



# CSIR NEWS

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## IIP signs MoU with NTPC for 'Developing Pressure Swing Adsorption Technology for CO<sub>2</sub> Capture from Flue Gas'

**THE Indian Institute of Petroleum (IIP)**, Dehra Dun, has recently signed an MoU with NTPC Ltd for 'Development of Pressure Swing Adsorption Technology for CO<sub>2</sub> Capture from Flue Gas'. The MoU was signed by Dr R. R. Sonde, Executive Director NTPC and Dr M. O. Garg, Director, IIP, in the presence of senior scientists and officers of the institute.

NTPC is a premier power utility company in India having expertise and strength in areas such as setting up of thermal power stations, operation and maintenance of power stations and sale of power. NTPC has developed comprehensive in-house

expertise in various facets of power generation from concept to commissioning, efficient operation to nurturing of ecology, and environment in accordance with National Power Policy of Government of India. NTPC is also setting up hydro-electric power stations and has its foray in other energy systems. NTPC, in its new initiative for meeting the future destinations, has set up energy technologies to take up the development of technology through fundamental R&D route. NTPC intends to conduct research, carry out experiments, build software and knowledge base leading to development of the above technology in collaboration with CSIR/IIP.

IIP has established expertise and has its footprints globally in the areas of petroleum refining technology, including the development of separation, conversion and upgradation processes for crude oil supplied to the refinery together with synthesis of specialty and fine chemicals for treating and blending the refined crude, etc.

Both IIP and NTPC are leading premier national organizations in their respective fields and are desirous of working together as a team to achieve national objectives, undertaken with their best abilities and maximum mutual cooperation with intent of helping each other in the power sector—a vital component in India's march towards becoming a developed nation.



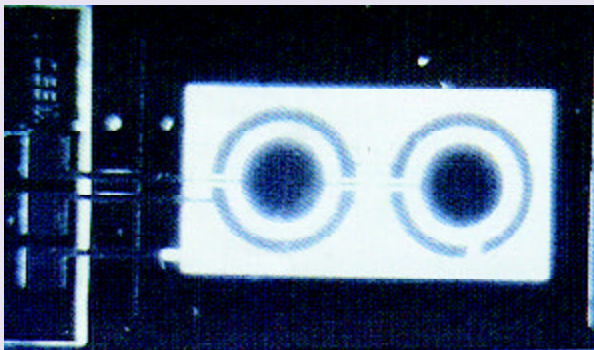
Dr R. R. Sonde, Executive Director NTPC and Dr M. O. Garg, Director, IIP, exchanging the MoU documents in the presence of Senior Scientists and officers of IIP

**New Products developed at CEERI**

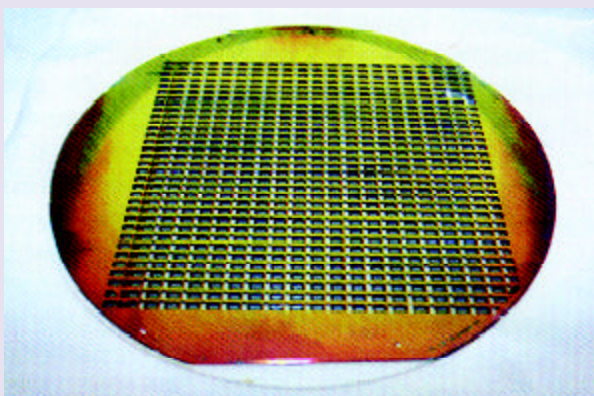
**T**HE new products developed at the Central Electronics Engineering Research Institute (CEERI), Pilani, in the recent past include:

**MEMS Pressure Sensor Fabrication on 6" Silicon Wafer**

Bulk micro-machined double ring capacitive pressure sensor chips of 3 mm × 5 mm size were fabricated on 6" diameter silicon wafer.



Bottom side of device



Fully fabricated 6" wafer

The MEMS sensor fabrication was completed in two parts. The first part having aluminium (Al) double rings was made on 6" diameter Pyrex glass wafer by Sputter Depositing Al followed by photolithography and Al patterning by wet etching. The second part was fabricated on 6" diameter silicon

wafer. The cavity was etched at one side of the wafer and metallised. The aligned silicon diaphragm was formed on backside of this cavity by bulk micro-machining of silicon. Both parts of device were anodic bonded at 400°C by applying 1000 V across the Pyrex glass and silicon wafer coated with silicon nitride. The pressure sensor was tested using DH Budenberg gas pressure controller.

**C-band 60 W Space TWT**

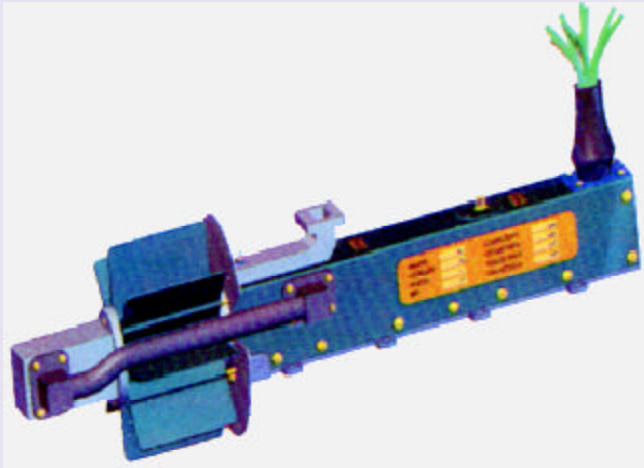
**Specifications**

Chip size	: 3.0 mm × 5.0 mm
Chip thickness	: 1.62 mm
Absolute pressure range	: 10-60 psi
Supply voltage	: 5 V
Capacitance range	: 17-18 pf
Package	: User defined

- I. Two Qualification Models (QM-1 and QM-2) of C-band 60 W space TWT were fabricated by BEL, Bangalore, based on CEERI design. These models were tested at BEL for complete environmental tests as per quality Assurance and Reliability documentation, including thermo-vacuum test, ON/OFF cycle test, vibration test, shock test, and burn-in test.
- II. Two Flight Models (FMs) of C-band 60 W space TWT were fabricated by BEL based on CEERI design. Desired power and gain were achieved.

**Ku-band 140 W Space TWT**

As per the CEERI developed design of Ku-band 140 W (CW) Space TWT for ISRO INSAT/GSAT Programme, beam stick tube was fabricated by BEL, as shown in the figure, for the experimental evaluation of electron beam generation, transmission and collection. The tube is fully packaged with fin-type

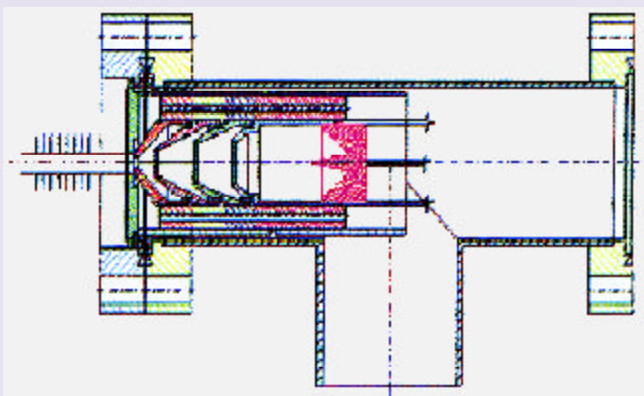


Ku-band 140 W space TWT

isotropic radiator, base plate and cover, and with potted high voltage feed through for gun and 4-stage collector. The desired beam current (100 mA) at the rayed cathode voltage (5.8 kV) was achieved along

### Beam Stick Tube Parameters

Parameters	Value
Heater Voltage	4.8 V
Heater Current	0.8 A
Cathode Voltage	-5.8 kV (w.r.t. helix)
Beam Current	100.0 mA
Helix Current	2.0 mA Beam
	Transmission 98%
BFE Voltage	27.0 V (w.r.t. cathode)
Anode Voltage	+100V (w.r.t. helix)



Demountable collector assembly with graphite electrodes

with the DC beam transmission better than 98% under pulsed condition. Beam transmission is expected to improve to 99% for DC condition. BEL has fabricated all assemblies including input and output helix SWS sections as per CEERI design for the first prototype of Ku-band 140 W space TWT. Test results of the beam stick tube are given in the table.

### Graphite Multi-stage Depressed Collector

A 4-stage depressed collector has been fabricated using high density POCO graphite for collector electrodes and CGCRI developed ceramic insulators, and assembled. This collector is to be used in a 140 W Ku-band space TWT, using demountable set up.

### Application Specific Processor Based Speech Synthesis Technology Development for Hindi Language

The project sponsored by DIT was successfully completed recently. The significant achievements under this project are as follows:

- ◆ Design of the 'Voice Chip' that is an application specific instruction set processor (ASIP) for Klatt's formant-based parametric speech synthesizer. This is the first such implementation of a formant-based speech synthesis engine in India as well as at the global level. The ASIP consists of 45 numbers of 32-bit instructions and has an execution unit with a number of application-specific dedicated functional blocks, some with combinational architectures and others with their own optimized sequential architectures and associated controllers. The floating-point arithmetic blocks (addition, subtraction, multiplication, division, compare) in the execution unit were designed to support 32-bit single-precision IEEE-754 format.
- ◆ Implementation of the 'Voice Chip' as a FPGA and its successful demonstration
- ◆ Enrichment of the parametric database and rule-set for Hindi speech synthesis and its implementation in software

## Microbial-surfactants in Biomedical Sciences

**P**OOJA Singh and Swaranjit Singh Cameotra of the Institute of Microbial Technology, (IMTECH), Chandigarh, have reported the Potential applications of microbial surfactants in biomedical sciences in their paper published in *Trends in Biotechnology* Vol 22(3), 2004.

Surfactants are amphiphathic molecules with both hydrophilic and hydrophobic moieties that partition preferentially at the interface between fluid phases that have different degrees of polarity and hydrogen bonding, such as oil and water, or air and water interfaces. Surfactants of microbial origin, referred to as biosurfactants, have advantages over their chemical counterparts because they are biodegradable and less toxic, and are effective at extreme temperatures or pH values. In addition, they can be produced from several inexpensive waste substrates, thereby decreasing their production cost. Different groups of biosurfactants have different natural roles in the growth of the organisms in which they are produced. These include increasing the surface area and bioavailability of hydrophobic water-insoluble substrates, heavy metal binding, bacterial pathogenesis, quorum sensing and biofilm formation.

The main commercial use of biosurfactants is in pollution remediation because of their ability to stabilize emulsions. This enhances the solubility and availability of hydrophobic pollutants, thus

increasing their potential for biodegradation.

Most work on biosurfactant applications has been limited to their use in (i) pollution removal and (ii) enhancing the availability of various hydrophobic compounds for microbial degradation, including oil, polyaromatic hydrocarbons and pesticides, for example endosulfan (1,2,3,4,7,7-hexachlorobicyclo-2,2,1-heptene-2,3-bishydroxy methane-5,6-sulfite), which is used on a wide range of crops, including cotton to control chewing and sucking insects such as *Helicoverpa* species. In addition, biosurfactants have a variety of other uses, particularly as antimicrobial agents.

This paper discusses current and potential applications of various microbial surfactants in the field of biomedical sciences – of particular importance at this point in time, when increasing numbers of drug-resistant microorganisms are being encountered and there is a need for alternative lines of therapy. So provides an overview of biosurfactant activities that could be exploited further in developing an alternative effective therapy for treating patients.

### Iturin group of biosurfactants

One of the earliest noted antimicrobial activities of biosurfactants was that of iturin A, a potent antifungal lipopeptide produced by strains of *Bacillus subtilis*. In yeast cells, iturin A disrupts the plasma membrane by

the formation of small vesicles and the aggregation of intramembranous particles. It also releases electrolytes and high molecular mass products, and degrades phospholipids. Iturin A dramatically increases the electrical conductance of biomolecular lipid membranes, which has stimulated discussion on the pore-forming activity of lipopeptides and their action against pathogens. Iturin A has been proposed as an effective antifungal agent for profound mycosis. Other members of the iturin group, including bacillomycin D and bacillomycin Lc were also found to have antimicrobial activities. A new strain of *Paenibacillus* produces an iturin-like antifungal compound, which could prove to be a more effective agent against disease-causing fungi.

### Surfactin group of biosurfactants

Surfactin, a cyclic lipopeptide produced by *B. subtilis* is another biosurfactants with well-known antimicrobial properties. There are three different types of surfactins, A, B and C, which are classified according to the differences in their amino acid sequences. Apart from antifungal and moderate antibacterial properties, surfactin (i) inhibits fibrin clot formation, (ii) induces formation of ion channels in lipid bilayer membranes, (iii) inhibits cyclic adenosine monophosphate (cAMP), (iv) inhibits platelet and spleen cytosolic phospholipaseA2 (PLA2)

and (v) exhibits antiviral and antitumor activities. Surfactin also has antimycoplasma properties and has been used in a fast and simple method for complete and permanent inactivation of mycoplasmas in mammalian monolayer and suspension cell cultures. Vollenbroich *et al*, showed that surfactin treatment improved proliferation rates and changes in the morphology of mammalian cells that had been contaminated with mycoplasma. In addition, the low cytotoxicity of surfactin to mammalian cells permitted specific inactivation of mycoplasmas without significant deleterious effects on cell metabolism and the proliferation rate of cells in culture. Surfactin is active against several viruses, including semliki forest virus, herpes simplex virus (HSV-1 and HSV-2), suid herpes virus, vesicular stomatitis virus, simian immunodeficiency virus, feline calicivirus and murine encephalomyocarditis virus. Inactivation of enveloped viruses, especially herpes viruses and retroviruses, was significantly more efficient than that of non-enveloped viruses, suggesting that the antiviral action of surfactin is primarily due to a physiochemical interaction between the membrane active surfactant and the virus lipid membrane.

The plasminogen – plasmin system is involved in blood clot dissolution as well as in a variety of physiological and pathological processes requiring localized proteolysis. In a rat pulmonary embolism model, surfactin C increases plasma clot lysis when injected in combination with

prourokinase. These results suggest a possible use for surfactin in urgent thrombolytic therapy related to pulmonary, myocardial and cerebral disorders. Moreover, surfactin has advantages over other available thrombolytic agents because it has fewer side effects and, hence, has potential for long-term use.

Genetic engineering of the known biosurfactant molecules holds promise for the production of novel antimicrobial agents. Genetic engineering of the surfactin biosynthesis mechanism has resulted in the production of a novel lipohexapeptide with altered antimicrobial activities. The studies made provide the first evidence that similar surfactin derivatives might exhibit reduced toxicity against eukaryotic cells, which could improve their therapeutic applications.

### **Mannosylerythritol lipids**

Members of the *Candida antarctica* strain produce two kinds of mannosylerythritol lipids (MEL-A and MEL-B) that exhibit antimicrobial activity, particularly against Gram-positive bacteria. MEL-A is one of the most useful biosurfactants examined to date. Isoda *et al*, investigated the biological activities of seven biosurfactants (MEL-A, MEL-B, polyol lipid, rhamnolipid, sophorose lipid and the succinoyl trehalose lipids STL1 and STL3). All glycolipids, except for rhamnolipid, induce cell differentiation instead of cell proliferation in the human promyelocytic leukemia cell line HL60. They also induce the human myelogenous leukemia cell line K562

and the human basophilic leukemia cell line KU812 to differentiate into monocytes, granulocytes and megakaryocytes.

### **Other biosurfactants with biological activity**

A complex of acylpeptide antibiotics, pumilacidin A, B, C, D, E, F and G was isolated from strains of *Bacillus pumilis*. Pumilacidin exhibited antiviral activity against HSV-1, inhibitory activity against H<sup>+</sup>, K<sup>+</sup>-ATPase, and was found to be protective against gastric ulcers. A new antibiotic from *Pseudomonas fluorescens*, with biosurfactant properties different from those of the known biosurfactant viscosin from the same species, was later identified and named viscosinamide, which was also found to have antifungal properties. Massetolides A-H, novel cyclic depsipeptides, were isolated from *Pseudomonas* species, derived from a marine alga, and were found to exhibit *in vitro* antimicrobial activity against *Mycobacterium tuberculosis* and *Mycobacterium avium-intracellulare*. *B. subtilis* strain C1 was isolated in the laboratory from petroleum sludge and was found to produce a complex of three lipopeptides.

### **Biosurfactants as anti-adhesives**

Swarming motility and biofilm formation are the key actions in the colonization of a surface by bacteria, and increase the likelihood of nosocomial infections. Biosurfactants have been found to inhibit the adhesion of pathogenic organisms to solid surfaces or to infection sites. Surfactin decreases

the amount of biofilm formed by *Salmonella typhimurium*, *Salmonella enterica*, *Escherichia coli* and *Proteus mirabilis* in polyvinyl chloride wells, as well as in vinyl urethral catheters. Precoating the catheters by running the surfactin solution through them before inoculation with media was just as effective as including surfactin in the growth medium. Given the importance of opportunistic infections with *Salmonella* species, including urinary tract infections of AIDS patients, these results have potential for practical applications.

The prior adhesion of biosurfactants to solid surfaces might constitute a new and effective means of combating colonization by pathogenic microorganisms. A biosurfactant of *P. fluorescens* was found to inhibit the adhesion of *Listeria monocytogenes* LO28 to polytetrafluoroethylene and stainless steel surfaces. *Lactobacilli* are important in the maintenance of the healthy urogenital flora. There are reports of inhibition of biofilm formed by uropathogens and yeast on silicone rubber by biosurfactants produced by *Lactobacillus acidophilus*. This finding opened up avenues of research on the use of *Lactobacilli* as a probiotic for the prevention of urogenital infections. *Lactobacillus fermentum* RC-14 releases surface-active components that can inhibit adhesion of uropathogenic bacteria, including *Enterococcus faecalis*. The anti-adhesive property of biosurfactant produced by *Lactobacilli* species holds promise for application to many human sites where pathogens attach, colonize and confer disease, including the urinary and vaginal tracts.

The finding of a role for surfactants in the human body is not a new phenomenon. Pulmonary surfactant is a lipoprotein complex synthesized and secreted by the epithelial cells of lungs into the extracellular space, where it lowers the surface tension at the air-liquid interface of the lung and also plays a role in host defense against infection and inflammation; this suggests an interesting line of therapy for infections and inflammatory lung diseases.

### Other biomedical and therapeutic applications

To generate conventional or monoclonal antibodies for the serological detection of drugs, antibodies, toxins and other low molecular mass substances, a suitable and effective adjuvant is needed. Mittenbuhler *et al*, showed that bacterial lipopeptides constitute potent nontoxic and nonpyrogenic immunological adjuvants when mixed with conventional antigens. The synthetic lipopeptide N-palmitoyl-S-[2,3-bis(palmitoyloxy)-(2R,S)-propyl]-<sup>®</sup>-cysteinyl-serine (P3CS) coupled to a Th-cell epitope (P3CS-Th) efficiently enhanced the specific immune response against low molecular weight compounds in different species. A marked enhancement of the humoral immune response was obtained with the low molecular mass antigens iturin AL, herbicolin A and microcystin (MLR) coupled to poly-L-lysine (MLR-PLL) in rabbits and in chickens. Conjugates of lipopeptide-Th-cell epitope also constituted effective adjuvants for the *in vitro* immunization of either

human mononuclear cells or mouse B cells with MLR-PLL and resulted in a significantly increased yield of antibody-secreting hybridomas.

Biosurfactants have the potential to form an important part of food supplements. Instead of pure minerals and vitamins as food supplements, it is now advisable to use homeostatic nutrient complexes, which are a mixture of vitamins and minerals liberated and maintained in their natural form by probiotic microorganisms and their byproducts, including enzymes and organic acids. This increases the bioavailability, adsorption, usefulness and effectiveness of the minerals and vitamins, in addition to providing many other nutritionally important compounds. Also created in the complex are numerous essential biochemicals that are required by the body, including the master antioxidant superoxide dismutase, as well as various immune supportive  $\beta$  glucans, antimicrobial peptides, bacteriocins, biosurfactants, biotins, coenzymes, conjugated linolenic acids, glutathione, chromium compounds, hydrogen peroxide, lactic acid and lysozymes (<http://www.health-interlink.co.uk/Multi.html>).

One of the most important groups of organisms being studied for their use as an effective -probiotic are members of the *Lactobacilli* group, which have the potential to prevent pathogen colonization and help to restore the normal microbial flora. In spite of the immense potential of the biosurfactants in this field, their use still remains limited, possibly because of their comparatively high production cost, as well as scant

information on their toxicity towards human systems.

### Concluding remarks

Biosurfactants have potent antimicrobial applications including antifungal, antibacterial, antimycoplasmal and antiviral activities. They have been used for gene transfection, as ligands for binding immunoglobulins, as adjuvants for antigens and also as inhibitors for fibrin clot formation and activators of fibrin clot lysis. Their ability to alter properties of molecules such as cAMP and PLA2 might lead to their use as modulators of signal transduction. Genetic alteration of biosurfactant genes could produce potent biosurfactants with altered antimicrobial profiles and decreased toxicity against mammalian cells. One of the most beneficial uses of biosurfactants, apart from their use as potential alternative antimicrobial agents, is their use as antiadhesives. Biosurfactants have the potential to be used as a preventive strategy to delay the onset of pathogenic biofilm growth on catheters and other medical insertional materials, thus lowering the large number of hospital infections without the use of synthetic drugs and chemicals. They can also be used in pulmonary immunotherapy and incorporated into probiotic preparations to combat urogenital tract infections. Important for probiotic use are members of the biosurfactant-producing *Lactobacilli* species, which are also a part of the normal healthy human flora. Because they are biological and safe, biosurfactants are a suitable alternative to synthetic medicines and antimicrobial agents, and could be used as safe and effective therapeutic agents or probiotics, especially at a time when drug resistance among causal organisms for many life-threatening diseases is on the rise.

## Training Workshop on Isotope Ratio Mass Spectrometry at NIO

THE National Institute of Oceanography (NIO), Goa, organized a training workshop on Isotope Ratio Mass Spectrometry (IRMS) recently. Department of Science and Technology, New Delhi; GV Instruments UK Ltd; Manchester (UK); and Thermo Finnigan Corporation, Mumbai, cosponsored the workshop. In his inaugural address, Dr S. K. Aggarwal, President, ISMAS & Head, Mass Spectrometry Section, FCD, Bhabha Atomic Research Centre (BARC), Mumbai, said that use of this technique is finding applications in research in earth sciences, environment, hydrology and oceanography. He expressed his happiness over NIO's acquisition of a full-fledged IRMS facility for the isotope measurement in water, carbonates and sediments. Earlier, Dr C. G. Naik, Deputy Director, NIO, welcomed the Chief Guest, faculty members and the participants of the workshop.

The workshop was coordinated by Dr P. V. Shirodkar, Senior Scientist, NIO, and was attended by more than 100 participants, mostly students, research fellows, scientists and faculty from universities.

The workshop had lectures by invited speakers and demonstrations by the operators experienced in use of the system.



Demonstration of mass spectrometer to the participants

## Workshop on Road Information and Computerized Project Information System

**T**HE Central Road Research Institute (CRRI), New Delhi, organized a workshop on 'Road Information System (RIS) and Computerized Project Information System (CPIS)' recently in association with National Highways Authority of India (NHAI) and M/s Consulting Engineering Services Pvt. Limited (CES), New Delhi. The workshop was organized to deliberate on various issues related to the development of software for RIS and CPIS. Shri H.C. Gupta, Member (Administration), NHAI, Chaired the workshop. Dr P.K. Nanda, Director, CRRI, welcomed Shri Gupta, on behalf of CRRI. While inaugurating the workshop, Shri H.C. Gupta, Chairman, mentioned that Road Information and Computerized Project Information System being developed by NHAI are new to the country and there is scope for further development and learning. Seventy four representatives from the World Bank, M/s Consulting Engineering Services Pvt. Limited, New Delhi (CES); Tata Consultancy Services (TCS); Computer Maintenance Corporation (CMC); WIPRO; Border Roads Organization (BRO) and Central Road Research Institute (CRRI), New Delhi; attended the workshop. Presentations were given by M/s Consulting Engineering Services (CES), M/s Computer Maintenance Corporation (CMC), Tata Consultancy Services (TCS) and WIPRO.



Shri H.C. Gupta, Member (Administration), NHAI, speaking during the workshop on 'Road Information System (RIS) and Computerized Project Information System'. Others seen (from left) are: Dr P.K. Nanda, Director, CRRI; Dr V. K. Sood and Dr T.S. Reddy, Scientists, CRRI

On behalf of CES, Prof. N. Ranganathan made the presentation on 'Road Information System' being developed for National Highways Authority of India. He briefed about various modules such as location referencing, asset management, pavement management, bridge management, traffic management, accident management, toll management, document management, performance management, environment management, security and access control, query and HDM-4 integration systems etc. He also highlighted data collection methodology, system development, system architecture etc. An on-line demonstration of RIS software module was also presented

subsequently. The interlinking of the GIS module with RIS modules was explained separately to underscore the importance of GIS features. Enquiries were made about the real time updation of database, availability of software for different categories of roads etc. by the Director, CRRI and participants from CRRI and other organizations.

On-line and real-time Computerized Project Information System (CPIS) jointly developed by TCS and CMC was presented by Ms Jyotsna Pabbi. CPIS has different modules such as pre-construction module, construction module, post construction module, GIS module, and interfaces with RIS, toll collection system and CISCO IP

phone. It can be used to generate the updated thematic maps, reports viewing of progress of projects at national and state levels. It has other salient features like timely alert, plot features in the form of hard copy, better monitoring through graphical view of project status and scaleable system with security files. WIPRO made a presentation on independent verification of RIS and CPIS software. They will verify the requirement of band width, functional testing, performance engineering of the software etc. The software testing included test strategy, test plan, test case design, default design and defect reporting

Dr P.K. Nanda, Director, CRRI, appreciated the organizations for their presentations. He mentioned that presentations were very extensive and informative. He expected that the country will be benefitted from this knowledge based software developed for road and road transport sector. Dr Nanda expressed the desire that the system being developed by the NHAI should be available to MoSRTTH, NRRDA and BRO for upkeep of their respective highway inventory. It will be a national waste if these organizations were to develop similar systems for their use separately.

The workshop ended with the vote of thanks by Dr V. K. Sood. Dr Sood mentioned that it is the first ever kind of system in the country. Software will be useful for development of High Density Corridors. Dr P.K. Nanda, Director, CRRI, presented a memento as a token of appreciation to the Chairman.

## Workshop on Outcome of Ceramic Cluster Development Programme at Thangadh Ceramic Cluster in Gujarat State

**T**HE Central Glass & Ceramic Research Institute, Naroda Center, Ahmedabad, organized review meeting cum workshop on ceramic cluster development programme at Sthanakwasi Jain Bhojanshala, Thangadh. Shri R. J. Shah, Principal Chief Industrial Advisor, Government of Gujarat, was the Chief Guest. Dr K. N. Maiti, Scientist-in-Charge, CGCRI, Naroda Centre, Ahmedabad and Principal Investigator of the Project; Shri Ram Ji Bhai Maru, President, Panchal Ceramic Association, Vikas Trust, Thangadh; Shri Suresh Bhai Sompura, President Federation of Ceramic Industries, Thangadh; Shri Karsan Bhai Adroja, President, Sanitaryware Association, Morbi-Wankaner Cluster and Shri R.V. Bhatia, GM, District Industries Centre, Surendranagar, also participated in the workshop and graced the occasion. The representatives from different ceramic industries viz, Sanitaryware, Wall tiles, L.T., Insulator and Clay and other raw material suppliers participated in the workshop.

Shri R.M. Savsani, TO, CGCRI, Naroda Centre, Ahmedabad, introduced the dignitaries and requested Dr K. N. Maiti, Principal Co-ordinator

of ceramic cluster development programme to deliver the welcome address followed by the presentation on the outcome of CCDP. Dr K.N. Maiti welcomed the participants and said that the CGCRI, Naroda Centre has been conducting CCDP for the last four years. To start with, Dr K.N. Maiti made a presentation on 'Sustainable ceramic cluster development programme in Gujarat state (CGCRI – Gujarat model)'. He said that two laboratories namely M/s National Cera Lab and M/s Chem Bio Scientific, Morbi, have been set up for physical and chemical analyses of ceramic RM(s) and ceramic products with technical assistance from CGCRI, Naroda Centre. The export from Thangadh and Morbi-Wankaner cluster has also increased by about 60% and 40%, respectively.

Dr Maiti further elaborated that the various developments taken place are self sustainable and SME(s) are now in healthy position and looking forward to grow better improving their competitiveness at home and abroad. On environmental protection front reduced rejection after firing and its part recycling not only affected resource conservation but also greatly reduced the solid waste pollution



Dr K. N. Maiti, Scientist-in-Charge, CGCRI, Naroda Centre, Ahmedabad (left), and Shri R. J. Shah, Principal Chief Industrial Advisor, Government of Gujarat, (right) being honoured by Ceramic Association, Thangadh, during the workshop for their outstanding contribution to the Ceramic Cluster Development Programme in Gujarat State

in the clusters. He had stressed importance on some R&D projects: development of blended and beneficiated clays for each sector of ceramics, blending and beneficiation of Than fire clay, import substitution of Ukraine clay in Granito tile production, use of non-conventional RMs and development of additives to increase unfired strength and casting properties of cast articles.

Further, presenting the 'Road map for future development of ceramic industries in Gujarat state', Dr Maiti elaborated in details the problems associated with non-standard raw materials. Elaborating on other aspects, Dr Maiti suggested that unification of various industries association is also essential for the sustainable cluster development programme.

Shri Ram Ji Bhai Maru, President, Panchal Ceramic Association, Thangadh, put forth his reaction stating that with the extraordinary efforts of Dr K. N. Maiti and Shri R. J. Shah, tremendous developments in ceramic industries of Gujarat have

taken place. He also mentioned that under this CCDP, a project proposal worth Rs 1.75 crore for making of building of association, display centre and laboratory has been sanctioned and necessary work in this regard is under progress and hopefully their next meeting of CCDP would be arranged in the newly built association hall. Shri Maru also requested manufacturers of sanitary-wares to unite and take suitable steps to increase the prices of their products to compensate the increased cost of production because of inflation.

Shri Suresh Bhai Sompura, President, Federation of Ceramic Industries, Thangadh, expressed his opinion in agreement with Shri Ram Ji Bhai Maru and said that standardized raw materials are primary requirement of ceramic industries and the clay manufacturers should come forward and do some concrete work in this direction. Shri Suresh Bhai also thanked CGCRI and Government of Gujarat for their support in upliftment of ceramic industry of Gujarat.



A view of audience during the workshop

Shri Karsan Bhai Adroja, President, Sanitaryware Manufacturers Association, Morbi, expressed that the ceramic industries of Thangadh and Morbi-Wankaner have made an impact on world market of sanitaryware and have been able to make their presence felt. Shri Karsan Bhai also shared his experience during his recent visit to China. Shri Adroja further talked on narrowing gap of profit margin in sanitaryware trading and stressed the need for increasing the selling prices of their products.

Shri R. J. Shah, PCIA, Government of Gujarat, shared the interesting story of events taken place in formulating and sanctioning of CCDP to CGCRI, Naroda Centre, with the participants. He also emphasized the need of strengthening and unification of industries associations and formation of a federation to steer sustainable cluster development programme. Shri Shah also explained various schemes of Government of Gujarat for the benefits of ceramic industries in Gujarat state.

All the participants exchanged their views during the open discussion and highly appreciated the efforts taken by Dr K. N. Maiti, Scientist-in-Charge and his dedicated team members of CGCRI, Naroda Centre, Ahmedabad.

The workshop concluded with a vote of thanks proposed by Shri Jayendra Bhai Maru, Panchal Ceramic Association, Thangadh.

## Workshop on High Value Essential Oils

A two day workshop on production of high value essential oils was organised at the Regional Research Laboratory, Srinagar. More than eighty participants attended the workshop. These included young entrepreneurs, progressive farmers, NGO's, business houses, academicians, scientists, user industry people from U.K. Speaking on the occasion Prof. A. Wahid, Vice Chancellor, University of Kashmir, lauded the role of RRL in developing agro and processing technologies of high value essential oils which are used in perfumery, flavour, cosmetic industry and also in aromatherapy.

In his inaugural address Dr A. S. Shawl, Head, RRL, informed about the core competence of the institute in the development of high value essential oil bearing crops. He informed about the locational advantage of Kashmir with regard

to the production of these essential oils, which have both domestic consumption and export potential. He emphasized that six/seven essential oils namely, Lavender, Rose, Geranium, Clarysage, Rosemary, *Tagetes*, *Artemisia annua* and *Mentha piperata* instead focusing only on one essential oil in the same distillation plant, this agribusiness will be better protected against market fluctuations at national and international level.

Dr G. N. Qazi, Director, RRL, Jammu, stressed the need to develop market linkages at national and international level as has been done in case of Lavender oil by RRL scientists. He also informed that RRL is actively involving Common Wealth Business Council of U.K. for mass cultivation of Lavender in Kashmir valley. He further said that an effective partnership between private and R&D institutes is the



Display of high value essential oils used in aromatherapy

need of the hour. He informed that RRL has already involved local progressive farmers in this sector by providing quality planting material and technical know-how in case of these high value essential oils. Dr Charles Wells of Essentially oils Ltd, Oxfordshire, informed that Kashmir lavender oil has a tremendous potential in the European market in view of its quality standards. He further said that RRL Field Station at Bonera is comparable to any growing and distillation facility in the world. Kashmir can produce some of the finest, organically grown essential oils with technical back up of RRL. The participants also visited RRL Field Station Bonera for practical training in cultivation protocols and processing of these high value crops.

In the end, Shri Tej Kumar, Scientist, Bonera Farms, proposed formal Vote of Thanks.

## OPPI members visit NCL

A group of members of Organization of Plastic Processors of India (OPPI), Mumbai, led by Shri V. K. Taparia, Ex-President and current Chairman of Programme Committee of OPPI and Executive Director, The Supreme Industries Ltd, Mumbai, visited the National Chemical Laboratory (NCL), Pune, recently. The group consisted of about 20 people mainly CEOs/Directors/Owners of the member companies.

Dr S. Sivaram, Director, NCL, in his welcome remarks spoke about NCL and briefed on different business models and proposed two ideas: i) a consortium approach to solve scientific problems of common interest and, ii) sharing of NCL's facilities with OPPI, for the benefit of its members.

Shri Taparia gave a brief introduction about OPPI and its activities. Shri Venugopal, Head, Business Development Division, NCL, spoke about business activities, present and past clients, and different business models. Dr B. L. V. Prasad, Scientist, NCL, talked about nanomaterials and nanoscience research at NCL. He specifically focused on metal oxide nanomaterials. Specific queries from OPPI delegates focused on use of gold nanotriangles as Near IR (NIR) absorbers in packaging products. Dr

Radhakrishnan, Scientist, NCL, gave an introduction about nanofillers and emphasized NCL's capabilities in preparing up to 1 kg level of nano  $\text{CaCO}_3$ , nanotalc, and nano  $\text{Fe}_2\text{O}_3$ . Several delegates expressed interest in these materials for barrier and FR applications. Dr Lele, Scientist, NCL, gave a general introduction regarding nanoclays and polymer-nanoclay composites. He summarized NCL's activities in this area. Interest was expressed in terms of using nanoclays as barrier materials in especially retortable packaging and injection molded products. Shri Pol, Scientist, NCL, talked about NCL's capabilities in polymer processing, rheology and numerical simulations. Delegates showed interest in the use of numerical simulations in profile extrusion die design.

The OPPI members indicated that NCL may allow other interested OPPI members to interact directly with NCL. Several members from individual companies expressed interest in working with NCL towards materials/product development activities. OPPI members also visited the Polymer Processing Center of NCL. Delegates expressed interest in the DSM Microcompounder/Micro Injection Molding machine and the Haake PolyLab system.



OPPI members with Dr S. Sivaram, Director, NCL and NCL Scientists (left); and Dr S. Sivaram and Shri V.K. Taparia, Executive Director, The Supreme Industries Ltd

## Nigerian Delegation visits IIP

A high level Nigerian Delegation led by Dr Edmund Daukoru, Honb'le Minister of State for Petroleum Resources and Amb. Adamu Waziri, Honb'le Minister of Commerce Federal Government of Nigeria, visited Indian Institute of Petroleum (IIP), Dehra Dun, recently. Other members of the delegation being Shri Sadayomi and Shri Timiri. Shri R. S. Butola, Managing Director, ONGC Videsh Ltd, accompanied the delegation. The visit is of immense importance as IIP is an integrated and independent research institute to conduct R&D activities in the area of refining, gas, chemical and automobile industry.

The delegation was briefed about the R&D activities of the institute by Dr M. O. Garg, Director, IIP, and Senior Scientists of the institute. Detailed discussions were held on the technologies developed by IIP which are commercialised in the Indian refineries and allied sector of the industry. The delegation also visited some laboratories including bio-diesel pilot plant. Dr Daukoru showed keen interest in the institute's activities particularly in the area of catalysis, biotechnology and renewable energy sources namely bio-diesel. Impressed with the R&D activities of the institute, Dr Daukoru remarked that Nigeria will follow these developments with a view to get benefit in a collaborative way. The delegation also visited KDMIPE, ONGC, Dehra Dun.

## Science Motivation Programme at RRL-Jorhat

**T**HE Regional Research Laboratory (RRL), Jorhat, organised a five-day Science Motivation Programme for some selected students and teachers of Assam and Tripura with the aim of exposing the bright students and teachers of the region to the exciting world of science. A total of 40 students and teachers from Nagaon, Nalbari, Barpeta and Dhemaji districts of Assam and North Tripura and South Tripura districts participated in the programme. Dr P. G. Rao, Director, RRL, Jorhat, presided over the inaugural function and wished the students in his speech a bright career in science.

Dr D. C. Goswami, Principal Coordinator of the programme, informed that the laboratory had been organising this kind of programmes for talented students and teachers of the region since 1982. The participants were taken to various departments of the laboratory where they were shown some live demonstration of the scientific activities. They were also taken to Tocklai Experimental Station where they witnessed some demonstration on tea science. They also attended some illustrated lectures and after each lecture there held a highly

interactive session.

On the second day, the participants were taken to Assam Agricultural University. They particularly visited the Agricultural Technology Information Centre (ATIC), Extension Education Department, the Faculty of Home Science, the Biotechnology Department and Biofertilizer Laboratory. In the afternoon, the participants were divided into four groups as per their options and were guided in four disciplines through hands-on type experiments under the supervision of some senior scientists of the laboratory.

On the third day Dr Chandra Mohan, Director, Rashtriya Vigyan Evam Prodyogiki Sanchar Parishad (RVSPS), New Delhi, the sponsoring agency of the programme, addressed the participants and expressed his satisfaction for organizing the programme in a better way. He also emphasized on the development of educational infrastructure in north-east so that it could attract scholars from other parts of the country. The students demonstrated their elocution skill in a science elocution competition and the winners of the competition were suitably awarded.

## *Foundation Day Celebration*

On the fourth day, the participants visited the Gibbon Wildlife Sanctuary for an on the spot study of the nature. There was a very interactive lecture and slide show presentation about the apes and monkeys of Assam by Kumud Ghosh, a naturalist, which was arranged to the delight of the participants. A very interesting 'Face to Face with Scientists' programme was held where a panel of scientists from the laboratory and Assam Agricultural University responded to the innumerable questions asked by the participants.

A valedictory function was held to formally declare the closure of the programme which was presided over by Dr Naleen Borthakur, Deputy Director, RRL. The programme was sponsored by RVSP, DST, New Delhi.

### CSIO celebrates Foundation Day



Prof. B. R. Arora, Director, Wadia Institute of Himalayan Geology, Dehra Dun and Dr Pawan Kapur, Director, CSIO, exchanging the documents of MoU

**T**HE Central Scientific Instruments Organisation (CSIO), Chandigarh, recently celebrated its 47<sup>th</sup> Foundation Day by organizing a guest lecture by Prof. B. R. Arora, Director, Wadia Institute of Himalayan Geology, Dehra Dun.

Prof. B. R. Arora in his Foundation Day Lecture said that natural disasters like landslides, earthquakes, cloud bursts etc. cannot be totally prevented but significant technological advances have made it possible to reduce the societal risk of these disasters considerably through planned, systematic and sustained efforts. Availability of low power digital seismometer that can work unattended for weeks can help in strengthening the seismic networks in the hard terrains of

Himalayas. Talking about the predictions of earthquake, he said that certain earthquake precursory changes reported from different seismogenic belts of the world, can be considered as a diagnostic for the prediction of earthquakes.

Earlier, Dr Pawan Kapur, Director, CSIO, welcomed the Chief Guest and highlighted the significance of CSIO Foundation Day. Before this lecture, CSIO, signed an MoU with Wadia Institute of Himalayan Geology, Dehra Dun and an agreement with M/s Logican Control and Automation Pvt. Ltd., Bangalore.

The programme concluded with a colourful cultural programme presented by CSIO Staff Club. Shri Hari Mohan, COA, CSIO, proposed Vote of Thanks.

## Dr T. Ramasami delivers Prof. P. Khanna Memorial Lecture at NEERI

**T**HE National Environmental Engineering Research Institute (NEERI), Nagpur, recently organized the first Prof. P. Khanna Memorial Lecture in the NEERI auditorium. Prof. Khanna was the Director of NEERI during 1987-99. Padmashri Dr T. Ramasami, Director, Central Leather Research Institute (CLRI), Chennai, who was the Chief Guest, delivered the first memorial lecture on 'Vision of a Missionary in Prof. Khanna for Leather'. Describing Prof. Khanna as a living legend, Dr T. Ramasami reminded the vital contributions made by Prof. P. Khanna in the field of leather and environment. He said that there was a time when all the tanneries in the country were alleged for polluting the environment. Prior to 1995, the situation had so worsened that the



Dr Atya Kapley briefing the audience about Prof. P. Khanna Memorial Lecture. Seated (from left) are: Dr S. P. Pande, Scientist & Head, Research & Development Planning Unit, NEERI; Dr S. Devotta, Director, NEERI; Dr T. Ramasami, Director, CLRI, and Dr J.S. Pandey, Science Secretary, NEERI

apex court ordered to close down 400 tanneries in Tamil Nadu, since the pollution control norms were not met by the tanneries, Dr Ramasami remarked. He further pointed out that till that time India was contributing to around 10 percent of the world's leather production and a sudden closing down of tanneries struck a bad patch on leather

industry in the country. In Tamil Nadu alone, where six percent of the world's leather production took place, this problem became a serious one, he added. This situation led to seek for an eco-friendly approach towards leather manufacturing process, Dr Ramasami said. He

further informed that in 1997, NEERI, CLRI and the association of tannery industries interacted with each other and formulated an effective technology plan to mitigate adverse effects on the environment. Its implementation by establishing 13 common effluent treatment plants and 149 effluent treatment plants, brought many changes in leather industry of the country. Initiation of environmental commitments for tanneries through Prof.

Khanna's vision really gave a new life to leather industry, Prof. Khanna had built a vision towards environmentally safe leather processing. Dr Ramasami termed Prof. Khanna as a missionary who worked for a near-zero environmental risk arising from industries. Dr Ramasami concluded by saying that he thought of Prof. Khanna as a hero, who carried forward his vision and mission towards a better environment-friendly leather manufacturing. Earlier, in his welcome address, Dr Sukumar Devotta, Director, NEERI, appreciated the valuable contributions of Late Prof. Khanna in the field of Environmental Science & Engineering. Dr S. P. Pande, Scientist & Head, Research & Development Planning Unit, introduced the Chief Guest. Dr J. S. Pandey, Science Secretary, proposed a Vote of Thanks.



Dr T. Ramasami, Director, CLRI, delivering the Memorial Lecture

## Dr Kresge delivers Dr Paul Ratnasamy Endowment Lecture at NCL

NCL Research Foundation, an institution aimed at promoting excellence in science and technology, in association with Dow Chemicals Company, USA, has instituted an Endowment Lecture series in honour of Dr Paul Ratnasamy, former Director of NCL. In this series, Dr Charles T. Kresge, Vice President R&D, The Dow Chemical Company, Midland, Michigan, USA, delivered the second Dr Paul Ratnasamy Endowment Lecture at the National Chemical Laboratory (NCL), Pune. Dr Kresge spoke on 'Novel Porous Materials'. The first lecture in the series was delivered by Prof. Wolfgang F. Hoelderich, Director, Chemical Technology and Heterogeneous Catalysis, University of Technology, RWTH Aachen, Germany.

Dr Kresge described novel mesoporous materials containing a variety of pore sizes and channels. He described different strategies and synthetic techniques for making new mesoporous materials with different morphologies. He stated that the power of synthesis coupled with an ability to characterize and theoretical modeling results in new and exciting mesoporous materials. These zeolite like porous materials find applications in diverse fields, such as, ion-exchange, gas separation, petrochemicals and catalysis. In depth understanding of nucleation/gelation by a variety of characterization techniques and ability to exploit that understanding



Dr Charles T. Kresge, Vice President R&D, The Dow Chemical Company, Midland, Michigan, USA, delivering Dr Paul Ratnasamy Endowment Lecture

helps in generating/synthesizing new and exciting novel mesoporous materials.

Dr Kresge also mentioned that combinatorial approach has paid rich dividends in accessing new zeolite type materials. Flexible as well as rigid organic templates with different conformations define the porosity of materials. In describing the strategies for making new materials, he mentioned that rigid and/or flexible organic templates with multiple functionalities apparently play a crucial role in the formation of three

dimensional structures. In yet another development, tethering a metal ion on the surface of MCM-41 has been explored for catalytic application and selective separation processes. He also mentioned that pillared layered materials can be exploited for making variety of porous materials. The chemical composition of layered materials, pillar length, inter pillar position etc can be modified easily to make variety of new porous materials. More than eighty materials have been commercialized based on the pioneering work of Dr Kresge and his coworkers. Earlier Dr S. Sivaram, Director, NCL, welcomed the audience and introduced Dr Kresge to the audience. Dr Sivaram described Dr Kresge's pioneering contribution to material science and catalysis as watershed in the history of chemistry. Dr Kresge's work on supramolecular assembly published in *Nature* and *Journal of American Chemical Society* in the early 1990's led to the emergence of a whole new field of research. For the first time an organic material was used as a template to assemble an inorganic material, the like of which only nature could produce before. Dr Sivaram further said that Dr Kresge's discovery was not only beautiful, but very useful in practice. Mobil Corporation of USA have exploited his research and developed various catalytic processes which are in commercial use today.

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