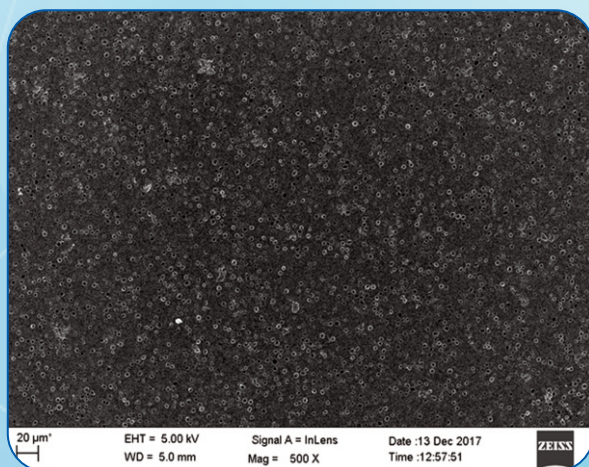


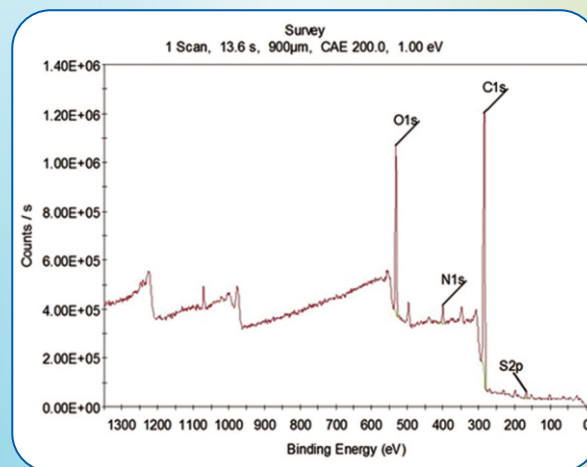
Fig: Effect of pressure on membrane flux



- ❖ **Work on Racemic Resolution Membrane for Separation of Amino Acids:** Single walled CNT has been functionalized and modified for synthesis of polymeric membranes for resolution of drugs.



SEM photograph of membrane



XPS analysis of Membrane

- ❖ **Development of thin film nanocomposite membranes for mixture gas separation:** Metal organic framework (MOF) incorporated thin film nanocomposite (TFN) membranes are prepared by interfacial polymerization method. Prepared TFN membranes significantly enhance the water vapor transport performance from the flue gas. The MOF  $\text{NH}_2\text{-MIL-125(Ti)}$  was prepared by hydrothermally and incorporated in TFN membranes. The MOF nanoparticles loading in the thin film raise the surface hydrophilicity and roughness. MOF particles play very vital role for water vapor transport through the TFN membranes.

- ❖ **Work on Bio-oil upgradation:** Energy is a crucial parameter of present economic growth and is strongly correlated with the Human Development Index. The required energy produced in a sustainable manner, therefore, can provide economic benefits with an added advantage to society and environment. A successful technology based on the Chemical/Thermo-chemical and biochemical methods will attract entrepreneurs; can boost rural economy and job creation in long term. Thus, under the project works have been done on upgradation of bio-oil and pyrolysis in absence and presence of catalysts. Based on the TG analysis, established the kinetic regime for pyrolysis reaction for rice-husk.

- ❖ **Work on Waste water treatment:** Porous microfiltration range ceramic membranes were prepared using kaolin and other inorganic suitable materials at different sintering temperature. Stable oil-in-water emulsion has been successfully separated by dead end filtration using the prepared membrane at maximum rejection efficiency of 95.4%. The permeate oil concentration was within the permissible range of environmental tolerance ( $<12 \text{ mg/L}$ ). The flux decline data were compared with various pore blocking models and it was appraised that cake filtration model best represents the fouling mechanism. The selection parameter of  $14.78 \times 10^{-6} \text{ m}^3/\text{m}^2.\text{s}$  indicates a good combination of flux permeation,

declination and rejection for the membrane sintered at 900°C.

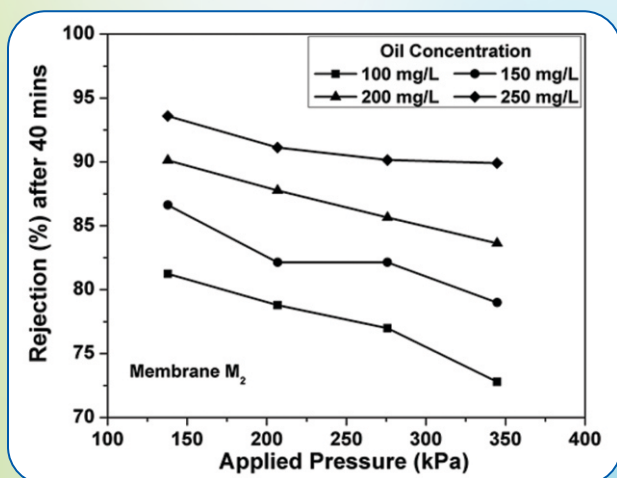


Fig : Effect of the trans-membrane pressure for on rejection different pore

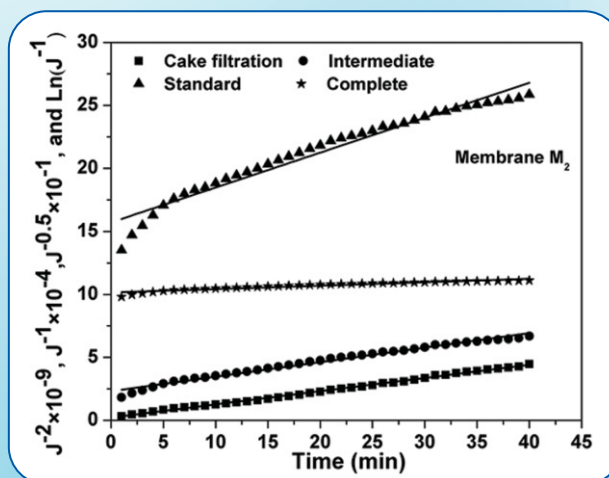


Fig : Permeate flux vs. time blocking models

- ❖ **Optimization and Scale up of OP-12 culture from 10 L to 100 L bioreactor** The scale up studies for OP-12 microbial production in large scale was done. Shake flask optimized data for maximized growth in terms of CFU was taken as a basis for bioreactor operation. The optimized conditions were validated in a 10 L bioreactor followed by 50 L working volume pilot bioreactor.



Fig : Scale-up at 10L NBS Bioreactor

**Project Title:** Engineering Intervention for Value Addition to Natural Resources of NER through Process Intensification, Design, Simulation, New Methodologies for Construction Materials

**Work Package-III:** Performing Computational Fluid Dynamics (CFD) & Finite Element Analysis (FEA) of some of the selected CSIR-NEIST technologies/ products.

**Project No:** OLP-2004



**Funding Agency:** CSIR, New Delhi

**PI & Members:** Dr Subodh Chandra Kalita (PI), Mr J J Bora, Mr D Neog, Mr D Das, Mr J K Doley

### Objectives:

Performing Computational Fluid Dynamics (CFD) & Finite Element Analysis (FEA) of some of the selected CSIR-NEIST technologies/ products namely,

- ❖ Computational Study of Biomass fired Devices.
- ❖ Computational study of mechanical processes involved in bioremediation technology with special reference to drill site application.

### Salient Achievements:

Combustion characteristics of different types of biomass and heat transfer analysis are performed.

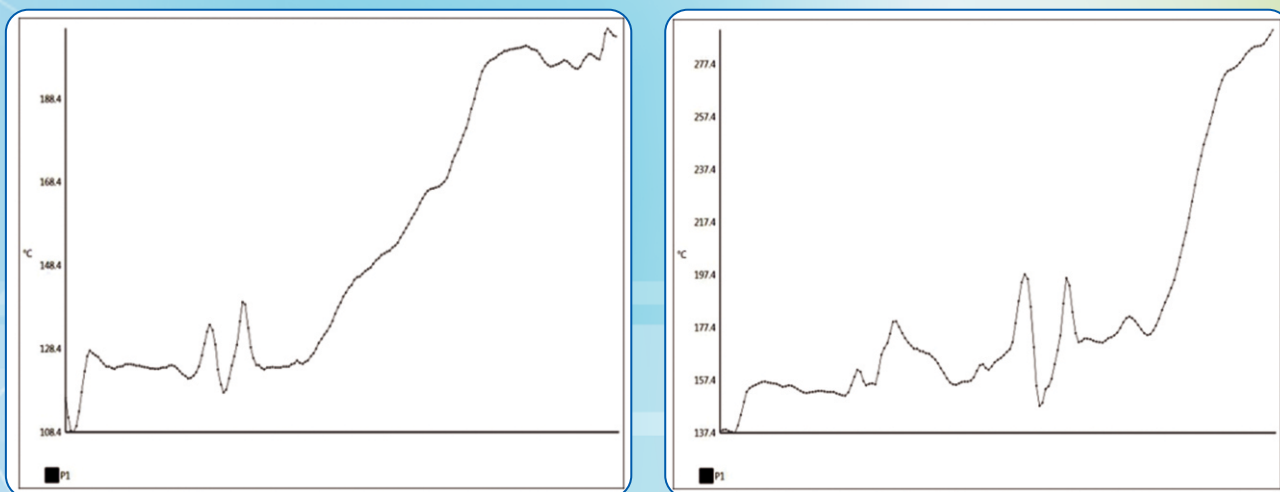
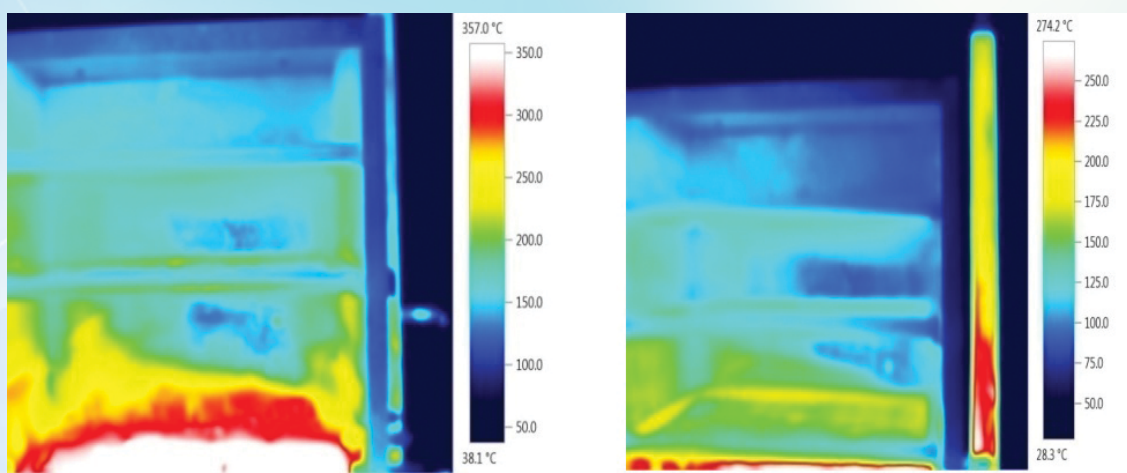


Fig: Temperature profile from top to bottom plate inside the chamber after 90 and 120 minutes using 3kg dry biomass.



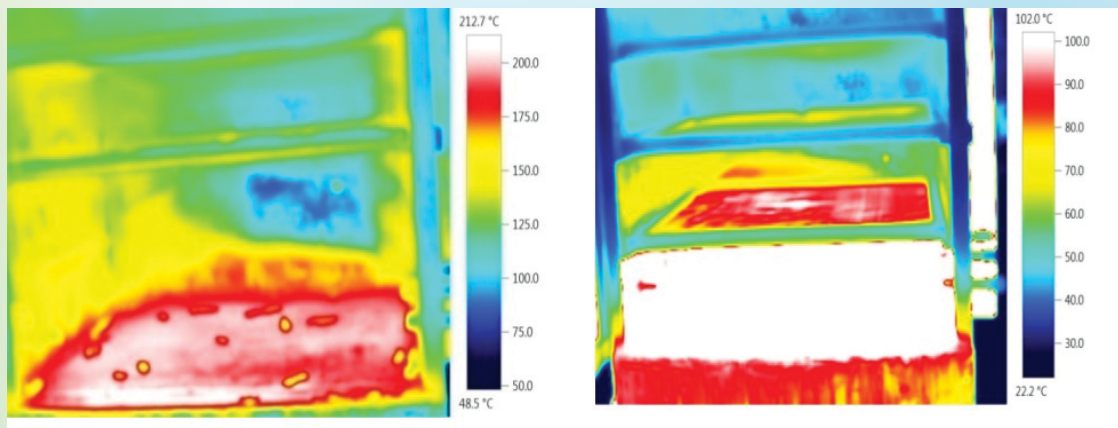


Fig: Thermal image inside the drier at different time intervals.

Following conclusions are achieved from the analysis.

- ◆ With the increase of biomass variation of temperature in different plate inside the drier is higher.
- ◆ After 130 minutes, there are less amount of ( $\pm 5^{\circ}\text{C}$ ) temperature change is observed inside the chamber for another 45 minutes.
- ◆ From the above analysis, it is observed that optimum weight for biomass for drying different vegetables is 3kg.
- ❖ Computational study of mechanical processes involved in bioremediation technology with special reference to drill site application:
- ❖ A header pipe is designed using solidworks software and computational study is performed.

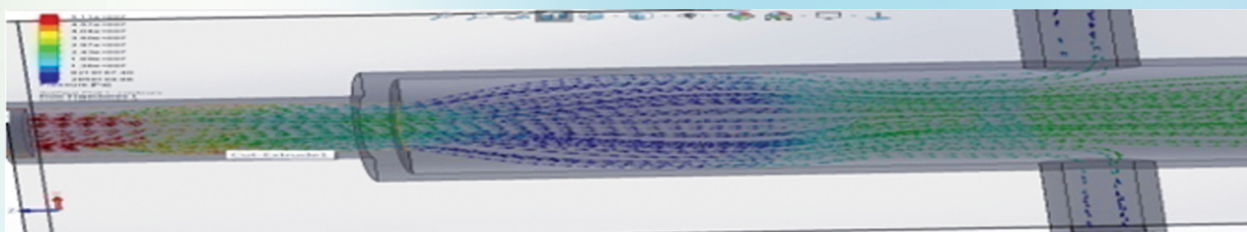


Fig: Header pipe

**Project Title:** CSTRI and Common Facility Centre on Weaving and Textile Product Manufacturing

**Project No:** GAP-232 & GAP-283

**Funding Agency:** Department of Science & Technology (DST), Govt. of India

**PI & Members:** Mr Dipankar Neog (PI), Ms I I Zhimo (Co-PI), Mr J J Bora, Mr S C Kalita

**Objectives:**

- ❖ 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.

### Salient Achievements:

- ❖ Setting up of a Common Facility Center (CFC) on weaving and textile product manufacturing under the CSTRI Centre of CSIR-NEIST was done successfully.
- ❖ Basic training on natural dyeing, textile design, operating the different equipments including jacquard looms are imparted to 160 nos. of weavers in 8 batches at the CFC, Mariani has been completed
- ❖ Cluster based commercial production of different types of textile products is presently going on.
- ❖ Invitation to take part in different Exhibition and Trainings.

**Project Title:** Promoting Innovations in Individuals, Start-Ups Msmes (PRISM)

**Project No:** GAP-2014

**Funding Agency:** Department of Science & Technology, Govt. of India

**PI & Members:** Mr Dipankar Neog (PI), Mr. J J Bora, Mr S C Kalita

### Objectives

- ❖ Regular advertisement for scouting for project proposal.
- ❖ Counseling with the innovators across the table for the innovative idea thrown by the individual innovators for funding and helping the innovators for preparing the project proposal.
- ❖ Reviewing the proposals through the empanelled list of subject experts, providing all necessary supports to the innovators towards implementing their project proposals. These supports include technical guidance for design, mathematical calculations, fabrications of models and prototypes, report preparation, IPR protection etc.
- ❖ Continuous monitoring of the project implementation and timely review.

### Salient Achievements:

- ❖ Under the project “Promoting Innovations In Individuals, Start-ups MSMEs (PRISM)”, two projects are successfully completed. 5 nos of projects are different stages of evaluation under TOCIC-NEIST Jorhat. Two project namely, development of digital paper facility and portable muga reeling machine has recently been approved by DSIR and works are going on under the supervision of TOCIC-NEIST, Jorhat

**Project Title:** Catalytic and Reaction Engineering Studies on Bio-oil Upgradation

**Project No:** GPP-328

**Funding Agency:** Department of Science & Technology, Govt. of India

**PI & Members:** Dr Ashutosh Namdeo (PI)

### Objectives

- ❖ Bio-oil production and characterization
- ❖ Catalyst synthesis, characterization and screening for bio-oil upgradation
- ❖ To perform kinetic studies and determine the parameter space (appropriate range of pressure, temperature, catalyst loading, promoter content, etc.) for the products of interest.
- ❖ To suggest the best reactor configuration for the desired performance by performing simulations, with the results supported by representative experiments.

### Salient Achievements:

- ❖ Reaction engineering lab is under development to accomplish the given objectives.
- ❖ Initial reactions on pyrolysis on micro level are going on.

**Project Title:** Development of Appropriate Product by Studying the Possible Use of Coir Dust in Oil Industry With Reference to North-East India for Absorption of Oil Spill

**Project No:** CLP-285

**Funding Agency:** CCRI, Govt. of India

**PI & Members:** Mr Jayanta Jyoti Bora (PI), Mr D Neog (Co-PI), Dr R L Goswami, Dr D Kalita, Mr D Das, Mr SC Kalita

### Objectives:

- ❖ Study of different properties of coir pith as an absorbent to be used for prevention of oil spillage effect with reference to NE oil industries.
- ❖ Design and development of coir pith captor in the shape of membrane/ blanket/ block/ granules to deal with oil spillage.
- ❖ Study on possibilities of re-use & disposal of coir pith captor.



### Salient Achievements:

- ❖ Physicochemical treatments of coir pith:
- ❖ Physico-chemical treatments of coir pith are done to improve its hydrophobicity and oleophilic character so that it absorbs oil spillage.
- ❖ Water and Crude Oil absorption capacity of coir pith were done:
  - (i) For different particle sizes raw coir pith
  - (ii) Heat treated coir pith
  - (iii) Acetylated coir pith
  - (iv) Acid treated coir pith
  - (v) Alkali treated coir pith
  - (vi) Acylated coir pith

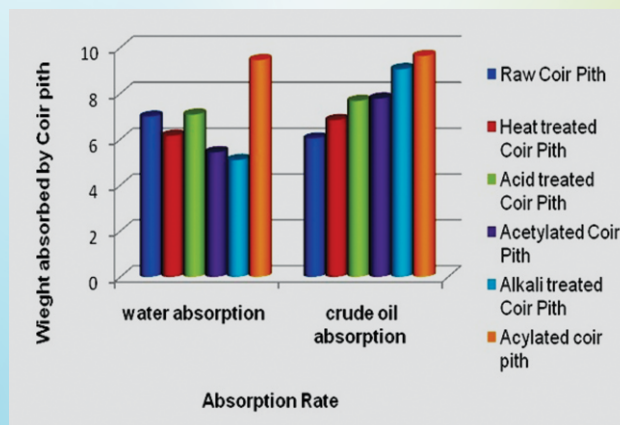


Fig: Absorption Rates of Coir pith sorbent in Oil And Water

The absorption capacity increases in acetylation, alkali treatment and Acylation treatment. Heating at relative low temperature also shows good result of absorption.

- ❖ Development of Coir pith as blocks (bricks type), pouches, Sheet/ pad and check its absorption capacities both in water and crude oil.

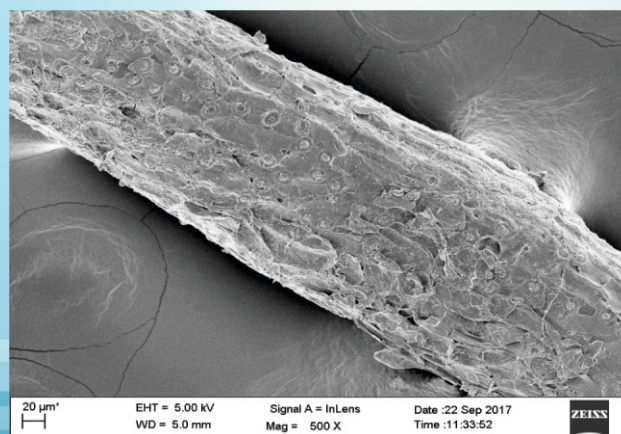
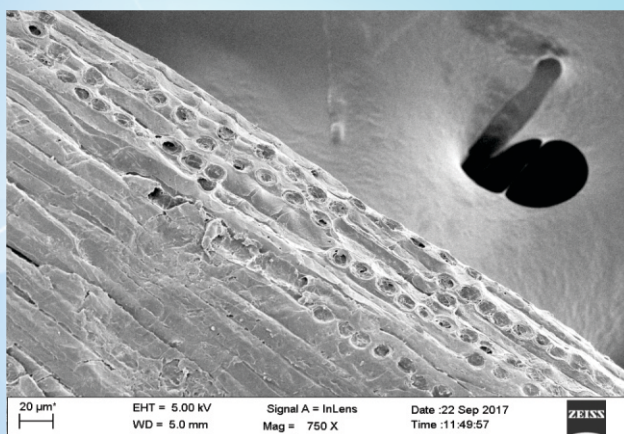
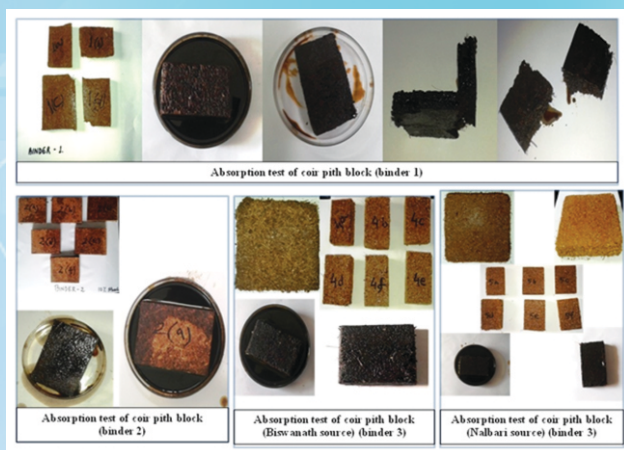


Fig: SEM Image of Treated and Untreated Coir pith Absorbent sheet/pad



- ❖ From the SEM Analysis of untreated and treated coir pith sheet, it is seen that the wax-gum particles were removed in chemical treatment of coir pith and the pores of the coir pith were empty. So the absorption capacity of treated absorbent sheet increases as compared to untreated coir pith sheet.



Fig: Experimental Photos

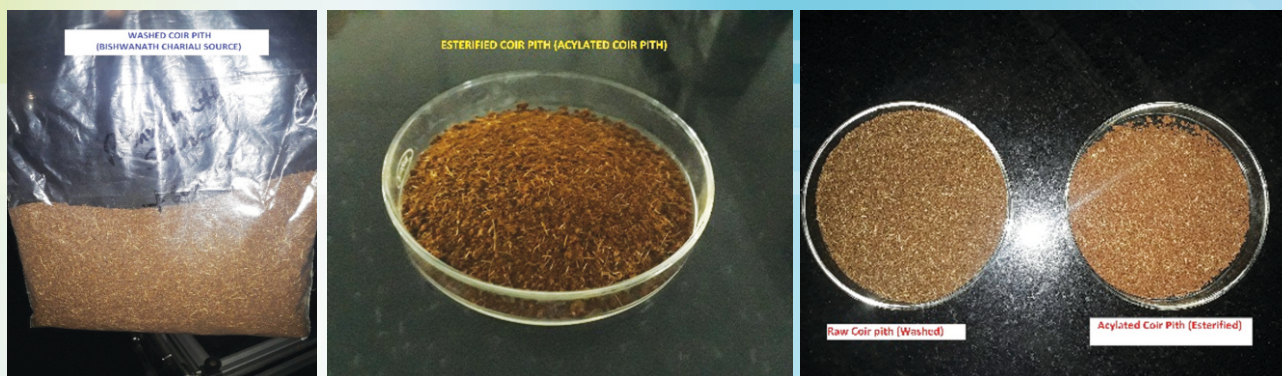


Fig: Essential reaction of coir pith

Fig: At the time of washing the acylated Coir pith

**Project Title:** Soil Investigation Work for LPG Mounded Bullets at NRL

**Project No:** CNP-470

**Funding Agency:** Numaligarh Refinery Limited (NRL), Golaghat

**PI & Members:** Mr Sanjay Deori (PI), Mr D Basumatari (Co-PI), Mrs A Bharali, Mr N P Borah, Mr R Das

**Objectives:**

- ❖ To compute safe bearing capacity of foundation soil.

**Salient Achievements:**

- ❖ Field work and field test at the proposed location.



- ❖ Collection of soil samples from site and laboratory tests.
- ❖ Computation of safe bearing capacity of foundation soil.
- ❖ Preparation and submission of interim as well as final report.

**Project Title:** Soil Investigation for Bio Refinery Plant and Township at Numaligarh Refinery, Golaghat.

**Project No:** CNP-470

**Funding Agency:** Numaligarh Refinery Limited (NRL), Golaghat

**PI & Members:** Mr Sanjay Deori (PI), Mr D Basumatari (Co-PI), Mrs A Bharali, Mr N P Borah, Mr R Das

**Objectives:**

- ❖ To compute safe bearing capacity of foundation soil.

**Salient Achievements:**

- ❖ Field work and field test at the proposed location.
- ❖ Collection of soil samples from site and laboratory tests.
- ❖ Computation of safe bearing capacity of foundation soil.
- ❖ Preparation and submission of interim as well as final report.

**Project Title:** Design of Secant Pile at KSEBL Munnar

**Project No:** CNP-472

**Funding Agency:** Numaligarh Refinery Limited (NRL), Golaghat

**PI & Members:** Dr Leon Raj (PI), Mr S Deori (PI), Mr D Basumatari, Mr N P Borah, Mr R Das

**Objectives:**

- ❖ Design and analysis of for 800 mm dia secant pile with capping beam (on top of secant pile) at the depth of 21 m deep or exit gradient.
- ❖ Design and analysis for 2 layers of strutting and waller beam for excavation upto 15.5 m deep at intake pool area and box culvert from ground.
- ❖ Design and analysis for king post work at intake pool area (if necessary).

**Salient Achievements:**

- ❖ Field work at the proposed location.
- ❖ Design and analysis.
- ❖ Preparation and submission of interim as well as final report.

## GEO SCIENCES & TECHNOLOGY DIVISION

The North East India has a complex structural framework with changing behaviors of Seismic activity in different tectonic domains controlled by ancient Plate margin. It occupies a distinct position in the World Seismicity. The division is fully focused on real-time monitoring of active faults along plate margin to assess the seismic hazard potential, dissemination of scientific knowledge in public decision making and to create mass awareness to mitigate the adverse effects of earthquakes by reducing the vulnerability.

A seismic network of 27 (twenty seven) unmanned VSAT based online / realtime high resolution seismic broadband stations has been established covering entire 8 (eight) states of North East India called North East Wide Area Seismic Network (NEWSN) to intensify seismic monitoring on a real-time basis to observe the present seismicity and to understand the geodynamics of the region.

The network helps in Seismic vulnerability assessment of the populated cities & urban areas in NE India is a major program of the division. The division has initiated work for hazard-risk-vulnerability assessment of Shillong and greater Guwahati on priority basis.

Estimation of expected earthquake ground motion parameters is the main aim of seismic microzonation. Microzonation maps provide basic inputs for designing new infrastructure or retrofitting of the existing ones.

In association with NDMA and SDMA's the division also tries to assess multi – state earthquake disaster preparedness and evaluate the State/District Disaster Management Plans with an aim to identify gaps and generate the greater level of awareness in community about the seismic vulnerability of the region pertaining to high magnitude earthquake for risk reduction.

### A) National Collaboration

#### In-house, Grant in aid & Consultancy Projects

**Project Title:** Seismic vulnerability assessment of major cities in North-Eastern India

**Project No:** GPP-275

**Funding Agency:** North Eastern Council, Shillong

**PI & Members:** Dr Saurabh Baruah (PI), Dr S Sharma (Co-PI), Dr S Baruah (Co-PI)

#### Objectives:

- ❖ 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.

#### Salient Achievements:

- ❖ The seismic vulnerability concept is a yard-stick of damage estimation from a probable earthquake considering physical and socio-economic dimension. We aim vulnerability



assessment of the typical complex urban system of capital city Shillong situated on hilly terrain. High resolution satellite imagery of Shillong facilitates analysis of building footprints-its various types, road & street network and identification of open ground. A total of nine different building typologies are identified taking into account the building's structural configuration besides several other parameters assessed through rapid visual survey of more than fifteen percent of houses located in twenty seven numbers of wards. Simultaneously, structural model such as fragility and capacity curve are estimated for these typologies. Slope map from SRTM data demarcate the landslide prone area through discrete elevation modelling (DEM). A new methodology incorporating six gross variables i.e., building parameters, slope angle variation, site characteristics, geomorphology, socio-economic condition, occupants at day and night in correlation with physical measurement of vulnerability is presented. Here, three different dimensional co-ordinated systems is applied to estimate the dimension of vulnerability. MASW survey in eighteen locations of the city indicates lithology up to 7 meters depth characterized by stiff soil condition while existence of rock is available up to 30 meters. Additionally, resonant frequency estimated from H/V ratio is encompassed by higher frequencies between 6 to 8 Hz in these area. Integrating all these information, it is observed that the more than 60% of Shillong comprising the various wards falls under moderate to higher vulnerability. The rest of the area is characterized by low level of vulnerability. Identification of vulnerability enables a basis for decision-makers to develop mitigation strategies.

**Project Title:** Setting up of multiparametric geophysical observatory in Mikir Hills, North Eastern India for earthquake precursory research.

**Project No:** GPP-294

**Funding Agency:** Ministry of Earth Sciences, New Delhi

**PI & Members:** Dr Saurabh Baruah (PI), Dr S Sharma (Co-PI), Dr S Baruah (Co-PI)

#### Objectives:

- ❖ To establish multi-parametric geophysical observatory in Mikir Hills Plateau, Assam with number of state-of-the-art geophysical/seismological equipments.
- ❖ To create high quality geophysical database for earthquake precursory studies.
- ❖ To develop physical models of earthquake processes/sources and evaluating the potential of multi-parametric precursors in practical earthquake prediction programs.
- ❖ Numerical modeling of Total Electron Content and its temporal perturbations in Ionosphere as a possible indicator of earthquake.

#### Salient Achievements:

- ❖ Continuous observations of radon emanation from soil gas was recorded in multiparametric Geophysical Observatory to study the co-relation of radon anomalies to the earthquake occurrence. Radon monitoring in soil gas was carried out in highly strained region. The observed radon anomalies are co-related with the earthquake events which ranges from

occurred within the distance of 130 km from the MPGO. Simultaneous effect of temperature and pressure on soil gas radon are examined. A correlation coefficient has been calculated between soil gas radon, soil pressure and soil temperature to examine the empirical relation between earthquake magnitude, epicentral distance and precursory time.

**Project Title:** Estimation of ground motion parameters in Shillong Mikir hills plateau from acceleration time history of earthquake events originated in North East India.

**Project No:** GPP-300

**Funding Agency:** Ministry of Earth Sciences, New Delhi

**PI & Members:** Dr Sangeeta Sharma (PI), Dr S Baruah (Co-PI)

**Objectives:**

- ❖ Collection and Parameterization of seismic records within the studied area.
- ❖ Correlations of ground motion parameters, characteristics of source and media.
- ❖ Estimation of peak ground acceleration due to maximal credible earthquake and the attenuation relation.
- ❖ Computation of three dimensional Q structure of the region

**Salient Achievements:**

- ❖ 33 ground motion parameters have been ascertained for three components of 11 events for each station. Necessary Fourier power spectra, response spectra, Fourier amplitude verses frequency plot, power amplitude versus frequency plot and Response acceleration versus frequency plot have been plotted for all the components for each of the recorded stations each of these events. Contour plots of maximum acceleration and predominant period are determined for 11-08-2009 Mw5.6 earthquake to identify the characteristic of the source and the media. For estimation of site response, the horizontal component of shear wave spectra at each site of one event (15-02-2009; Mw4.4) is divided by the vertical component spectra observed simultaneously at that site. Moreover, the sediment-to-bedrock ratio is determined by dividing the Fourier spectrum of a site by that of a nearby reference (rock).

**Project Title:** Crustal anisotropy studies for Shillong-Mikir plateau and subsequent determination of velocity structure of NE India.

**Project No:** GPP-302

**Funding Agency:** SERB -Department of Science and Technology (DST), Govt. of India

**PI & Members:** Dr Santanu Baruah (PI)

**Objectives:**

- ❖ To study the polarization obtained from source mechanism of earthquakes and to correlate the observed polarization with the polarization obtained from source mechanism.
- ❖ To make an effort to image 3D seismic structures by local earthquake tomography



### Salient Achievements:

- ❖ The stress inversion results shed a new light on the stress regime in the Shillong plateau and its implications to seismo-tectonics. GPR derived stress associated stress has got clear influence on the total stress field of the Shillong plateau, which is found to vary from the western edge due to higher topography and density heterogeneities to that of eastern edge. We examined first and second order stress contributors in the study region. It is ascertained that the tectonic loading from the Himalaya, seismic and GPE stresses collectively govern the stress pattern in the Shillong plateau region.

**Project Title:** Site characterization and seismic vulnerability studies of greater Shillong

**Project No:** GPP-308

**Funding Agency:** Meghalaya State Disaster Management Authority, Shillong

**PI & Members:** Dr Manoj Kumar Phukan (PI), Mr M Borkotoky (Co-PI), Mr K C Deuri, Mr P Kalita, Mr S M Bhattacharyya, Mr A K Hazarika and Mr A Saikia

### Objectives:

- ❖ Preparation of base map and thematic maps such as geology & geomorphology, lithology, soil & rock types, seismicity & seismotectonics, groundwater & hydrogeology, land use/ land cover, forest type, habit & habitat and population density.
- ❖ Preparation of a seismotectonic map covering 350-500 km radius of Shillong city and using local/global seismic network data. Identification of active tectonic lineaments.
- ❖ Geotechnical investigation, using available SPT borehole data and n value up to 30m depth using empirical relations.
- ❖ Determination of predominant frequency from the ratio between Fourier spectra of horizontal and vertical component of noise survey (Nakamura's method).
- ❖ Integration of data to generate Seismic Site Amplification Map for Shillong.

### Salient Achievements:

- ❖ Completed seismotectonic study of the city and adjoining region. Acquisition of seismic ambient noise data in a grid pattern covering greater Shillong city. Total 114 points covered in three field sessions.

**Project Title:** Tectonic evolution of the Mishmi Thrust in the Mishmi Metamorphic complex

**Project No:** GPP-311

**Funding Agency:** Department of Science and Technology (DST), Govt. of India

**PI & Members:** Dr R K M Devi (PI)

### Objectives:

- ❖ Role of transverse faults in the tectonic evolution of Mishmi Thrust Belt.
- ❖ Studies on the tectonic movements associated with the evolution of Mishmi Thrust and

reactivations along the Mishmi Metamorphic complex.

- ❖ Studies on Neotectonics & Active faults of the study area with reference to Structural mapping & Tectonic Geomorphology.
- ❖ Studies on abutment of the Eastern Himalaya along the Tidding Suture zone and its structural complexities.

#### Salient Achievements:

- ❖ In Arunachal Himalaya, major tectonic units show a bend of their regional bedding and foliation strike from ENE–WSW to NW–SE, known as the Eastern Syntaxis. It represents a major antiformal structure i.e. the Siang Antiform. In the Eastern Syntaxis, active deformations are also found to be concentrated in the frontal region. Transverse fault activities are observed along (a) the Lohit River Exit at Parsuramkund with Neotectonic evolution of 5 (Five) level terraces and dextral fault movement associated with oblique sinistral fault movement (b) the Roing-New Chidu road with a scarp plane showing foliated hard marble and quartzite bands exhibiting a series of chevron folds due to the presence of regional/local compressive force caused by the Mishmi Thrusting.

#### Project Title: Seismic microzonation of greater Dimapur, Nagaland

**Project No:** GPP-326

**Funding Agency:** Nagaland State Disaster Management Authority, Govt of Nagaland

**PI & Members:** Dr Manoj Kumar Phukan (PI), Dr S Baruah (Co-PI), Mr M Borkotoky, Mr K C Deuri, Mr P Kalita, Mr S M Bhattacharyya, Mr A K Hazarika and Mr A Saikia

#### Objectives:

- ❖ Seismotectonic study of Dimapur city and adjoining region. Identification of major active faults and lineaments.
- ❖ Spatial Distribution of Shear Wave Velocity from available geotechnical data
- ❖ Acquisition and processing of seismic ambient noise data in a grid of 0.5-1.0 km covering the entire city
- ❖ Determination of predominant frequency and preparation of seismic site amplification map.

#### Salient Achievements:

- ❖ Initiation of seismotectonic study of the city using existing seismic database.



## MATERIALS SCIENCES & TECHNOLOGY DIVISION

Materials Sciences and Technology Division (MSTD) comprises of three groups, namely Advanced Materials, Cellulose Pulp and Paper and Polymer Petroleum and Coal Chemistry.

**Advanced Materials Group** formerly Materials Science has been working on different aspects since its inception. The contribution ranges from Vertical Shaft Kiln (VSK) technology, silicate materials, cement and building materials, ore beneficiation and palletization, oil field chemicals, zeolites, catalysts and other inorganic chemicals. Later the department added new and exciting research areas like ores and minerals of North Eastern region, adsorption, clay chemistry, organometallic and coordination compounds, supported nanometals, nanostructured materials, layered materials, homogeneous and heterogeneous catalysts. The group has taken up research in the fields of nanocomposite materials, metal organic frameworks, catalysis, small molecules activation and nano oxidic membranes for water and gas purification etc.

**Cellulose Pulp and Paper Group** of CSIR-NEIST is the only laboratory in the whole CSIR carrying out R&D on cellulose, pulp, paper, board and natural fibres. The major R&D area of this Group is utilization of natural resources of North- Eastern region of India for value added process and product development. Based on naturally available biomass of this region a number of technologies have already been developed and some of them have been transferred to different places of the country. The technology developed e.g.; Carbonless copypaper, Thermographic paper, Direct copy paper, ECG paper brought name and fame to this institute. Handmade paper, paper slate, plastic slate, particle boards, gummed paper, gum paste are some of the rural/cottage scale technology developed by this Group. In recent years the technologies e.g.; low dust technology, liquid deodorant cleaner and banana fibre have been transferred in the country and abroad (Sri Lanka). In societal activities the Group has been organizing seminar, workshop, training programme to attract the young entrepreneurs and for skill development and entrepreneurship in the region.

**Polymer Petroleum and Coal Chemistry Group** (PPCC) is working on coal and petroleum sciences in India and abroad. The group has been engaged in the resource quality assessment and the development of indigenous processes for the rational utilization of NER low-grade coals to value added products like carbon dot, humic acid etc. The groups contributed significantly in the development of tailor made polymeric additives for use in the petroleum and allied industries. Research area 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 (ATRP), preparation of polymeric materials based on renewable natural resources. The group is also working on different aspects of coal and environmental issues including national emission inventories for coal-based industries.

### A) International Collaboration

**Project Title:** Metal nanoparticles on graphene, h-BN and low dimensional (2D) transition metal chalcogenides

**Project No:** GPP-301

**Funding Agency:** Department of Science and Technology (DST), Govt. of India and Russian Foundation for Basic Research (RFBR)

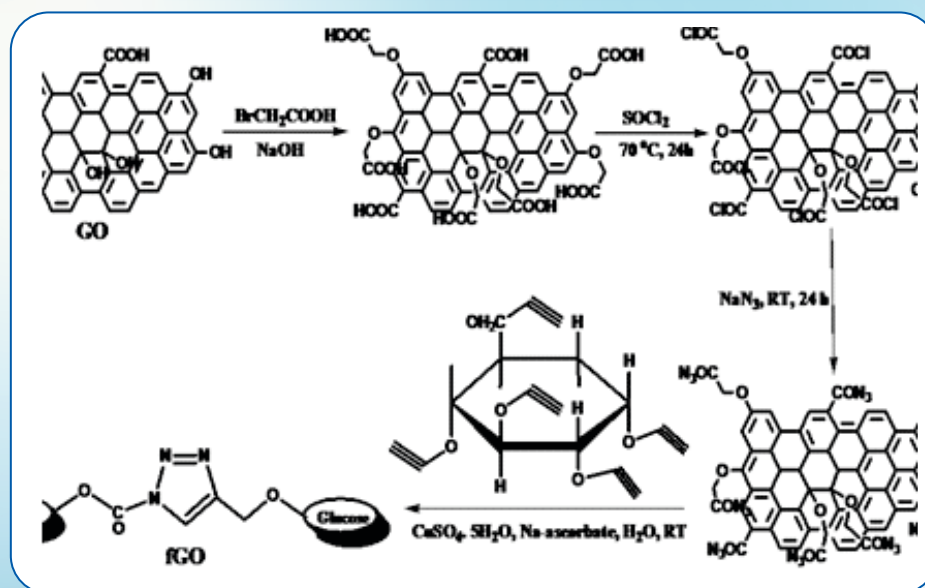
**PI & Members:** Dr Manash Ranjab Das (Indian PI), Prof Vladimir E. Fedorov, Nikolaev Institute of Inorganic Chemistry, Novosibirsk, Russia, Dr P Sengupta (Indian Co-PI)

### Objectives:

- ❖ Synthesis of the metal nanoparticles (Au, Ag, Pt, Pd, Cu, Ni) on the exfoliated graphene/functionalized graphene nanosheets and its complete characterization.
- ❖ Synthesis of the metal nanoparticles (Au, Ag, Pt, Pd, Cu, Ni) on highly exfoliated other inorganic layered compounds such as hexagonal boron nitride (h-BN), transition metal chalcogenides (TMC) and its complete characterization
- ❖ Investigation of the fundamental properties of the metal nanoparticle-graphene/functionalized graphene, metal nanoparticles-TMC composite materials and prospective practical uses
- ❖ Catalytic activity of the metal nanoparticles on the graphene/functionalized graphene, h-BN and TMC will be investigated

### Salient Achievements:

- ❖ Functionalization of the graphene surface by click chemistry approach to obtain hydrophilic functionalized graphene oxide sheets (fGS)
- ❖ Decoration of Cu(0) nanoparticles on fGS nanosheets and their characterization
- ❖ Colorimetric detection of toxic Cr(VI) ions using Cu-fGS nanocomposites



Characterization of fGS and Cu-fGS nanocomposites



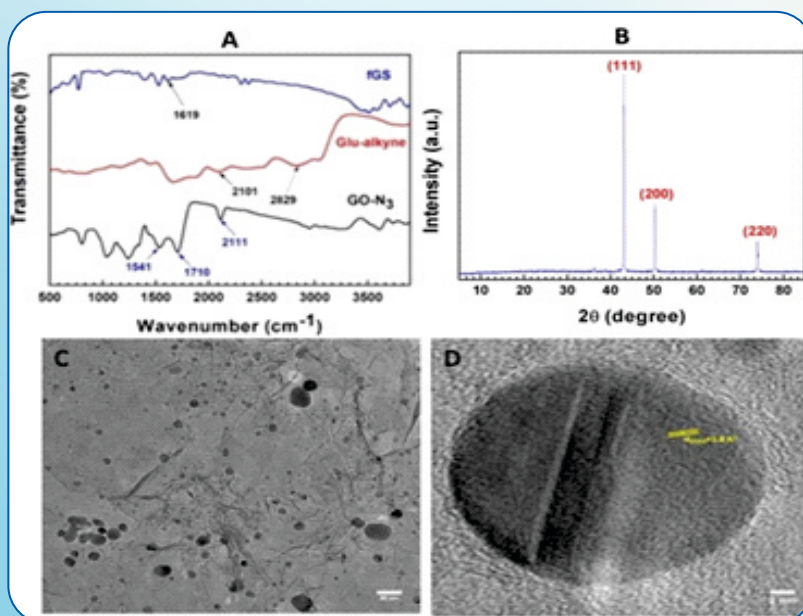


Fig : (A) FTIR of fGS (B) XRD patterns of Cu-fGS (C,D) TEM and HRTEM images of Cu-fGS

### 3. Colorimetric detection of Cr (VI) using Cu-fGS

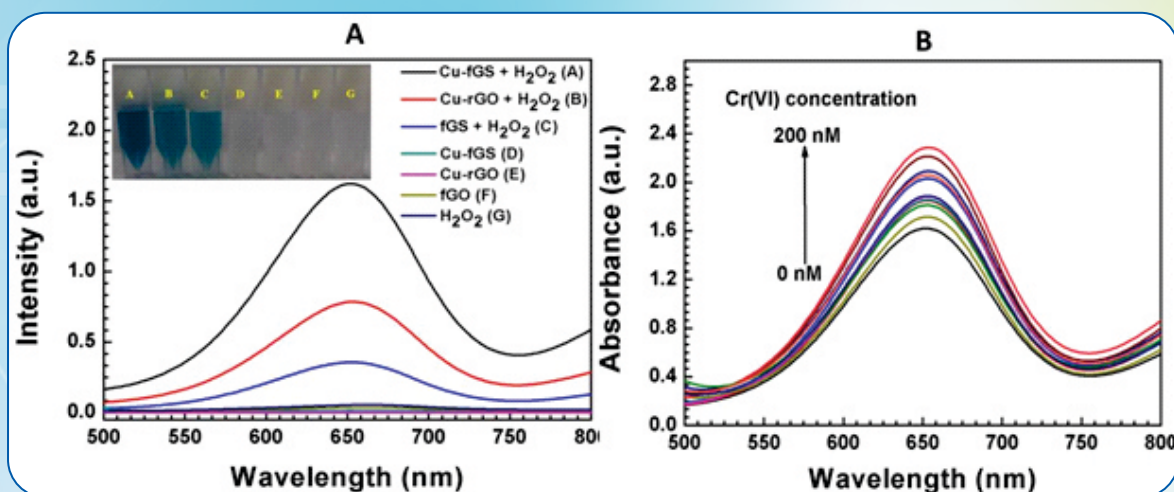


Fig : (A) Oxidation of 3,3',5,5' tetramethylbenzidine in presence of different artificial peroxidase enzymes (B) Colorimetric detection of Cr(VI) using peroxidase mimetic Cu-fGS nanocomposite

#### A) National Collaboration

##### (i) In-house, Grant in aid & Consultancy Projects

**Project Title:** Sustainable Materials and Processes for Energy, Environment and Industry

**Work Package 1:** Development of Advanced Materials for Improvement of Environmental Quality

**Project No:** OLP-2003

**Funding Agency:** CSIR, New Delhi

**PI & Members:** Dr Pinaki Sengupta (PI), Dr R L Goswamee (Co-PI), Dr L Saikia, Dr M R Das

### Objectives:

- ❖ Indigenous layered minerals of NE region and their composites for environmental and water quality improvement
- ❖ Advanced synthetic layered 2D materials and composites for catalysis by greener process

### Salient Achievements:

- ❖ Carbonised Silver-IpomeaCarneaNanocomposite for Free radical Scavenging: Developed an environmentally benign one step reductant free route towards synthesis of silver nanoparticles supported over low temperature carbonized residues of some pernicious weed

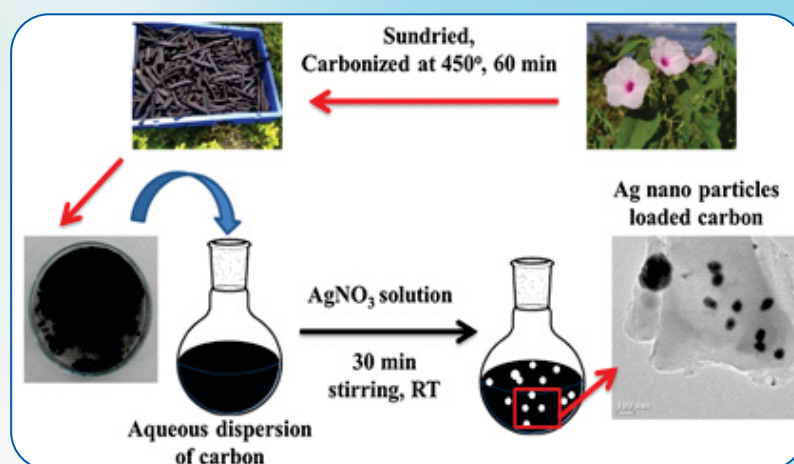


Fig : SEM of relics of carbonised mass their honeycomb like channels and Ag nano particles deposited over the carbon surface and the particle size distribution of Ag nano particles

- ❖ A prototype water defluoridisation plant of capacity 500 L/day was developed. The plant operates without electricity and can be fabricated and maintained in the village by rural semi-skilled people. Salient point of the process is its unique spent adsorbent management process. Efforts are underway to install first trial plant in Fluoride affected areas of Hojai district -



Demonstration of prototype of water defluoridation plant to hon'ble MP Mr K P Tasa



Conceptual design of the prototype to be set up in the Fluoride affected areas



**Project Title:** Sustainable Materials and Processes for Energy, Environment and Industry

**Work Package 3:** Value Added Products from North East Indian Petroleum, Coal and Biomass

**Project No:** OLP-2003

**Funding Agency:** CSIR, New Delhi

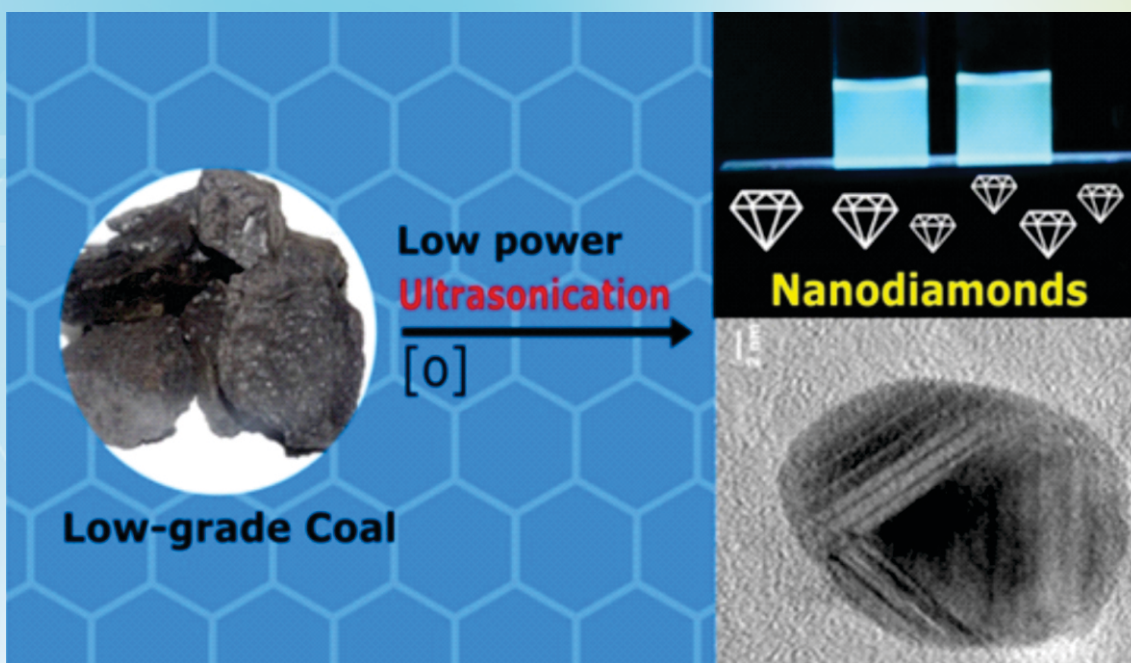
**PI & Members:** Dr Pinaki Sengupta (PI), Dr Jayaramudu Jarugala (Co-PI), B K. Saikia (Co-PI), Dr P Saikia, Dr U N Gupta, Mr T Das, Mr R C Bohra, Mr L Phukan, Mr P Handique

**Objectives:**

- ❖ Value added product from North East Indian Coals and biomass resources
- ❖ Specialty polymer additives for petroleum industry

**Salient Achievements:**

- ❖ Nanodiamonds produced from low-grade Indian coals: High-impact material nanodiamond was synthesized from low-grade Northeast region coals by low-power ultrasonic-assisted stimulation for their sustainable utilization. (ACS Sustainable Chem. Eng., 5 (2017), 9619-9624)



- ❖ Co-pyrolysis of Low-grade Indian Coal and Waste Plastics: Future Prospects of Waste Plastic as Source of Fuel: A process is demonstrated for effective utilization of waste plastics via. Co-pyrolysis with low-grade high sulfur coals at different temperatures. Quality of the char products was found to be improved through this process. Tar products having high heating value can be used for heating purpose. (Energy Fuels, 32 (2018), 2421-2431)