

CSIR NEWS

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Team CSIR



IICT commissions Nanofiltration Plant

THE Membrane Separation Group of the Chemical Engineering Division, the Indian Institute of Chemical Technology (IICT), Hyderabad, has successfully commissioned a nanofiltration plant for recovery of impurity-free sodium thiocyanate solvent from aqueous process stream for Consolidated Fibres and Chemicals Limited, (CFCL), Kolkata.

Nanofiltration is making significant strides as a membrane separation process for concentration/separation of important fine chemicals and treatment of industrial effluents due to its special charge-based repulsion property as well as unique range of molecular weight cut off (200-700). Several industries which produce acrylic fibre raw materials for textile mills, use an aqueous solution rich in sodium thiocyanate (58%) for spinning of the fibre. During the several processing stages in acrylic fibre manufacture, an effluent containing 10-12% of sodium thiocyanate besides 3-5% of impurities such as colour, sodium sulfate, Fe, Ca, β -SPA, β -SPN and low molecular weight polymer is generated. The impurities which degrade fibre quality must be removed to recover sodium thiocyanate. Pilot scale nanofiltration experiments were carried out to investigate the performance of various spiral wound membranes including hydrophilised polyamide of 250 MWCO (HPA-250), cellulose triacetate (CTA-700), polyamide-300 and HPA-400 for extracting pure sodium thiocyanate along with water in the permeate. The membrane area was 2.5 m² and operating pressure 21 bar (300 psi) to process a feed volume of 100 litres in batch mode with retentate recycle. HPA-250 gave optimum performance in terms of impurity rejection (80-90%), flux (20-40 litres/m².h) and NaSCN recovery (99%). A commercial plant employing a five-stage process with intermittent dilution was designed to process 4 m³/ day of the effluent. The plant was expected to incur a capital investment of Rs 14 lakh and an operating cost of Rs 120 per m³ and 4% impurity-free sodium thiocyanate generated.



A view of CFCL Plant at Haldia, West Bengal, based on IICT technology



IICT Network Projects

CSIR identified around 56 Network Projects for implementation during tenth five year plan (2002-07) by networking among various CSIR laboratories. Based on expertise and competence available, the Indian Institute of Chemical Technology (IICT), Hyderabad, was identified as nodal laboratory for two Network Projects i.e. Developing Green Technologies for Organic Chemicals (CMM-0006) and Globally Competitive Chemicals, processes and products (COR-0003) with Director, IICT as Chairman. During preliminary meetings, Director, IICT as Chairman and the participating laboratory scientists as members identified project components and sub components. During the review period, monitoring meetings were held on 4-5 July 2006 at IICT among participating laboratories on both the projects.

Summary on progress of the Network Projects up to 30 September 2006 is as follows:

1. Title of the Project

Developing Green Technologies for Organic Chemicals (CMM-06).

1.1 Participating labs

CIMAP, IHBT, IICT, IIIM-Jammu, NEIST-Jorhat, NIST-T, NCL, NEERI, IMMT-BB, IIP, CSMCRI, CECRI, CFRI.

1.2 Objectives

To develop new products/processes/catalysts/reagents/techniques which

attributes green concept and to make feasible green products and processes for transferring to commercial exploitation.

1.3 Outcomes achieved

- Extraction and isolation of artemisinin in 5 kg batch.
- Laboratory scale synthesis of pheromone components IV (E11-hexadecene-1-ol) and V (E11-hexadecenylacetate) (25g batch)
- Synthesis and up-scaling of the process technology for pheromone components I (Z11-hexadecen-1-ol), II (Z11-hexadenal) and III (Z11-hexadecenyl acetate) on 25 g batch size
- Process for trifluoroethanol demonstrated on 300 gm/batch scale
- a) Chemical route: Process for heptafluoropropane (HFC-227ea) demonstrated and technology transferred
- b) Electrochemical route: Process developed starting from isobutyric acid To HFC-227ea by electrochemical fluorination
- A continuous process for 1, 1, 1-trifluoro-2, 2-dichloroethane (HCFC-123) developed.

1.4 R&D outputs

- a. Publications in SCI Journals 22

- b. Patents (Indian/Foreign) 8
- c. Technologies transferred 2

2. Title of the Project

Globally Competitive Chemicals, Processes and Products (COR-03)

2.1 Participating labs

CFRI, CIMAP, CSMCRI, IHBT, IIP, NCL, NEERI, IMMT-BB, IIIM-Jm, NIST-T, IICT

2.2 Objectives

The major objective of the project is to develop globally competitive chemical entities, processes and products of high commercial value.

Outcomes achieved

- Calli formation with respect to its proliferation/growth medium optimized; nature and texture of calli were documented and used for biosynthesis of indigotin.
- Process know-how for xanthophylls dye from *T. erecta* flowers. Process for extraction; isolation of crude dye up to 5 kg fresh flowers basis was developed.
- New homogeneous and supported catalysts on biopolymer are synthesized and evaluated for Heck reaction.

- Upscaling of taxol side chain and diltiazem using the supported catalysts, lab scale work for taxol side chain is completed and demonstration to the industry.
- Studies on low temperature $TiCl_4$ hydrolysis completed. Modeling and validation completed. Preliminary studies on chlorine recovery completed.
- Aluminium phosphate and aluminium zirconium phosphate catalysts were prepared and tested for dehydration of methanol to DME.
- Preparation of 50 g and 100 g batch of isonicotinamide and INH has been standardized getting 95% yield of INH with high purity.
- A promising catalyst formulation has been identified for the synthesis of p-methoxy benzonitrile.
- New catalyst systems Cr-terephthalate mesoporous materials were prepared for direct hydroxylation of benzene.

R&D outputs

a. Publications in SCI Journals	18
b. Patents (Indian/Foreign)	3
c. Technologies generated	1

Sponsored Projects taken up/completed and S&T Services taken up by IIP

THE Sponsored Projects taken up/completed, and S&T Services taken up by the Indian Institute of Petroleum (IIP), Dehra Dun in the recent past include:

Sponsored Projects taken up

- Studies on the naphtha samples of CPF Gandhar and LPG plant, Ankleshwar
- Utilization of Glycerol to 1,3/1,2 propanediol
- Batch/continuous transesterification process for utilization of coconut oil for bio-diesel production
- Study of lubricants
- Studies on use of bio-diesel (B-100) in automotive diesel engine for performance emissions

Projects completed

- Studies on detailed evaluation of NIKO crude oil sample

S&T Services

- Testing of bio-diesel samples for Raksha Mantralaya Anusandhan Tatha Vikas Sangathan Field Research Laboratory
- Testing of bitumen contents/asphaltin residue for M/s Tikki Tar Industries, Mumbai
- Testing of HSD samples for Himachal Road Transport Corporation
- Testing of turbine oil samples for M/s Jaiprakash Associates, Chamoli
- Testing of antioxidants for Canilin Fine Chemicals Ltd, Mumbai
- Dynamic Shear Rheometer test and thin film oven test for M/s Tinna Overseas Ltd, New Delhi
- Testing of CBFS-oil sample marked as CBFS – A, B & C for estimating C/H Ratio for M/s Continental Carbon India Ltd, Ghaziabad
- Performance certification of multigrade gear oils for the Western India Genuine Ghee Co (P) Ltd, Mumbai
- Fabrication of gas apparatus for ONGC-KDMIPE, Dehra Dun



North-East Institute of Science and Technology (NEIST), Jorhat

R&D Highlights 2005-2006

THE Annual Report of the North-East Institute of Science and Technology (NEIST), Jorhat, for the year 2005-2006 reveals that performance-wise it had been a successful year for the laboratory. The institute, during the year, engaged itself intensely in the applied as well as basic research and also in the extension activities under its rural development programme. The spectrum of laboratory's R&D mainly focused on five broad areas namely Biotechnology, Chemical Sciences, Engineering Sciences, Environmental Sciences and Earth Sciences.

Among the significant achievements the laboratory made during the year, the first and foremost being the conferring of ISO 9001-2000 quality certificate to the laboratory by the international quality audit, 'DET NORSKE VERITAS (DNV)' of Netherlands. Mention can be made about the transfer of the Low Dust Chalk Pencil process to two more parties within the state and three parties reportedly commenced production. Of the new projects contracted by the laboratory during the year, 11 were Grant-in-Aid, 1 collaborative assignment and seven were consultancies with a total contract value of Rs 318.9 lakh. The laboratory rendered testing/analysis/technical services to more than 200 of its regular and other clients comprising of R&D establishments, industries,

manufacturers, tea-gardens, government departments and other private agencies earning an amount of Rs 8.1 lakh. The laboratory published a total of 65 research papers in various reputed national and international journals with an average Impact Factor of 1.866. During the year the quality of institute's research papers had improved a lot over the previous year in terms of impact factor.

On the societal front, a total of 176 hectares of land was newly brought under the cultivation of aromatic plants in places like Mizoram, Arunachal Pradesh and installation of five distillation units in those areas thereby creating employment avenues for 760 rural people.

During the period a total of 15 projects including 6 consultancies were completed and the final reports were submitted to the respective parties. The laboratory earned an amount of Rs 327 lakh as External Cash Flow through various contract research, consultancy, testing/analyses, etc.

During the year, the laboratory entered into three important Memorandum of Understanding with the reputed centres of learning viz. Allahabad Agricultural Institute - a deemed university; Assam Medical College, Dibrugarh (Assam) and POGL Institute for Petroleum and Energy Development, Guwahati for functional coordination and human resource development in Science & Technology.

Under the HRD programme of the laboratory, 12 staff members were awarded the degree of Doctor of Philosophy in different disciplines of science by the various Indian universities.

R&D HIGHLIGHTS

Biological Sciences

Study of essential oil composition of Eaglewood trees (*Aquilaria malaccensis*)

The Eaglewood tree *Aquilaria malaccensis* is a precious floral wealth of Northeastern India. The resinous patches of fragrant wood of the plant known as agar in trade has great demand in Egypt, Arabia and throughout the East for use as incense. Agar is considered to be a pathological product and also used for distilling a kind of essential oil called *agar attar*. It is a vulnerable perfume retainer and attracts very high price by the European perfumers for mixing their best grade scent. It is also described as aphrodisiac, cardiatic, carminative and termed in trade as liquid gold because of its high value. An oil obtained from non-diseased (healthy) wood of the species has been in use amongst the agar wood traders in North East India. Therefore, an investigation was carried out to study the differences in the compositions of essential oils obtained from healthy, naturally infected and artificially inoculated eaglewood using GC and GC-MS

analysis. The study showed a marked difference in the oil composition among the treated woods with regard to their quality.

Complementing a novel bacterial genus and species into Microbial Taxonomy from Garampani Hot-spring of Nambor, Assam

A novel bacterial strain designated GPTSA 20T was isolated from Garampani, Nambor of the Golaghat district of Assam. The cells were gram-negative, mesophilic, oxidase- and catalase-positive, motile aerobic rods. It was confirmed that the strain GPTSA 20T belonged to the class 'Grammaproteobacteria' and named as *Aquimonas voraii*, gen. nov.sp.nov. The type strain is GPTSA 20T (=MTCC 6713 T =JCM 12896 T. This is a part of joint collaborative work of IMTECH, Chandigarh and NEIST.

Search for novel metabolites from microbial endophytes

Isolated seven strains of endophytic fungi and *Streptomyces* from medicinal plants of Tawang, Bomdila, Arunachal Pradesh at 12000 ft. altitude and the potential metabolites showing antimicrobial activity in the preliminary screening were put into structure elucidation through HPLC-DAAD assay, NMR spectroscopy. Partial sequence of 16srRNA gene and related assay to determine their entity was in progress.

Release of Partial sequence of 16srRNA genes to NCBI Gene Bank, Bethesda, USA

Partial sequence of 16srRNA gene of several functionally important strains were released to

NCBI Gene Bank, Bethesda, Maryland, USA. The work was carried out in collaboration with IGIB, New Delhi. The work was a part of exploratory work on microbial diversity of NE India to explore and enrich the national gene bank from the untapped gene pool of Indo-Burma hot zone.

Development of microbial inventory/database

The work on development of microbial database/inventory of the strains being isolated and characterized by the laboratory from Indo-Burma hot zone having important functionalities was in progress.

Isolation, identification and characterization of antibacterial proteins from Muga silkworm *Antheraea assama*

The flacherie disease has been causing considerable damage to the silkworm, especially the muga *Antheraea assama*. A bacteria strain was identified as the pathogenic *Pseudomonas aeruginosa* strain AC-3 that causes the disease in muga silkworm *Antheraea assama*. The antibacterial proteins were isolated from haemolymph of heat killed bacterial protein isolation were performed with column chromatography (Sephadex G-75) and HPLC using C-18 column. The fractions isolated were freeze dried and analyzed by LS-MS. It was found to be a positively charged protein molecule having molecular weight 23 kDA.

International collaborative programme on drug discovery from Actinomycetes proposed

An international composite

project on 'Drug discovery from Actinomycetes' against neglected bacterial and parasitic diseases was submitted to European Commission under Specific Targeted Research project scheme for financial support.

Plant tissue culture and molecular biology

Micropropagation protocol through axillary shooting was developed for pitcher plant, *Nepenthes khasiana*, a highly endemic and endangered plant. Rooting in the *in-vitro* formed shoots was initiated. DNA finger printing works on *Machilus bombycina*, *Zanthoxylum* spp. collected from different location of North East India was in progress. Two batches of cell culture of *Panax quinquelolium* in Bioreactor produced secondary metabolite particularly ginsenosides to a desired quality.

Study of composition of essential oil in various plant species

Composition of *Cinnamomum pauciflorum* leaf essential oil found to differ from *Cinnamomum verum* and *C. cassia* by the presence of three components, one aldehyde and two diterpenes consisting only 0.3% of the total oil. Marked differences in the compositions of essential oils obtained from healthy and naturally infected strain was observed in *Aquilaria malaccensis* (Eagle wood tree).

Ethnobotanic Studies

Information on the usage of 50 plant species by Shyam communities of Assam represented by 62 prescriptions and 15 broad



ailments were recorded. For each plant species, local names, medicinal uses, parts of plant used, forms of preparations and applications and their use in particular ailments was documented.

Agro-practices for propagating *Lentinus edodes*, commonly called Shiitake mushroom, was developed. This species fetched good prices for its medicinal values and was found suitable nutritional values and suitable to grow in hilly region.

Study of root rot disease

Root rot the causal organism of wilt disease of *Withania somnifera* was identified as *Fusarium solani* which caused 30-50% mortality. Work to control this disease was in progress.

Study for yield of higher biomass

Determination of optimal parameters for production of higher biomass of *Aquilaria agallocha*, *Cymbopogon citratus*, *C. Jawarancusa*, *Litsea cubeba*, *Asparagus racemosus*, *Bacopa monerri* was continuing.

Plant extract for bioactive molecules

Under the project "Development and commercialization of bioactive and traditional preparation", 1500 plant extracts and lead extractives were taken up for agro bio evaluation against designated target insects under toxicity, feeding deterency and ICR studies. Six extracts were confirmed to have possessed with promising activities by repeat screening.

Eighty-nine samples were

collected. Among these, 51 herbarium specimens were sent to NBRI, Lucknow, seed samples of 39 species sent to CIMAP and 89 plant samples to IIIM-Jammu.

Evaluation of *Jatropha* accessions

Under a NMITLI project for genetic improvement of *Jatropha curcas* for adaptability and oil yield, institute collected 15 accessions from geographically distinct habitats of N. E. India which were found to contain fatty oil from 25 to 36 percent. Elite accessions from different regions viz. U. P., Gujarat, Andhra Pradesh, Tamilnadu, Haryana, West Bengal, Orissa, etc. were also collected and planted to evaluate their performance under agro-climatic conditions of N. E. India. Cuttings of native stock were collected and sent to ten different institutes of India for evaluation. Further work was in progress.

Studies were also undertaken on: Search for chemotypes of *Litsea cubeba* from North East Indian Germplasm for exploiting high quality essential oil of commercial utility; New method for propagation of *Piper longum*; Development of new strain of lemongrass (*Cymbopogon flexuosus*); and Development of high value medicinal and aromatic plants for Arunachal Pradesh.

Chemical Sciences (Material sciences)

Modified clay catalysed Friedel-Crafts reaction of phenol with 4-hydroxy-butan 2-one to produce 4-(4'-hydroxyphenyl)butan-2-one (Raspberry ketone)

Industrially important organic

molecule such as 4-(4'-hydroxyphenyl)butan-2-one also known as "Raspberry Ketone" is used in perfume industries, food industries and also in compositions for weight loss with improved taste. A process has been developed to produce 4-(4'-hydroxyphenyl)butan-2-one using modified supported clay (Montmorillonite) as solid acid catalysts where about 80% selectivity and 40% conversion were achieved. The surface area (BET), oxidic compositions, thermal characteristics, crystallinity (XRD) etc. of the catalysts were determined. The reaction products were characterized by GC, NMR, IR, HPLC and elemental analyses. Further optimization and scale-up studies were in progress.

Studies were also undertaken on: Cleaning of high sulphur N. E. coals; X-Ray analysis of graphene layers of Assam coal; and Development of a new analytical method for estimation of Diosgenin.

HPLC method of ergot alkaloids developed

Effective analysis of the various ergot alkaloids is often difficult. The laboratory developed a HPLC method which was successfully employed to separate all the compounds with excellent peak shape. The compounds were Agroclavine, Lysergene, Festuclavine, Pyroclavine, Ergocornine, d-Ergocryptine and Ergocristine.

Studies were undertaken on: Ion pair formation and Hofmeister effects in electrolyte solutions; Oxidative addition of different electrophiles with rhodium(I) carbonyl complexes of

unsymmetrical bis-(phosphine) monoselenide ligands; Monocarbonyliridium(I) complexes of P-Se ligands and oxidative addition reactions; Interaction of bulky cationic dyes (Pyronin Y and Rhodamine 6G) with different forms of Montmorillonite clay matrix and characterization of the composites; and Adsorption of small organic aromatic acids on oxide surfaces.

Characterization of limestone resources of NE Region for value addition and rational utilization

Beneficiation of limestone from New Umrangshu (North Cachar Hills, Assam) was investigated by dry and wet grinding followed by size separation. The coarse fraction (-25 mm + 18.75 mm) contained maximum amount of CaO (~ 52%) and minimum amounts of SiO₂ (1.53), Al₂O₃ (0.79%) and Fe₂O₃ (0.68%). The fine fraction (-12.5 mm) contained the minimum amount of CaO (50.92%) and maximum amount of SiO₂ (2.25%), Al₂O₃ (0.93%) and Fe₂O₃ (1.32%). Most of the kaolinite clay mineral concentrated in the fine fraction. The limestone might find use as a fluxing material in metallurgy and raw material for manufacturing lime required in manufacturing of sugar, soda ash, caustic soda, water treatment etc. It was possible to obtain a fraction having more than 54% CaO with low SiO₂ (~ 0.5%), Al₂O₃ (~ 0.6%) and Fe₂O₃ (~ 0.7%) by further grinding the lime stone followed by separation by dispersion-cum-settling technique. The work was funded by Ministry of Mines, New Delhi.

Alkali activated blended cements: mechanical strength, pore solution composition and zeolite formation

The effect of sodium hydroxide, sodium carbonate, sodium sulphate and sodium silicate on the lime reactivity of metakaolin was investigated as per Indian Standard methods. The hydration products were separated by dispersion cum sedimentation technique and the same were characterized. The strengths of the mortar cubes were affected by the nature and concentration of the alkali/salt. The work was funded by Ministry of Water Resources, Research & Development Division, New Delhi.

Evaluation of bench scale conditions of preparation of Mixed-Metal Hydroxide and suitability of it as drilling fluid additive for drilling operations of OIL

The suitability of Mixed-Metal Hydroxides prepared in the laboratory was evaluated as viscofier for clay based drilling fluid of OIL using clay supplied by OIL Duliajan. Results obtained showed that the less than 1 mm fraction content in clay was extremely important for MMH to work as viscofier. MMH, being an inorganic environmentally benign and economically cheap material is a suitable product for oil industry for using as a viscofier in normal drilling operations. The steps involved in its preparation are not very complex. Therefore, the project on successful completion bore prospect for successful commercialization. The work was carried out under a collaborative project funded by OIL, Duliajan.

Natural Products

Bioactive Molecules

Under a CSIR coordinated project on development & commercialization of bioactive molecules from plant sources a total of 16 plants and 16 plant parts were extracted with three different solvents and a total of 47 extracts made. These extracts were sent to different bioevaluating laboratories for screening against different diseases. Under single molecule discovery scheme, a total of 9 pure single molecules were sent for bioevaluation. Out of these samples, RRLJ-Dan/Eto exhibited anti-gastric ulcer activity and sample RRLJ-Dan/Ac exhibited anti-Parkinson's activity. Repeat samples were sent for further study.

Total Synthesis of Natural Products

(+)-Boronolide, an α , β -unsaturated d-lactone containing a polyacetoxy side-chain was isolated. *Tetradenia fruticosa* is known to possess antimalarial property; a stereoselective total synthesis of this molecule was accomplished.

A concise synthesis of the pharmacologically important natural product (+)-preussin was achieved. Two asymmetric C-C bond-formation reactions mediated by binaphthol-derived asymmetric catalysts were applied to control the stereochemistry of its three stereocenters.

The piperidine alkaloid (+)-sedamine has long been used for the treatment of narcotic poisoning, coal gas asphyxia, pneumonia and control of anxiety as folk medicine in the



Indian subcontinent in crude form. This molecule was synthesized utilizing two regioselective ring-opening reactions of epoxide with vinyl metallic reagent and a ring closing metathesis reaction as the key steps.

A total synthesis of the aminopeptidase inhibitor (-)-bestatin was achieved involving asymmetric nitro-aldol reaction as the key step.

The chemistry of steroidal lactones is of great interest as many of this class of compounds were potent antitumor agents. Metal-mediated halogenation technique was used as a key step to synthesize D-ring fused 16- α -steroidal- γ -butyrolactones 2&3 from 20-oxopregnane I.

The phytotoxic lactone herbarumin III was synthesized in 11% overall yield. The approach applied involved, Keck's asymmetric allylation and Sharpless epoxidation to build the key fragment. Esterification with known acid and a ring closing metathesis was used to arrive at the target.

New Chemistry developed

Acyl derivative of N-hydroxy-2-thiopyridone (1) popularly known as 'Barton ester' is a good source of alkyl radical.

A study was carried out to generate substituted alkyl radicals from dicarboxylic acids or from acids of complex stereo structures. Further study would be about its use in carbon-carbon bond formation reaction.

Use of non-conventional energy source such as microwave energy,

sunlight, etc. was being exploited in the course of the reactions.

Studies were carried out on the Mild and efficient indium(III) chloride catalyzed Sonogashira coupling reaction of aryl halides.

The chemistry of pyrimidine is of great interest because they constitute the basic unit of DNA bases and are also used as antibiotic (blasticidin), CNS depressants (Phenobarbital), antimicrobial (pyrimido-2,4-diamines) and antitumor agents (5-fluoro uracil). On the other hand, the steroidal heterocycles such as danazol, deflazacort, cortivazol, nevazol, 2-azasteroid and finasteride, attract much attention due to their biological activities against various ailments such as benign prostatic hyperplasia, asthma, prostate cancer and L-1210 leukemia. Because of the biological activities imparted by these heterocycles or steroids, the attention for the preparation of novel A- and D-ring annelated heterosteroids continue to intensify. A novel strategy for the construction of pyrimidine nucleus on steroids using chemistry of β -formyl enamide was developed and the reaction was generalized by employing various. A- and D-ring steroidal, alicyclic and acyclic formyl enamides.

Development of Green Chemistry

I_2 /surfactant/water system deprotecting oximes and imines to the corresponding carbonyl compounds under neutral conditions in water

In recent years, development of environmentally benign methods/

reagents received attention from chemists, because of the conservation of global eco-system. Water is an environment friendly solvent. It is cheap, readily available and non-toxic with high dipole moment. Therefore, the development of new methodology in water is necessary for conservation of environment. However, the main hurdles in using water as a solvent are (1) most of the organic reagent/catalysts are insoluble in water (2) the moisture sensitive reactants/catalysts cannot survive in water. To overcome these hurdles, a surfactant in water is an appropriate candidate for solubilizing the organic reactants/catalyst and maintaining an anhydrous environment for moisture sensitive reagents and performing the reaction in water. In this endeavour, a selective oxidation of oximes and imines to carbonyls under neutral conditions in water was undertaken and performed successfully. Here, the surfactant solubilized water insoluble I_2 and organic reactants in water and selectively deprotected imines and oximes to carbonyls. No over oxidized product i.e. acid was detected in the reaction mixture. The concept could be applied to R&D/technology development.

(a) Surfactant/ I_2 water

An efficient system for deprotection of oximes and imines to carbonyls under neutral conditions in water. The system was used for deprotecting a range of oximes and imines to the corresponding carbonyls under neutral conditions in water at [25-40] $^{\circ}$ C with high to excellent yield.

(b) Conversion of alcohols to aldehydes and ketones using I_2 -KI- K_2CO_3 - H_2O system

A new system, I_2 -KI- K_2CO_3 - H_2O , which selectively oxidized alcohols to aldehydes and ketones under anaerobic condition in water at 90°C with excellent yield was developed. The process is green, mild and inexpensive. The selective oxidation of alcohols to carbonyls is an important transformation in organic synthesis. This transformation uses organic solvents, transition metals, air/ O_2 , toxic oxygen containing oxidants, etc. To overcome these classical hurdles, a new reagent system [KI/ $1/2K_2CO_3$ /Water] which avoids organic solvents, transition metals, air/ O_2 , toxic oxygen containing oxidants, etc. was developed. The process is clean, anaerobic and economically viable.

Petroleum Products

Development of specialty polymers for use in petroleum and allied industries

Work was undertaken for the development of specialty polymers by Controlled/Living Radical Polymerization for use in petroleum and allied industries with the aim of developing tailor-made polymeric additives by transition metal catalyzed living radical polymerization technique for use as additives for crude oils and petroleum products.

Cocrystallization behaviour of poly(n-docosyl acrylate) with n-docosanoic acid by X-ray and differential scanning calorimetry studies

Cocrystallization of comb-like poly(n-docosyl acrylate) (PDA) with n-docosanoic acid (C_{22}) have been studied by differential scanning calorimetry (DSC) and X-ray diffraction (XRD) methods. DSC measurement of PDA/ C_{22} blends showed the characteristic melting endotherms and also suggested the existence of another crystalline form induced by the addition of the C_{22} . The existence of hexagonally-packed crystalline lattice and the phase behaviour of PDA/ C_{22} blends were established from XRD studies. Thermal degradation behaviour of PDA/ C_{22} blends were performed by thermogravimetric analyzer.

Studies were also undertaken on: Atom transfer radical polymerization of n-docosyl acrylate; Synthesis of comb-like polymers by atom transfer radical polymerization; and A novel indium-catalyzed Sonogashira coupling reaction, effected in the absence of a copper salt, phosphine, ligand and palladium.

Engineering Sciences

Studies were carried out on Development of a manufacturing process for green tea polyphenols (GTP) from Assam tea; Nutraceuticals for health and specialty foods through biotechnology approaches; Development of a process for production of liquid fuel from petroleum refinery solid waste of North Eastern Region of India by thermal and catalytic cracking; and Development of enantio-selective membranes from chiral polymers.

Earth Sciences

Studies were carried out on: Complex tectonic model of Shillong Plateau; and seismic hazard, risk assessment and environmental studies for North-East India: Attenuation of coda waves in the Northeastern region of India.

Seismological data base for Chedrang Valley, Meghalaya

Seismological data base was prepared for about 1776 earthquakes in Chedrang valley and its vicinity, East Garo Hills, Meghalaya during the period 2004-2005. The database is useful for the assessment of seismic hazard in the Chedrang valley region in Meghalaya.

Studies were made on: attenuation of coda wave and waveform analysis estimation of focal mechanism solutions using P-wave polarity method and waveform inversion technique; Attenuation parameters deduced from attenuation of coda wave in NER; and Attenuation properties of sampled area.

Studies were undertaken on: Preparation of Qc Map; Evaluation of an empirical relation between network duration magnitude, MD(A) and Energy(E); and Modelling of earthquake source and ground motion in chedrang fault and its neighbourhood.

Environmental Sciences

Remediation and management of coalmining wasteland of North Eastern Coalfields of Margherita

In situ remediation of the environment degradation in



overburden dumping site due to coalmine activity of the North Eastern Coal Fields of Margherita was undertaken. From the preliminary investigation, it was found that *Mimosa strigillosa* and *M. pigra* are suitable species for mine overburden tailings secondary succession. The species of monocots Lemongrass (*Cymbopogon flexosus*) and Citronella (*Cymbopogon winterianus* Jowith), the *Eupetorium* species and some bamboo species also reached its minimum canopy size. These species were also found to grow well in coalmine overburden dumps. However, for initial establishment amendment of organic manure seemed to be essential to get the targeted succession. Stunted growth and development were recorded in the plants introduced in the coalmine overburden dumping sites. The canopy size were also less than that of the actual size. On the basis of the observations made it can be confirmed that a close cultivation of different plant species is urgently important to achieve the maximum dominance of different plant species. The cultivation of shrubby annual legume plant *Dhanshyas* leguminous plant which can fix nitrogen and shrubby leguminous plant species of *Cassia* was recommended.

Assessment and promotion of wetland economic biodiversity of Manipur

NEIST sub-station at Manipur undertook a study of baseline information and analysis on the wetland bioresources, traditional medicinal plants, aromatic plants, wild edible plants, mushrooms cultivation/culture and vermi-composting, etc. of Manipur. The work was funded by the GB Pant Institute of Himalayan Environment & Development of Almora.

Seminar on Fluorine Compounds in Pharmaceutical and Agrochemical Industries

THE Indian Institute of Chemical Technology (IICT), Hyderabad, organized a one-day seminar on Fluorine compounds in pharmaceutical and agrochemical industries; in association with DuPont, the multinational giant and a pioneer in the fluorine chemistry in the world.

In his opening remarks, Dr J.S. Yadav, Director, IICT, said that IICT is the only laboratory in the country, which is undertaking any sort of work on fluorine chemistry, a job of hazardous nature. Dr A.V. Rama Rao, CMD, AVRA Labs and former Director, IICT, traced the evolution of the Fluoro-organics department at IICT and said that the importance of fluorochemistry in the present era can be gauged by the fact that "one out of three pharmaceutical products use fluorine as one of the combinations."

Ms Kelly G. Kolliopoulos, Global Head, DuPont, who made a presentation on the history of DuPont and its achievements in the 204 years since its inception informed the gathering that the company was going to set up a Rs 200 crore R&D facility at Hyderabad for research on fluorointermediates. DuPont was developing new reagents that will help fluorine to be put into drug compounds. Fluorine integration, in turn, would achieve more effective medicines, healthier crops and high performance polymers. Fluoro products, which constitute \$ 2 billion of DuPont's over \$ 30 billion turnover, find a range of applications in refrigeration, pharma, cookware, agriculture, electronics, semiconductor, consumer products and life sciences.

Ms Kolliopoulos further said that DuPont has the capability to incorporate fluorine in a growing variety in a number of ways. Single fluorines, difluorocarbene, trifluoromethyls and higher order fluorinated groups and new fluorinated intermediates launched by DuPont include TFEDMA, FTESA and HFIBO. These products and the other DuPont products in the pipeline will be of great use in promoting healthier crops, more effective medicines and high performance polymers.

Dr Rene Gree, Director of Research, University of Rennes, France, in his key-note address presented some of the work conducted in the field of fluorochemistry in relation to potential applications. Shri S.Narayan Reddy, Head, Fluoroorganics Division, IICT, Dr Homi Bhedwar, Director, R&D and Shri Sahil Bablani, Business Development Executive of DuPont India, respectively also spoke on the occasion.

Workshop on Integrated Fluorosis Mitigation: Challenges and Avenues

DUE to the lowering of groundwater in many parts of India, there are significant risks of increased bacteriological and chemical contaminations mainly due to arsenic, nitrate and fluoride. Therefore, to mitigate these contaminants there is a need for a “holistic” health management approach. This approach needs to begin with establishing tolerable levels of risk to human health for the specific chemicals followed by appropriate risk management strategies.

The National Environmental Engineering Research Institute (NEERI), Nagpur, with United Nations Children’s Fund (UNICEF), has jointly carried out a project on Technical Strengthening of PHED MP/CH UNICEF Bhopal/NEERI Collaboration of Effective Delivery of TSC/SD (Principal Investigators: Dr Samuel Godfrey, Dr S.R. Wate and Dr S.S. Rayalu) wherein a novel concept of Integrated Fluorosis Mitigation has been pursued to address the growing problem of fluorosis.

Fluorosis is caused by intake of high levels of fluoride from various exposure routes. A large number of

attempts have been reported mainly on Defluoridation of water, which reduces fluoride in water; however, it cannot address the problem of fluorosis completely. Therefore, the development of new materials as well as better water management is imperative for defluoridation of water, while nutritional supplements can also play important role in mitigation of fluorosis.

These studies have been conducted and the findings are being documented in the form of manual. This guidance manual may be considered as the first of its kind as it provides and applies Modern Scientific Approaches outlined in WHO GDWQ Vol. 3(2004) to rural Indian communities. The manual is the 2nd in the series published by NEERI in collaboration with UNICEF Bhopal. This manual presents a review of fluoride pollution in ground water and existing fluorosis mitigation approaches, while the main objective of this manual is to present the comprehensive approach of ‘Integrated Fluorosis Mitigation’ (IFM) involving QCRA, wise water management, domestic defluoridation of water and nutritional supplements. The manual contains results of recent

studies carried out on these approaches of fluorosis mitigation, under the joint research project between NEERI and UNICEF referred above.

The manual has been peer reviewed during two-day workshop on ‘Integrated Fluorosis Mitigation’ (IFM) held at NEERI. This workshop was sponsored by UNICEF with participation from various agencies including UNDP, IWMI, UNHSP, MPRLP, PHED, SEUF, DDWS, NCHSE, VVS etc.

A series of lectures were delivered during the workshop by Dr Samuel Godfrey, Dr S.R. Wate, Dr Sadhana Rayalu, Dr Nitin Labhsetwar, Dr Amit Bansiwala, Dr Sanjay Kamble and Dr Srimanth Kagne and demonstration for household treatment was presented by Dr Rajesh B. Biniwale.

Various dignitaries and academicians expressed their views on the manual on IFM which has been written specifically for practitioners involved in the fluorosis mitigation programme. This includes local governing bodies, engineers, water quality analysts, scientists, sociologists and professionals.



CSIR Trainer's Training Program on E-Journals, WoS, Patent Databases

INFORMATION Centre for Aerospace Science and Technology (ICAST) hosted a two days' workshop on 'CSIR E-Journals and Databases Trainer's Training Program' during 12-13 July 2007. This event, the third in a continuing series for all the CSIR laboratories at zonal level was organized under the CSIR E-Journals consortia, coordinated by the National Institute of Science Communication And Information Resources (NISCAIR), New Delhi. CSIR Centre for Mathematical Modelling and Computer Simulation (CMMACS), Bangalore; Central Food Technological Research Institute, (CFTRI), Mysore; National Institute for Interdisciplinary Science and Technology (NIST), Thiruvananthapuram; and some scientists of the National Aerospace Laboratories (NAL), Bangalore, participated. The main objective of this program was to impart training for accessing the e-journals, databases and standards. After a brief welcome by Dr I. R. N. Goudar, Shri Prakash Chand, the coordinator of CSIR E-Journals consortium spoke about the conception, inception and the status of this consortium with more than 5500 e-journals held by the major publishers. E-Journals, the consortium has also provided access to important bibliographic databases like Web of Science (WoS), Derwent Innovative Index (DII), Delphion from Thomson Inc., BIS (Bureau of Indian Standards) and ASTM standards on CD, a stand alone accessible through ICAST system only. The program concluded with lots of innovative ideas, shared thoughts for further improvement and new additions from the participants.

WHO Fellowship Training Programme on Water Quality Monitoring and Surveillance and Emergency Water Supply and Sanitation

THE training programme sponsored by World Health Organization (WHO), New Delhi, on Water Quality Monitoring and Surveillance and Emergency Water Supply and Sanitation was held during 5-30 March 2007 at the National Environmental Engineering Research Institute (NEERI), Nagpur. The trainees from Mynamar and Bhutan participated in training.

Under the broad umbrella of the subject, the training was divided in six categories.

Water quality parameters and health aspects; persistent organic pollutants in water; water quality monitoring and surveillance; water resources management; Different analytical techniques for analysis of water quality parameters including sea water; emergency water supply and sanitation.

In water quality parameters and health aspects significance of different water quality parameters, their guidelines health effects and technologies for their removal were discussed. The significant health related parameters mainly fluorides, arsenic and iron were discussed in detail which include chemistry, geological aspects, health criteria and technological intervention. Apart from this significance of biological and bacteriological parameters, regarding waterborne diseases were also taught.

Importance of surveillance of drinking water quality, managing

coastal area for water management and treatment, and process of conventional water treatment were discussed in detail, in the training programme.

Water resource management includes importance of EIA studies for various water resource management practices, importance of public participation in water supply, rain water harvesting. During the training programme, the lectures were delivered on topics like watershed management, remote sensing and resistivity meter technique as a tool for studying water resources and contamination.

The various issues relating to emergency water supply and sanitation were considered during the training. The unit developed by the National Environmental Engineering Research Institute (NEERI), Nagpur, for water supply during emergency period was also demonstrated.

The use of sophisticated analytical technique and instrumentation like GC, HPLC, ICP and AAS in analysis of persistent organic pollutants and metal analysis were demonstrated during the training programme.

Apart from lectures and laboratory studies, field visits were arranged for demonstration of water treatment technologies and water sampling. The study material on training programme and participation certificates were distributed on last day of training.



Training Programmes on Vehicular Pollution organized by IIP

TWO training programmes, each of one week's duration, sponsored by the Ministry of Shipping, Road Transport and Highways, Government of India, were organized by the Indian Institute of Petroleum (IIP), Dehra Dun for Officers of State Transport Departments from various states of India. The first programme was inaugurated by Shri S. Ramaswami, Secretary, Home & Transport and Transport Commissioner, Uttarakhand, and had 31 participants. The second programme was inaugurated by Shri R.C. Mittal, Chief Engineer, PWD, Uttarakhand and had 24 participants. The states represented were Andhra Pradesh, Gujarat, Uttar Pradesh, Rajasthan, Kerala and Maharashtra and Orissa.

World Environment Day celebrated at NEERI



Dr Ajay Mathur delivering the World Environment Day Lecture
Seated on the dais (from left): Dr S.P. Pande, Dr Sukumar Devotta and Shri A. Ghosh

THE World Environment Day was celebrated on 6 June 2007 at the National Environmental Engineering Research Institute (NEERI), Nagpur. Dr Ajay Mathur, Director General, Bureau of Energy Efficiency (BEE), Government of India, was the Chief Guest on the occasion.

Dr Mathur delivered the Environment Day lecture on the topic "Environment, Technologies and Markets: The Promise of Indian Global Competitiveness". Dr Mathur said that climate change mitigation has promoted the early and large scale adoption of renewable energy and energy efficient products. He informed that Suzlon / R E Power is the third largest wind energy equipment manufacturer in the world. Havells is globally the fifth largest manufacturer of CFLs/ lighting equipment, he added. He said that Hyderabad based Vijay

Electricals has captured global transformer market. He opined that environmental compliance has helped in creating more demand for such environmentally superior products widening their market. Dr Mathur said that although environmental compliance involves high cost, it also allows an increase in economic growth besides enhancing the global competitiveness of Indian manufacturers. Giving examples of some Indian companies, he said that the manufacturers/industries have now expanded to areas which had never even dared to venture earlier and were completely unknown.

Dr Mathur said that compliance of Kyoto protocol has led to creation of certain performance standards in the country, which were non-existent till now. It has also allowed use of renewable energy as a mandatory measure, he added. Dr Mathur informed that the Maharashtra grid



is fed with 1000 MW of energy generated from renewable sources as per the Central Electricity Act 2003. He said that rapid economic growth provides new and expanding market opportunities.

Global competitiveness drives adoption / manufacture of products providing environmentally superior services and for this R&D support is crucial for design and engineering, where NEERI has to play a major role, he added.

Earlier, Dr Sukumar Devotta, Director, NEERI welcomed the Chief Guest and in his inaugural address spoke on the importance of World Environment Day. Dr Devotta briefed about this year's theme "Melting Ice: A Hot Topic?" He said that each individual should take the responsibility for preserving our environment.

Dr S.P. Pande, Scientist & Head, R&D Planning Unit introduced the Chief Guest and Shri A. Ghosh, Sr. Scientist, R&D Planning Unit, proposed a vote of thanks.

Next Generation Healthcare Paradigms and Information Technology

PROF. Rajani Joshi from IIT-Bombay gave an informative talk titled 'Next Generation Healthcare Paradigms and Information Technology' at the Aerospace Laboratories (NAL), Bangalore, on 14 May 2007. The talk focused on latest research in the field of clinical diagnosis and treatment using concepts from Ayurveda and Yagya therapy. Prof Joshi mentioned that all human beings share 99.9 % of human genome sequences and all the physical variations among human beings are in fact attributable to the remaining 0.1%. Common gene in two individuals may cause a disease in one but not in the other depending on the phenotype of the person. An equivalent of the concept of human phenotype could be found in Ayurveda in the form of *prakriti*, which is defined by the *Vat - Pitta - Kaf* (the three *doshas*) structure. According to her, each person has a different level of each *dosha*. So the efforts are on to classify human phenotypes using the *Tridosha* structure. Only when such a mapping is complete would it be possible to identify how genes would work in a particular individual, and therapy based upon gene modifications be possible.

Prof. Joshi then discussed how modern research labs are trying to measure the pulse (Nadis) which are the channels of flow of blood. Experienced Ayurvedic doctors can identify the complete *tridosha* system of an individual based on the pulse.

The latter part of the talk dealt with her research at Brahmavarchas Research Institute, Haridwar on *Yagya* therapy. She mentioned that modern medical science is now convinced that inhalation is the most effective means of drug injection in human body. It has also been found that the medicines inhaled through *yagya* fumes are very potent for treatment and stay in blood for long periods of time.

NBRI organizes CSIR Programme on Youth for Leadership in Science

THE National Botanical Research Institute (NBRI), Lucknow, organized the two-day CSIR Programme on Youth for Leadership in Science (CPYLS) at NBRI on 10-11 May 2007. Thirty-five students of various schools and colleges participated in the programme. Twelve of them were

CSIR nominees and board position holders, whereas 23 were nominated from different colleges by the INSA local chapter. The function was inaugurated by the Chief Guest, Prof H.Y. Mohan Ram, former-Professor of Botany, Delhi University, Delhi. Dr R.K. Gupta, Senior most Scientist, NBRI, welcomed and

introduced the Chief Guest, whereas Dr J.K. Johri, Scientist, NBRI, spoke about the genesis of the programme.

Prof. Mohan Ram in his interesting lecture on 'Wonders and Challenges – The Plant Life', talked about some fascinating plants, like giant Sequoia tree and flowers which

change colours during pollination and later on when they are not ready for pollination.

Dr R.C. Srimal, former-Director, Industrial Toxicology Research Centre, Lucknow, on behalf of the local INSA chapter, told the students about the excitements of the science that holds for all of us. He said that science was growing at a great pace, especially in the field of biotechnology. The changing environmental conditions posed great challenges to the humanity and the young students could embark upon to become future leaders to tackle these challenges.

Delivering a talk on the fascinating world of ornamentals, Dr S.K. Datta, Scientist, NBRI talked about the research work and commercialization of ornamentals being pursued by NBRI. He also told the students about the careers and opportunities available in the field of floriculture.

The students were introduced to the new science of biotechnology by Dr P. Nath, Plants

at Antarctica by Dr Sanjeev Nayak and Enigmatic world of lower plants by Dr P.B. Khare. Students were explained the functioning of Electron Microscope by Dr M.R. Suseela. The last session was an interactive session where, the students raised a number of curious and intelligent questions which were explained by Prof. G.K. Garg, former-

Professor and presently Director (R&D), Krishi Dhan Seeds, Jalna, Maharashtra and a team of Scientists of NBRI. The

session ended with presentation of certificates to the participants by Prof. Garg.



Dr J.K. Johri, Scientist, NBRI, detailing the genesis of the CPYLS programme. Seated on the dais (from left) are: Dr R.K. Gupta, Prof. H. Y. Mohan Ram, Dr R.C. Srimal and Dr S.K.Datta



Prof. G.K. Garg, answering the queries put by students in the interactive session



A group photograph of students, scientists and educators who participated in the CPYLS 2007



Dr V.P. Dimri receives FAPCCI Award

DR V.P. Dimri, Director, National Geophysical Research Institute (NGRI), Hyderabad, has received the Chelikani Atchuta Rao Memorial cash award by Federation of Andhra Pradesh Chambers of Commerce and Industry (FAPCCI) for the period 2005-06. Dr Dimri received the award at the hands of the Chief Minister of Andhra Pradesh Shri Y.S. Rajasekhara Reddy on 8 June 2007.

The award has been instituted by Shri Late C.V. Sitaramaswamy, past president of FAPCCI for honouring the outstanding scientist or engineer in the state for the benefit of industry, trade and agriculture.

He received the award for his outstanding contributions to geophysical data analysis and interpretation for a variety of applications in precursors to earthquakes, exploration of



Dr V.P. Dimri, Director, NGRI, receiving the FAPCCI award from Shri Y.S. Rajasekhara Reddy, Chief Minister of Andhra Pradesh

hydrocarbons and groundwater.

Dr Dimri is pioneering a pilot project to enhance oil recovery from Indian oil wells in collaboration with Norwegian Scientists. He has proposed a new method for Tsunami wave propagation modeling using

fractals and finite difference. Dr Dimri has launched a very successful project in Nalgonda District of A.P. for assessment, management and exploration of groundwater in hard rock terrains for fluoride free water supply.

Dr Dinesh Mohan nominated as a member of the Editorial Board of Journal of Hazardous Materials



DR Dinesh Mohan, Scientist, Environmental Chemistry Division of Industrial Toxicology Research Centre (ITRC), Lucknow, has been nominated as member of the Editorial Board of *Journal of Hazardous Materials* (HAZMAT) published by Elsevier. In addition, he has also been nominated as member of Polish *Journal of Environmental Studies* and Managing Editor (ME) of India for *Journal of Environmental Protection*.

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