ISSN 0409-7467

CSIR News

NEWSLETTER OF THE COUNCIL OF SCIENTIFIC & INDUSTRIAL RESEARCH

Volume 65 No. 17 & 18 website: http://www.csir.res.in September 2015

In This Issue

Dr. Girish Sahni Appointed Director General of CSIR

DR. GIRISH SAHNI, eminent microbiologist and former Director of the Chandigarh-based CSIR-Institute of Microbial Technology (IMTECH), has been appointed as the new Director General of the Council of Scientific and Industrial Research (CSIR), and Secretary of the Department of Scientific and Industrial Research (DSIR). Dr. Sahni joined as DG-CSIR on 24 August 2015.

Dr. Sahni is well-known for his contribution to the production technology for India's first indigenous clot buster drug, natural streptokinase and recombinant streptokinase. His high-efficiency process package for production of natural streptokinase for the first time in India called STPase was commercially launched by Cadila Pharma Ltd. (Ahmedabad) in 2002.

Born on 2 March 1956, Dr. Girish Sahni did his M.Sc. (Honours) Microbiology from the Panjab University, Chandigarh (Silver medalist) in 1978, and followed it up with PhD in Biochemistry (1984) from the Indian Institute of Science, Bangalore. He was a Research Associate during 1985-86 in the University of California, Santa Barbara, USA, and Sr. Research Associate and Adjunct Faculty during 1986-91 at the Rockefeller University, New York and Albert Einstein College of Medicine, New York, USA.

Dr. Girish Sahni joined CSIR-IMTECH, Chandigarh in 1991 and became its Director in 2005. While at CSIR-IMTECH, his team developed the process for recombinant Indian bovine species, buffalo and goat hormone production, which is ready to

be transferred to industry. His team has also developed a novel life-saver thrombolytic drug (clot-specific streptokinase), India's first bio-therapeutic molecule which is not a biosimilar. This life-saver drug has been patented worldwide and licensed to a US Pharma company for which the commercial launch is expected in 2016. It is estimated that the new drug will cost Rs 2,000 per dose, while at present the worldwide used tissue plasminogen activator, a clot-specific drug, is priced at Rs 50,000 per dose.

Among the several awards that Dr. Sahni has received are the Vasvik Award in Biological Sciences in 2000, National Biotechnology Product and Process Development Award (for Protein Engg. and Molecular Biology) of the Department of Biotechnology in 2002, CSIR Technology Shield for Natural Streptokinase Process Development (2001-02), Ranbaxy Award (2003) in pharmaceutical sciences, Shri Om Prakash Bhasin Award 2013, Vigyan Ratan Award 2014, and CSIR Technology Award for Business Development and Technology Marketing 2014. He is a Fellow of the Indian Academy of Sciences, Bangalore, National Academy of Sciences, Allahabad and the Association of Microbiologists of India.

Dr. Sahni is the author of several papers published in high impact refereed scientific journals and has a number of national and international patents to his credit.

CSIR-IICT develops Technology to Manufacture Hydrofluorocarbons

Faced with the reluctance of multinational companies in the US, UK, France, Japan and China to transfer the technology to manufacture hydrofluorocarbons to India, the CSIR-Indian Institute of Chemical Technology (IICT), Hyderabad has now come up with a new technology to manufacture hydrofluorocarbons. The technology is ready to be transferred to the industry.

Chlorofluorocarbons earlier used in refrigeration systems as coolant were banned in 2005 because they were hugely contributing to the depletion of the ozone layer. In fact, the chemical was blamed as one of the causes for the depletion of the ozone layer up to 29 million square kilometers over the Antarctica – the ozone hole. As per the Montreal Protocol, of which India is a signatory, it was decided not to use Chlorofluorocarbons anymore. Hydrofluorocarbon emerged as a viable and effective alternative. However, western nations refused to part with the technology.

The technology to manufacture hydrofluorocarbon has been developed by scientists of the Fluoroorganic Division of CSIR-IICT. The technology has been transferred to two industries with one industry having already set up a manufacturing plant to producing 50 per cent of the country's requirement of refrigeration coolant.

Marine Natural Product-based Cdk4/D1 Inhibitors as Potential Anti-cancer Agents

Marine natural products have been a source of large number of kinase inhibitors.[1] Among various kinases involved in cancer progression, the inhibition of Cdk4-cyclin D1 with small molecules has been an area of major interest in the field of anticancer drug discovery since last two decades. There have been numerous scientific reports highlighting the role of Cdk4-cyclin D1 inhibitors in cancer treatment. Pfizer's palbociclib (PD-0332991), a selective inhibitor of Cdk4 and Cdk6 has received FDA approval for treatment of patients with breast cancer.

In this area, recently, CSIR-Indian Institute of Integrative Medicine (IIIM), Jammu in collaboration with De-Montfort University, Leicester, UK have discovered two Cdk4/cyclin D1 inhibitor anticancer leads N-(biphenyl-2-yl)tryptoline (BPT)[2], biphenyl-4-carboxylic acid and [2-(1H-indol-3-yl)-ethyl]-methylamide[3] based on the marine natural product fascaplysin. The chemical structures of fascaplysin and identified leads are shown in Figure 1.

Fascaplysin, a bisindole alkaloid originally isolated from a marine sponge *Fascaplysinopsis* Bergquist, specifically inhibits the Cdk4 enzyme and possess potent cytotoxicity in several tumor cell lines.[4] Nonetheless, it is unlikely that fascaplysin will ever be used therapeutically as an anticancer agent because it is highly toxic. The potential for its planar structure to intercalate with double-stranded DNA has been suggested as a possible explanation for its unusual biological activity and toxicity. The DNA binding property of fascaplysin is similar to structurally related DNA intercalating agents like cryptolepine and ellipticine. To overcome this unusual toxicity, IIIM scientists in collaboration with Prof. Bhabatosh Chaudhuri's group at De Montfort University, UK have discovered two non-planar analogs of fascaplysin exhibiting selective Cdk4/D1 inhibition with no DNA-intercalation property.

These identified lead compounds were tested in over 60 protein kinase assays. Both analogs displayed inhibition of Cdk4-cyclin D1 enzyme *in-vitro* far more potently than many other kinases including Cdk family members (Table 1). To understand the observed selectivity towards Cdk4-cyclin D1 versus Cdk2-cyclin A, molecular modeling studies

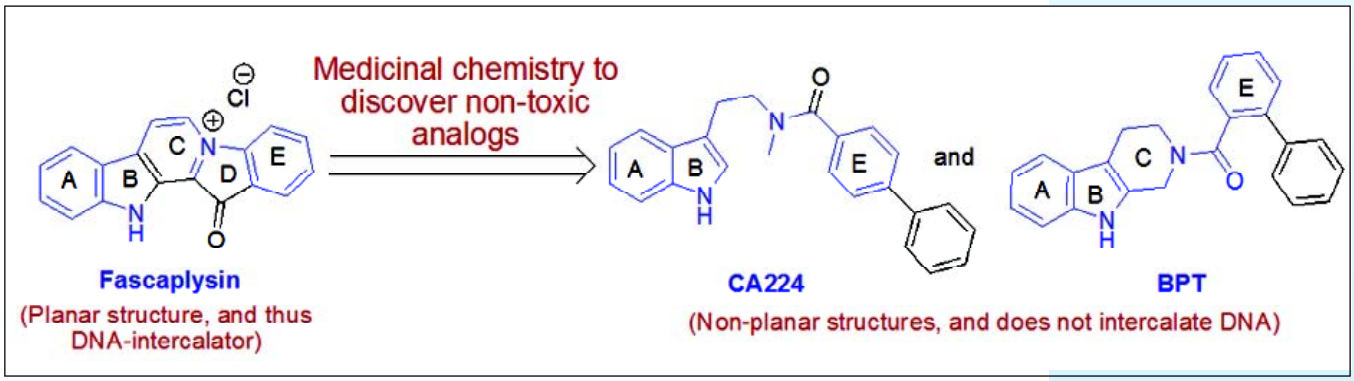


Fig. 1: Structure of fascaplysin and its non-planar analogs CA224 and BPT

were performed. BPT interacts with ATP-binding pocket of Cdk4-cyclin D1 with 83-fold selectivity with respect to Cdk2-cyclin A due to flexible conformational movement of the BPT amide-bond which allows free rotation of biphenyl ring leading to subsequent gain or loss of major hydrophobic interactions with one or other Cdk. BPT interacts with these Cdks in two different conformational states: (a) in *cis*-conformation (green-colored ligand in Fig. 1C, ψ = –9.6), it interacts selectively with the side-chain of Arg101 residue of Cdk4-cyclin D1 by hydrophobic π-cation interaction; whereas in Cdk2-cyclin A, this interaction is missing as the corresponding Lys88 residue side chain orients away from BPT binding cavity, and (b) in *trans*-conformation (orange-colored ligand in Fig. 2; ψ = 161.1) it interacts with Cdk2-cyclin A (Fig. 2b). Similar observations were found for CA224 (Fig. 2a).

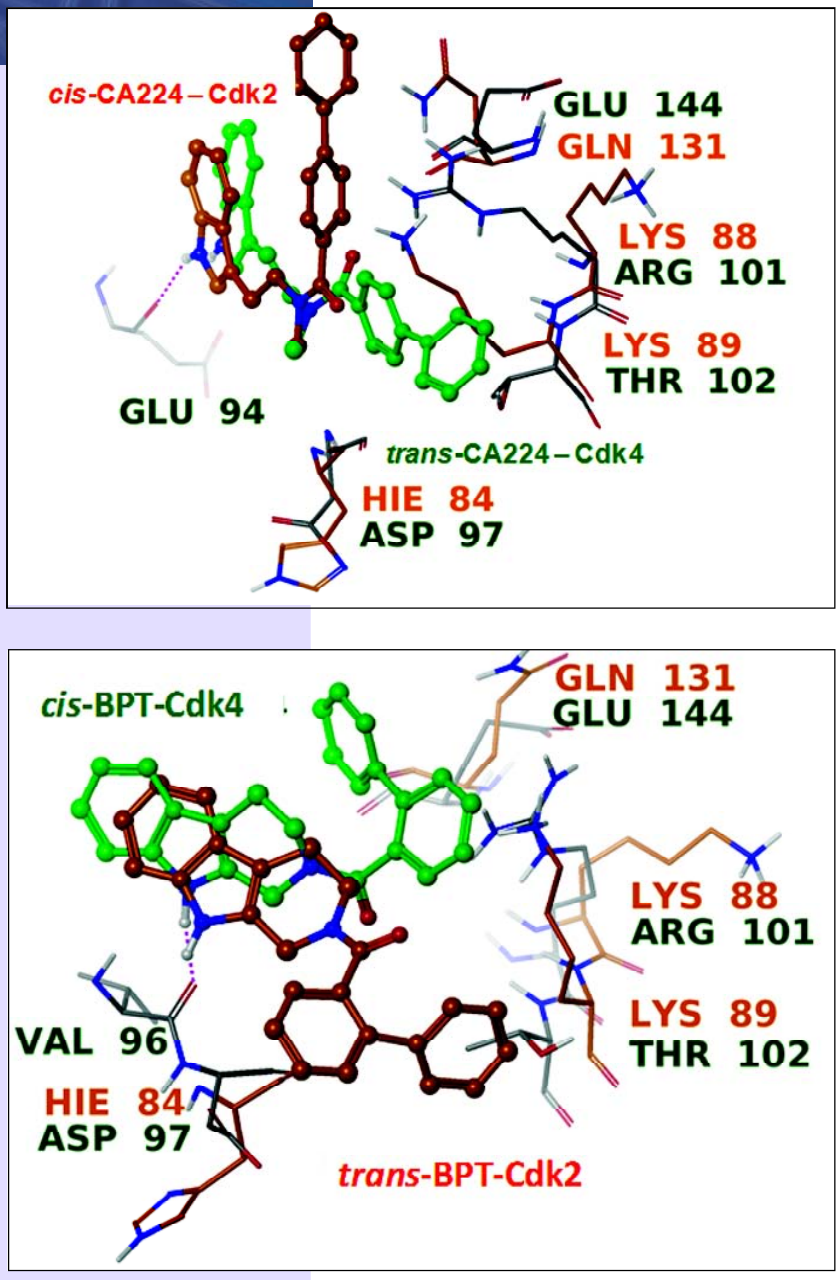


Fig. 2 : Molecular modeling studies to understand Cdk4 selectivity versus Cdk2:
(a) Interactions of *cis*- and *trans*-conformations of CA224 with Cdk2 and Cdk4, respectively (*cis*- and *trans*- conformations of CA224 are shown in orange and green colors, respectively;
(b) Interactions of *cis/trans*-conformations of BPT with Cdk2 and Cdk4, respectively (orange conformation is with Cdk2 and green with Cdk4).

The ability of CA224 and BPT to intercalate d-s DNA was important to segregate it from fascaplysin. It was studied by EtBr-dispacement assay and topoisomerase-I catalysed DNA relaxation or unwinding assay in-vitro. Unlike fascaplysin, both CA224 and BPT failed to displace bound EtBr from DNA, indicating that they do not compete with EtBr binding sites on DNA (EtBr is known to bind to the minor-groove of d-s DNA, and also to DNA double-helix and cross-linking sites) and therefore shows no detectable affinity towards DNA.

These compounds were tested *in vitro* in ten cancer cell lines known to be relatively resistant to known chemotherapeutic agents. The inhibitory effects of compounds were quantified using MTT assay. The results of cell proliferation assays indicate that CA224 and BPT inhibit the growth of cancer cells *in vitro* at sub-micromolar concentrations. Amongst all the analogues, BPT was found to be the most potent compound at the cellular level (Table 2).

Western-blot analyses of p53-positive cancer cells treated with these leads

Table 1 : Activity of fascaplysin and its non-planar analogs in *in-vitro* kinase and DNA binding assays

Assay	IC_{50} (μM)		
	Fascaplysin	CA224	BPT
Cdk4-cyclin D1	0.41 ± 0.04	6.2 ± 0.9	10 ± 1.2
Cdk2-cyclin A	>250	521 ± 11	831 ± 15.5
Cdk2-cyclin E	>250	ND	ND
Cdk1-cyclin B1	>250	>500	> 500
Cdk9-cyclin T1	>250	>1000	>1000
EtBr displacement	5 ± 0.4	Does not displace up to 100 μM	Does not displace up to 100 μM

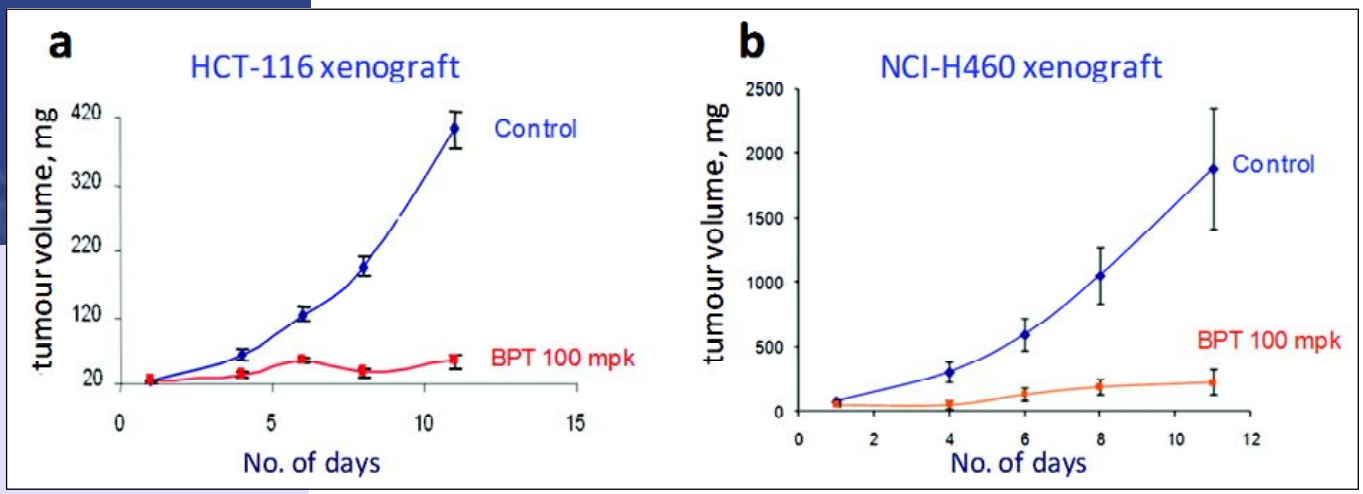
Table 2 : *In-vitro* cell growth inhibition by fascaplysin and its analogues for 48 h.

Cell lines[a]	Fascaplysin	CA224	BPT
LS174T	0.88 ± 0.04	3.5 ± 0.9	0.85 ± 0.07
PC-3	0.92 ± 0.06	6.2 ± 1.1	0.74 ± 0.09
MiaPaCa	ND	4.0 ± 0.3	0.8 ± 0.1
A549	0.69 ± 0.03	3.5 ± 0.6	0.92 ± 0.08
Calu-1	1.3 ± 0.1	11.5 ± 2.5	2.8 ± 0.4
NCI-H460	ND	2.0 ± 0.3	0.6 ± 0.06
NCI-H1299	ND	2.5 ± 0.3	0.9 ± 0.045
NCI-H358	ND	2.2 ± 0.6	0.68 ± 0.07
BNL CL2	ND	2.6 ± 0.9	0.72 ± 0.1
BNL SV A.8	ND	3.8 ± 0.9	0.75 ± 0.08

[a]LS174T: colorectal carcinoma (p53+, pRb+); PC-3: prostate (p53 null, pRb+); MiaPaCa: pancreatic (p53His273 mut, pRb+); A549: NSCLC (p53+, pRb+); Calu-1: NSCLC (p53 null, pRb+); NCI-H460: NSCLC (p53+, pRb+); NCI-H1299: NSCLC (p53 null, pRb+); NCI-H358: NSCLC (p53 null, pRb null); BNL CL2: mouse normal hepatic cells; BNL SV A.8: mouse hepatic; SV-40 mediated transformed cells. ND: not determined.

indicated up-regulation of p53, p21 and p27 proteins together with down-regulation of cyclin B1 and Cdk1. Although these leads block growth of cancer cells deficient in the mitotic-spindle checkpoint at the G_0/G_1 phase of the cell cycle, the block occurs primarily at the G_2/M phase. Both CA224 and BPT inhibits tubulin polymerization *in-vitro* and acts as an enhancer of tubulin-depolymerization of paclitaxel-stabilized tubulin in live cells.

Both these leads were found to be efficacious at 1/10th the MTD (1000 mg/kg), against human tumors derived from HCT-116 (colon) and NCI-H460 (lung) cells in SCID-mice models. The *in-vivo* results for BPT are shown in Figure 3. Similarly, CA224 also exhibited promising *in-vivo* anti-tumor activity in these xenograft models.[3] The ability of these leads to effectively halt tumour growth in human tumour-bearing mice would suggest that CA224 and BPT has a potential to become candidate(s) for further clinical development. IIIM and DMU are now actively working on these leads to further explore their potential for clinical development.



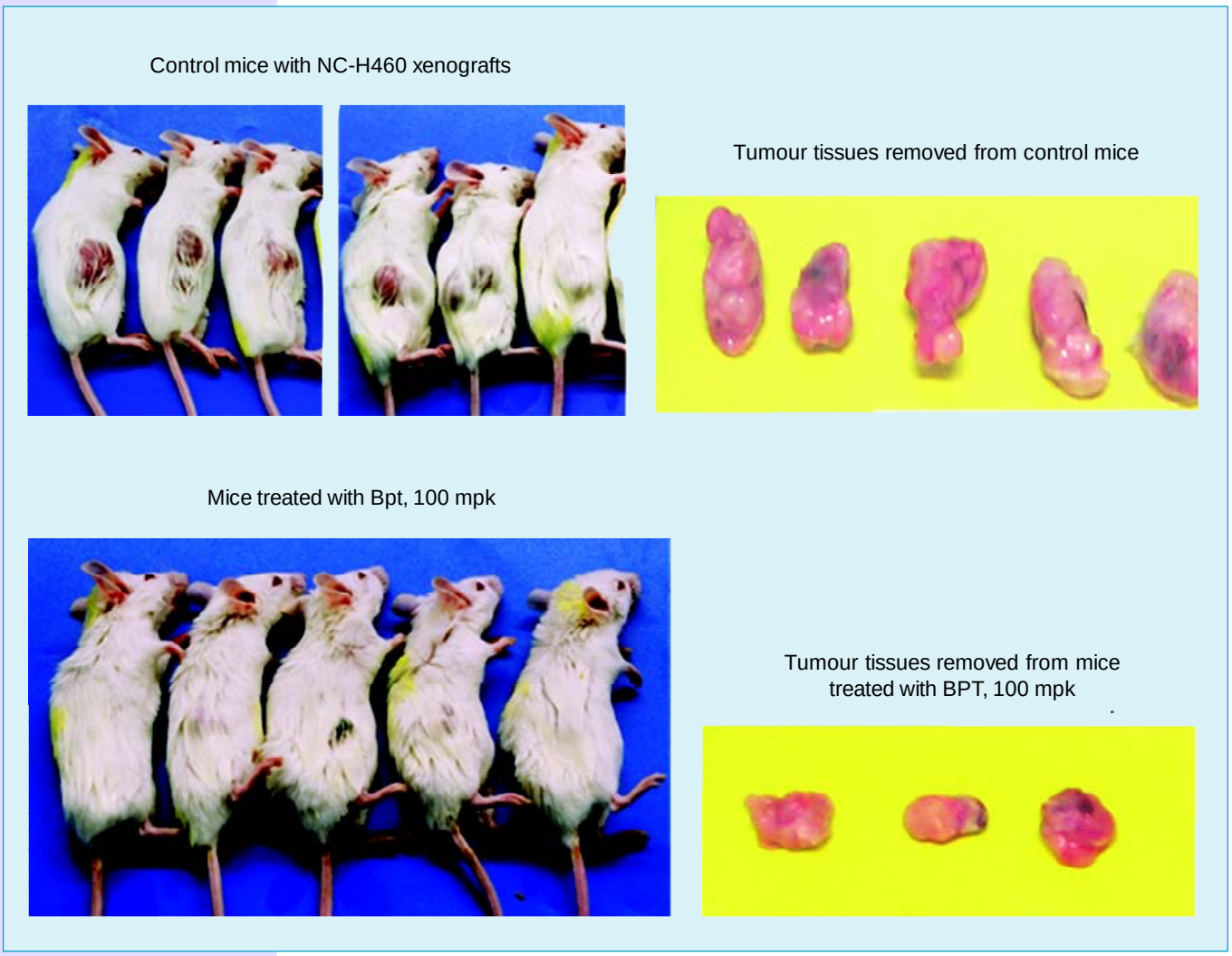


Fig. 3 : (a). In vivo tumour growth inhibition curve for BPT in the SCID mice-HCT-116 xenograft model. (b). Tumour growth inhibition curves for BPT in the SCID mice-NCI-H460 xenograft model. (c) The pictures of SCID mice showing NCI-H460 tumour growth inhibition followed by treatment with BPT at the concentration 100 mpk. (d) Pictures of NCI-H460 tumour tissues, from SCID mice, exhibiting tumour growth inhibition by BPT.

References

1. Bharate, S.B.; Sawant, S.D.; Singh, P.P.; Vishwakarma, R.A. Kinase inhibitors of marine origin. *Chem. Rev.* **2013**, *113*, 6761–6815.
2. Mahale, S.; Bharate, S.B.; Manda, S.; Joshi, P.; Jenkins, P.; Vishwakarma, R.A.; Chaudhuri, B. Anti-tumour potential of BPT: A dual inhibitor of Cdk4 and tubulin polymerization. *Cell Death Dis.* **2015**, 6, e1743
3. Mahale, S.; Bharate, S.B.; Manda, S.; Joshi, P.; Bharate, S.S.; Jenkins, P.R.; Vishwakarma, R.A.; Chaudhuri, B. Biphenyl-4-carboxylic acid [2-(1H-indol-3-yl)-ethyl]-methylamide (CA224), a non-planar analog of fascaplysin inhibits Cdk4 and tubulin polymerization: Evaluation of in vitro and in vivo anticancer activity. *J. Med. Chem.* **2014**, *57*, 9658-9672
4. Bharate, S.B.; Manda, S.; Mupparapu, N.; Battini, N.; Vishwakarma, R.A. Chemistry and biology of fascaplysin, a potent marine-derived CDK-4 inhibitor. *Mini-Rev. Med. Chem.* **2012**, *12*, 650-664.

Fragmented Layered Double Hydroxides as Multifunctional Nanofillers for Semicrystalline Polymers

Polymer-based nanocomposites filled with nanosized stiff particles have evolved and attracted great interests from both industry and academia during the last two decades. Performance of polymer nanocomposites strongly depends on the degree of dispersion and aspect ratio of layered materials in the polymer matrices. Preparation of highly exfoliated polymer nanocomposites using LDH is always a great challenge because of the stronger electrostatic interlayer interactions due to their higher charge density.

In most of these nanocomposites, either the LDH was modified with the organic compounds (surfactants) or the polymer itself was modified to facilitate the miscibility between the hydrophobic polymer and the hydrophilic LDH to achieve intercalated or exfoliated nanocomposites. However, these modifications could lead to additional steps in the preparation of nanocomposites, unwanted change in the polymer characteristics and possible degradation of organic modifiers upon the processing of these nanocomposites. The end-use applications of polymer nanocomposites would be greatly expanded with surfactant-free materials.

Dr. E. Bhoje Gowd, Senior Scientist, CSIR-National Institute for Interdisciplinary Science and Technology (CSIR-NIIST), Thiruvananthapuram and his group have developed novel methods to prepare highly dispersed isotactic polypropylene (iPP) nanocomposites by incorporating two different-sized Mg-Al LDH nanoparticles with different loadings from 1 to 10 wt % using a modified solvent mixing method. The dispersion of LDH nanoparticles within the iPP matrix was confirmed by WAXD and atomic force microscopy, which is indicative of compatibility of LDH nanoparticles with the iPP matrix.

It was found that sonicated LDH nanoparticles (fragmented LDH particles) dramatically improves the thermal stability, nucleation ability and crystallization rate of iPP at very low LDH loadings compared to that of nanocomposites with larger LDH particles with the same concentration.

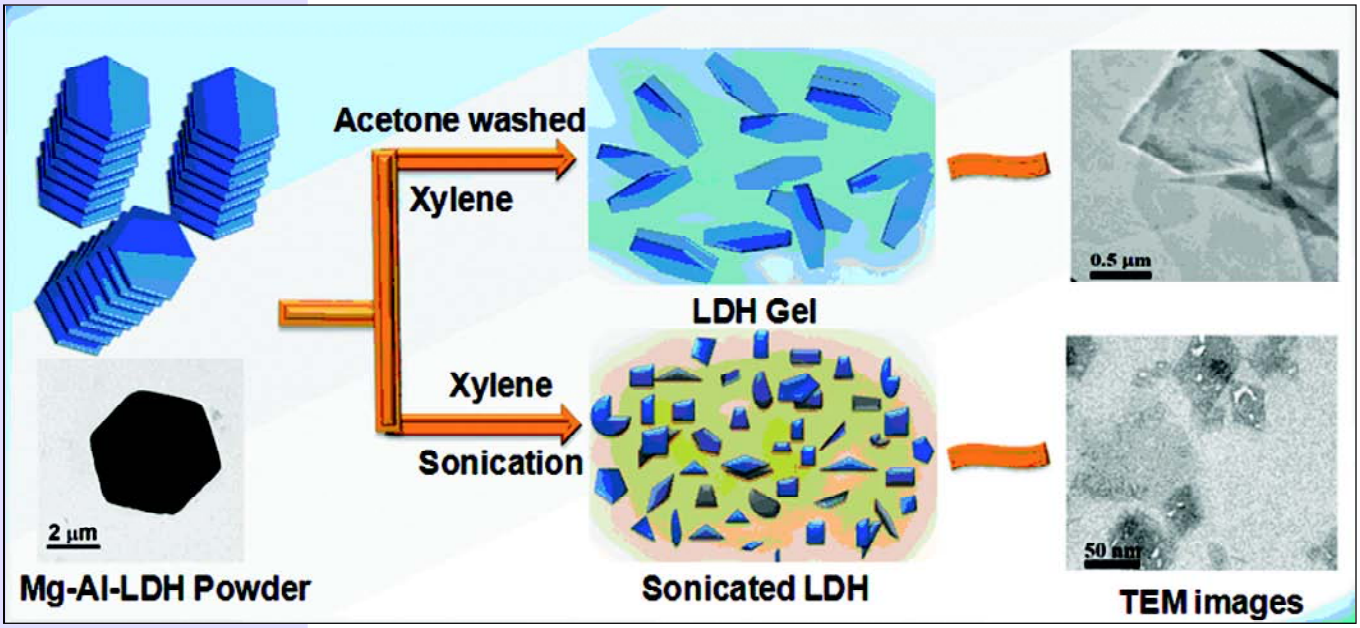
The research findings are published in the June 17, 2015 issue of *ACS Applied Materials and Interfaces*.

Liquid exfoliation of LDH is known for quite some time, and it has emerged as a process in producing the novel two-dimensional materials. The group successfully exfoliated the bulk Mg-Al LDH to single-layer nanosheets without the aid of surfactants. Larger-sized LDH nanoparticles (~3-4 μm) were prepared from the gel form of Mg-Al LDH and the smaller sized nanoparticles (~50-200 nm) were prepared by sonication of as-synthesized LDH particles. The sonication of LDH in xylene enables the modification of LDH surfaces to hydrophobic and simultaneously the LDH layers are broken into small fragments.

Incorporation of low loadings of sonicated LDH particles (fragmented LDH particles) (e.g. 1-2.5 wt %) show substantial effect on thermal stability, spherulite size, crystallinity and crystallization half-time and lamellar morphology of iPP compared to the pure iPP and that of nanocomposites with larger LDH particles with same loadings. The better nucleation ability of iPP in presence of sonicated LDH can be attributed to the high surface area of LDH nanoparticles along with its better dispersibility within the polymer matrix. The incorporation of LDH nanoparticles doesn't change the crystallization growth mechanism and crystal structure of iPP. Now the group is investigating the influence of fragmented LDH on the mechanical and flame retardant properties of iPP.

Reference:

B. Nagendra, K. Mohan and E. Bhoje Gowd. Polypropylene/Layered Double Hydroxide (LDH) Nanocomposites: Influence of LDH Particle Size on the Crystallization Behavior of Polypropylene, *ACS Applied Materials and Interfaces*, 2015, **7**, 12399-12410 (**DOI:** 10.1021/am5075826).



Delamination of layered double hydroxides

Taiwanese Delegation Visits CSIR

A six member delegation led by Prof. Chung-Liang Chien, Hon'ble Dy. Minister, Ministry of Science and Technology, Taiwan visited CSIR on 21 July 2015. The delegation was visiting India for participation in the 8th Meeting of the India-Taiwan Joint Committee on Cooperation in S&T organised by the Dept. of Science & Technology (DST).

The Taiwanese delegation held discussions on the possibilities of organising joint workshops and exchange of young scientists between CSIR, India and Taiwanese institutes. Prof. Chien had earlier visited CSIR-Institute of Genomics & Integrative Biology (CSIR-IGIB) on 20th July 2015.

The meeting was co-chaired by Prof. Chung-Liang Chien, Hon'ble Dy Minister, Ministry of Science and Technology, Taiwan and Dr. Chandra Shekhar, Director, CSIR-CEERI and Director (Addl. Charge) CSIR-NPL. Dr. Sudeep Kumar, Head, Planning and Performance Division (PPD), CSIR made an elaborate presentation on CSIR's strengths & achievements in various fields. The dignitaries appreciated the R&D activities and performance of CSIR and expressed their keen desire to partner with CSIR, India.

Dr. Chandra Shekhar presented an overview of CSIR's R&D capabilities in the area of Photonics & Optoelectronics. Prof. Chih-Chung Yang from National Taiwan University also made a presentation about the Taiwanese capabilities in these fields. Both sides discussed that there exist significant complementarities and opportunities to collaborate between the two sides.

Mr James Chang, Director, S&T, Taipei Economic & Cultural Centre, New Delhi presented an overview of Taiwan's National S&T programme outlining its vision, broad objectives, expenditure on R&D, Science Parks development, Academia Sinica and R&D organisations under its Ministry of Science & Technology. He also mentioned that the Industrial Technology Research Institute (ITRI) was an organisation similar in its role and mandate to CSIR, India. ITRI serves as a nonprofit R&D organisation engaged in providing applied research and technical services to industries and help them to remain competitive and sustainable.

From left to right: Mr Yuan-Ting Shih, Dr. Louis Chen, Prof. Chih-Chung Yang, Dr Purnima Rupal, Dr Chandra Shekhar, Prof. Chung-Liang Chien, Dr Amitava Bandopadhyay, Mr James Chang and Dr Sudeep Kumar

Dr Amitava Bandopadhyay, Head of CSIR's International S&T Affairs mentioned that R&D on Bamboo was an area CSIR would like to partner with Taiwan. A presentation on "Application of Bamboo and its Charcoal in Healthy Life" was shared by the delegation on behalf of the Industrial Technology Research Institute (ITRI), Taiwan. Both sides evinced keen desire to partner in areas of mutual interest which include

Photonics & optoelectronics; New materials for sustainable energy and storage devices; Affordable healthcare including functional genomics; Drug development & biomedical devices and Food science and technology.

It was agreed by both sides to initiate steps to explore funding possibilities and mechanisms or collaborative projects by CSIR in the above areas and also try to tap the potential of the existing bilateral S&T collaboration activities identified at the 8th Joint S&T Committee Meeting. Dr Purnima Rupal, Principal Scientist, International S&T Affairs Directorate represented CSIR at the India-Taiwan Joint S&T Committee Meeting organised by DST on 20th July 2015.

Events

CSIR-SERC Celebrates its Golden Jubilee Foundation Day

The CSIR-Structural Engineering Research Centre (SERC) Golden Jubilee Foundation Day was celebrated on 10th June 2015. The function was presided over by Shri Shyam Chetty, Director, CSIR-SERC and Coordinating Director, CMC. Dr. E. Sreedharan, Principal Adviser, DMRC & LMRC, Member, Kerala Planning Board & Adviser to A.P. Government was the Chief Guest of the function.

Welcome address by Shri Shyam Chetty, Director, CSIR-SERC and Coordinating Director, CMC

The Director, in his welcome address, extended warm and heartiest welcome to the chief guest. He greeted the retired and present staff members of CSIR-SERC on the occasion of the golden jubilee function.

Dr. K. Ravisankar, Chief Scientist & Advisor (Management), presented the report on Golden Jubilee Year Celebrations. Dr. K. Balaji Rao, Chief Scientist, gave introduction of the Chief Guest and the "Metro Man" was given a standing ovation for his extraordinary accomplishments.

Dr. K. Ravisankar, Chief Scientist & Advisor (Management) reporting on the Golden Jubilee Year Celebrations

The chief guest Dr. E. Sreedharan, delivered the Prof. G.S. Ramaswamy Memorial Lecture. Expressing his happiness at joining the Golden Jubilee Foundation Day celebration, he felt honoured to deliver the lecture with respect and homage to the founder Director Prof. G.S. Ramaswamy. Commending the achievements of CSIR-

Dr. K. Balaji Rao, Chief Scientist introducing the Chief Guest

SERC, he shared his experiences in implementing two major infrastructure projects in the country (the Konkan Railway and Delhi Metro Rail), thus inspiring the audience.

The 760-km-long Konkan Railway, running through the most difficult terrain in the country, was constructed with new innovations and novel construction techniques. In spite of technical difficulties the railway line was constructed in a record time of seven years within the estimated budget. Similarly, the Delhi Metro was constructed ahead of the stipulated time and within the estimated cost. The functioning of the Delhi Metro has saved tonnes of fossil fuel and mitigated road accidents thereby keeping the environment pollution free.

Dr. E. Sreedharan, citing the examples of these two major projects, carried out by the government agencies following rules and procedures, opined that government organizations can perform equally well or better than private companies. To achieve this, a unique work culture supported by four pillars *i.e.* punctuality, integrity, professional competence and social responsibility/accountability is required, he said. Acknowledging CSIR-SERC for providing excellent guidance on M-Sand, he urged the researchers to display commitment towards their work and to take the opportunities to serve the nation.

Octogenarian members of CSIR-SERC, Shri N.V. Raman, Former

Dr. E. Sreedharan delivering the Prof. G.S. Ramaswamy Memorial Lecture

Director honoring the Chief Guest with a memento

Shri Manuel Thomas, CoA reading out the felicitations of Octogenarians

Director felicitating the octogenarian Shri Zacharia George with Citation and Silver Plaque

Director, and Shri Zacharia George, Retd. Scientist were felicitated. Shri Manuel Thomas, CoA, CSIR-SERC, read the felicitations. Shri Shyam Chetty, Director, CSIR-SERC honoured Shri Zacharia George with Citation and Silver Plaque, Shri N.V. Raman was honoured in absentia.

The achieve-ments and develop-ments of CSIR-SERC, over fifty years, were felicitated by Prof. N. Rajagopalan, Chairman, Research Council, Former Directors (Dr. T.V.S.R. Appa Rao, Dr. N. Lakshmanan and Dr. Nagesh R. Iyer) and Shri Zacharia George. During the felicitations the progressive, steady and incremental growth of CSIR-SERC bringing all facilities under one roof was appreciated.

Quoting 'prefabrication technology' as one of the examples, they said that the technologies developed by CSIR-SERC were far ahead of time. The prototype tests on towers conducted at the TTRS facility of CSIR-SERC, showed failure modes that could not be predicted by any advanced softwares. Reengineering of Pamban bridge has saved Rs. 700 crores leading to enormous economical impact. Aerodynamically designed cyclone shelters saved a number of human lives during the Orissa cyclone. The first flyash building in the country was constructed by-and-in CSIR-SERC.

Praising the past fifty years' phenomenal attainments of CSIR-SERC, the felicitators wished that CSIR-SERC should continue to grow at a rapid speed, by developing cutting edge technologies serving the infrastructural needs of various sectors, benefiting the country. Shri C. Jeyabal, Chief Scientist & Head, KMD delivered the vote of thanks.

Prof. N. Rajagopalan, Chairman, Research Council, talking about CSIR-SERC's achievements

Dr. T.V.S.R. Appa Rao, Former Director, felicitating CSIR-SERC

Dr. N. Lakshmanan, Former Director, addresses the gathering

Dr. Nagesh R. Iyer, Former Director, felicitating CSIR-SERC

Independence Day-2015 Celebrations at CSIR-CECRI

Dr. M. Jayachandran, Chief Scientist, CSIR-CECRI hoisting the National Flag

Dr. M. Jayachandran, Chief Scientist, CSIR-CECRI delivering Independence Day address

Dr. M. Jayachandran, Chief Scientist, CSIR-CECRI hoisted the National Flag at 8.05 AM in the Institute in front of a large number of staff members, research scholars, students and wards.

In his Independence Day address, Dr. Jayachandran recollected the valiant and untiring efforts by our freedom fighters in obtaining independence for us and said it is now our turn to repay them by contributing our might for the welfare of the country especially, the common man. He presented the Institute's progress in the recent past under the Director Dr. Vijayamohan Pillai's leadership.

Dr. Jayachandran lauded the efforts of all the staff members including Scientists, Administrative and Technical & Support staff for bringing laurels to the Institute by bagging prestigious projects like Boeing, NTPC, Colgate Palmolive, etc., publishing in high impact-factor journals, filing patents, effective implementation and utilisation of ERP, Solar Power Plant installation, instrumentation facilities, etc. He complimented the unstinted support of the Administration and Technical & Support staff in this regard.

Dr. Jayachandran also congratulated the Centre for Education and AcSIR team for their commendable work and informed the audience that the number of PhD scholars has crossed 100. He

Dr. M. Jayachandran, Chief Scientist, CSIR-CECRI distributing the prizes

called for an even more rigorous approach and effective translation of the findings so that the common man can be benefitted.

Later, Dr. Jayachandran hoisted the National Flag in the Kendriya Vidyalaya and then in the Sishu Vidyalaya and interacted with the students. Later, he distributed prizes to the winners of various competitions conducted by the CECRI Club for staff and wards on the occasion of the Independence Day.

Lectures

Dr. Sonde Delivers Acharya P.C. Ray Memorial Lecture at CSIR-NCL

CSIR-National Chemical Laboratory (CSIR-NCL), Pune celebrated the 154th Birth Anniversary of Acharya P.C. Ray on 3 August 2015. On the occasion two lectures were organized. Acharya P. C. Ray Memorial Lecture on "Role of Chemical Sciences in the Evolving New Clean Energy Technologies" was rendered by the chief guest of the program Dr. R.R. Sonde, Executive Vice President, Research, Technology & Innovation Center, Thermax Ltd., Pune. An introductory lecture on P.C. Ray was delivered by Dr. Rahul Banerjee, Scientist, CSIR-NCL.

Dr. Sonde delivering the talk

Dr. R.R. Sonde started his talk by acknowledging the contributions of Acharya P.C. Ray to Indian science and industrialization. He said, "We are fortunate to have had great visionaries and patriots who through their work in the field of science and technology showed us the way how one could contribute to social uplifting and transformation by practicing science and technology." Dr. Sonde delivered a very energetic talk on emerging technologies in the area of energy generation, he also stressed why it was important to control carbon dioxide emissions on an urgent basis.

Dr. Sonde addressed the mammoth problem that our country was facing in the energy sector. He discussed about the rise in the demand for energy for electricity, transportation, etc. and how energy consumption was directly related to GDP growth of any country. He suggested that energy requirement is expected to go up four-fold in the next twenty years; 85% of fossil fuel in India is imported to meet the requirement. He pointed towards the issue of energy security keeping in mind sustainable ways of producing this energy and securing the resource for future generations. He pointed towards increasing the efficiency of energy generation and stressed upon the fact that with time the quality of fossil fuel will deteriorate and as scientists we would need to improve the emission control to deliver clean water and clean air to our ever-increasing population.

Dr. Sonde remarked that India needs a paradigm shift in technology

intervention. He talked about suitable solutions to improve the overall efficiency of electricity production from fossil fuel and thus address the energy crisis. He proposed to run the future power stations by taking cues from process industry, by utilizing the knowledge we learn in chemical and mechanical sciences. He said that chemical sciences will play a principal role to address it. A Thermax initiative, simultaneous gasification and combustion of coal, was highlighted to improve the efficiency of power generation, which has the potential to increase the efficiency from the present 35% to 80%. He also discussed in detail about the use of different working media like organic and non-organic liquids that can run conventional turbines more efficiently than water due to its better physical properties and lower critical point. He also touched upon innovative use of alternative energy solutions; among them solar energy and energy from hydrogen was discussed. He talked about the solar selective coatings and the frontier technologies regarding the solar energy. He acknowledged that fuel cells have much better efficiency than gas turbines and DG sets.

Dr. Sonde at the end suggested that the society should be ready to quickly adapt to the changing paradigms while scientists and technologists will have to innovate. Scientists are not communicating the information regarding current developments and the issues including the conflicts and the consequences. He concluded by saying that, "One single science cannot provide the sustainable solution as single man cannot survive alone; we have to survive collectively."

Dr. Rahul Banerjee in his talk introduced the father of Indian Chemistry Acharya P.C. Ray and informed about his journey of life. He talked about Acharya P.C. Ray's school education and his further education at the University of Edinburgh. He also talked about P. C. Ray's initiative to start the 'Bengal Chemicals', India's first chemical and pharmaceutical product company and how it became famous.

He talked about the acclaimed research work of P. C. Ray on mercurous nitrite and its derivatives. Dr. Banerjee also highlighted some of his quotations such as "Young minds can only change the face of the country" and "All young should apply their knowledge and energy to tread in industry". Dr. Banerjee finished his talk narrating a quotation of Mahatma Gandhi about Acharya P. C. Ray's work and life: "It is difficult to believe that the man in simple Indian dress wearing simple manners could possibly be the great scientist and professor."

Earlier, Dr. Vivek Ranade, Acting Director introduced the speakers Dr. R.R. Sonde and Dr. Rahul Banerjee. The Acharya P.C. Ray Chemistry Quiz contest was organized as a part of the celebration on 25th July for the children and wards of NCL staff, and the students of nearby schools. Winners of the quiz contest were honoured during the later part of the program and the prizes were distributed by Dr. R. R. Sonde.

Dr. Rahul Banerjee delivering the talk

Dr. Vivek Ranade offering memento to Dr. Sonde

Twelfth Atma Ram Memorial Lecture at CSIR-CGCRI

From left to right: Dr. K. Muraleedharan Dr. G. Sundararajan Dr. B. K. Sarkar and Shri Kamal Dasgupta on the dais

The CSIR-Central Glass and Ceramic Research Institute (CSIR-CGCRI), Kolkata, fourth in the chain of CSIR laboratories; having been formally inaugurated on 26 August 1950, marks its Foundation Day with a Lecture series named after Dr. Atma Ram – its first Director and CSIR's fourth Director General.

The 12th Atma Ram Memorial lecture was delivered by Dr. G. Sundararajan, Director, International Advanced Research Centre for Powder Metallurgy and New Materials (ARCI), Hyderabad on 26 August 2015. The title of his presentation was *Advanced Ceramics: Research and Technical Developments @ARCI.*

Dr. Sundararajan giving the talk

In his extremely erudite presentation, Dr. G. Sundararajan first introduced ARCI to the audience. ARCI is an autonomous R&D institute under the Department of Science and Technology (DST), GoI. It was established to develop unique, novel and techno-commercially viable technologies in the area of advanced materials and subsequently transfer these to industries.

In this context, he explained the nuances of the unique mandate of ARCI which included the development of high-performance materials and processes for niche markets; the demonstration of prototype/pilot plants, and transfer of technology to Indian industries. He outlined the technical programmes at ARCI which he said was entering many new areas; although his talk would focus only on the area of Ceramics.

He summed up almost all the new developments at ARCI in the field of Advanced Ceramics. He began by saying that advanced ceramics have great scope in the strategic sector, not to mention other sectors such as automotive, mechanical and many other areas. Usually, the way any research institute works is that it carries out basic research first, then converts the results to a technology which is tested and then transferred to Industry. However, it is not always possible to showcase the material behind the technology. The

material often remains invisible but is always absolutely essential for the technology to work.

He highlighted the R&D work being undertaken at ARCI in the areas of Oxide ceramics, and Non-oxide ceramics and development of substrates, applications, composites, etc., plus R&D in the area of Ceramic coatings. He spoke on novel ceramic materials and innovative processing technologies that have been either developed by ARCI or are under development. For example, he discussed about transparent ceramics and elaborated on its uses and the challenges of research in this field. Transparent ceramics is an emerging type of advanced ceramic material of much value as engineering material. It has the potential to be used in many different areas because it has a desirable combination of mechanical and transmission properties that make it appropriate for carrying out many diverse functions. Spinoff products for transparent Magnesium Aluminate Spinel ceramics, for example, find use as cosmetically-attractive invisible dental brackets, transparent spinel domes and transparent honeycombs. Ceramic honeycombs have wide-ranging uses in the fields of environmental engineering, biotechnology, and metallurgy to name a few.

ARCI is currently also working on transparent polycrystalline sub-micron alumina, aluminium oxynitride, spinel and zinc sulphide (ZnS) ceramics.

Chemically Vapour Deposited ZnS is an affordable alternative for infrared windows, domes and optical elements and ARCI has significant expertise in this area. In the context of ZnS domes, Dr. Sundararajan further said that ARCI has limited production of such domes for Project NAG; it has transferred the technology to a public sector undertaking and is involved in upscaling of CVD technology to meet the requirement of DRDO's projects in progress. Polycrystalline ZnS ceramics are another area where ARCI is active.

Much of his talk was dedicated to outlining the challenges of research in different areas followed by the outcomes. For example, the challenges of green machining involved six different planes of different angles, which was difficult to achieve; the challenges of CVD SiC coatings, challenges of Light-weighting etc.

Earlier, Dr. K. Muraleedharan, Director, CSIR-CGCRI welcomed Dr. G. Sundararajan to CSIR-CGCRI and also greeted the audience. Former Director CSIR-CGCRI, Dr. B.K. Sarkar introduced Dr. G. Sundararajan and also said a few words to the CSIR-CGCRI family.

Mr. Kamal Dasgupta, Chief Scientist, CSIR-CGCRI presented a brief outline of the late Dr. Atma Ram's enormous achievements in life.

Mementoes were presented to Dr. G. Sundararajan and Dr. B. K. Sarkar by Dr. K. Muraleedharan.

Dr. P. Sujatha Devi anchored the event and also delivered the Vote of Thanks.

Dr. K. Muraleedharan presenting a memento to Dr. G. Sundararajan

Dr. Harsh Vardhan Urges Use of Green Technology in Building Industry at CSIR-CBRI, Roorkee

Dr. Harsh Vardhan, Hon'ble Minister of Science & Technology and Earth Sciences visited CSIR-Central Building Research Institute (CSIR-CBRI) Roorkee on 23rd August 2015 urging scientists to use renewable, green and innovative materials and technologies in the Building Industry. He remarked that, "CBRI has a responsibility to implement the PM's vision of housing for all by 2022."

Dr. Harsh Vardhan further said, "At this transition phase where our country is narrowing down the gap with the developed world in terms of economy, technology, and human resources we need world class innovative, efficient and green technologies for rapidly meeting the demand of millions of *pucca*, comfortable and energy-efficient houses where occupants may live with safety, dignity and pride. For the first time the Union Government has set a deadline for providing every family a roof above its head, not only a roof but water supply, sanitation and 24x7 electricity, and we have a plan to construct 20 m houses in the next seven years, that is, 7800 houses per day. "

Dr. Harsh Vardhan said, "Top-class research on construction materials & technologies, improvement & value addition to traditional construction practices and specialized research work and problem solving for leading industrial sector, socially beneficial extension & dissemination activities carried out by CSIR-CBRI would form an essential component for the Prime Minister's project. I am sure that you people will help us realize the great dream."

" I see that all the major initiatives of the Government of India like Swachch Bharat, Swasth Bharat, Sashakt Bharat, Smart Villages, Smart Cities, Make in India have some or the other ingrained technologies available in a place like the Central Building Research Institute. It is my belief that some new technologies may also be generated at CBRI if you people take an oath to make the Housing mission a grand success. ," the Minister said.

Dr. Harsh Vardhan lauded the recent efforts for conservation of great cultural heritage monuments like the Sun Temple at Konark, Taj Mahal, Qutub Minar, Chittorgarh Fort, etc. using state-of-art techniques. He said, "It is my pleasure to announce that Kashi Vishvanath Temple and Ram Janam Bhumi Temple at Ayodhya are also being benefitted with the expertise available with CBRI."

The Minister also he interacted with the staff members and listened to them as they shared the varied challenges they face in fulfilling the national tasks assigned to them. He emphasized that they should not be satisfied with past laurels and achievements but constantly try to think of out-of-the-box solutions to the various problems faced by the society and consider them to be world citizens at par with other developed societies.

The Hon'ble Minister inaugurated the "Technology Gallery" where all the ongoing research activities are displayed in pictorial form..

While thanking the industry representatives for supporting CSIR-CBRI, Dr. Harsh Vardhan called for forging greater partnerships to accept the challenges. "Prime Minister has given a call for 'Make in India'. We need to generate millions of jobs within a couple of years so that the great potential of youth power is suitably utilized. Seamless partnership will help in developing the products and technologies for the benefit of the common man," he pointed out. "At the same time, the entrepreneurs should focus on using renewable and green materials of Indian origin which have reasonably low carbon foot print as well are low cost."

CSIR News is profiling all the CSIR laboratories throwing light on the significant areas they work in and their achievements.

CSIR-Central Glass & Ceramics Research Institute, Kolkata

The foundation stone of the CSIR-CGCRI was laid on 24 December 1945 – the first foundation stone laid for any CSIR laboratory – although initially its name was the Central Glass and Silicate Research Institute. After independence, the name of the Institute was changed to Central Glass & Ceramic Research Institute and on 26 August 1950 the Institute was formally inaugurated.

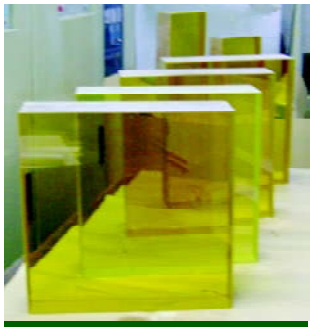
Early Decades and Milestones

In the early decades, CGCRI was engaged mainly in the benefaction and characterisation of minerals that were of interest to the nascent glass & ceramic industry in India. The work on glass-forming machines and glass-lined equipment received major priority. A notable technological breakthrough was the indigenous development and production of optical glass, which is a strategic material used as lenses and prisms of wide class of instruments. This breakthrough gave CGCRI an international visibility. CGCRI also became the first to obtain a patent on coloured glass and could transfer its technology to the Indian Railways for making signals.

In the seventies, CGCRI established the process knowhow for manufacture of high alumina refractory bricks from indigenous raw materials for application in the steel plant refractories. The research work on glass-metal seals led to cheaper products for specific uses in electric devices and electronic elements.

During the eighties, a number of high-end frontier areas of R&D, such as, Optical fibre, Sol-gel processing, Glass-fibre based composites and Electroceramics where glass and ceramics materials have great use surfaced and laboratories were set up in these areas at the Institute. These initiatives placed CGCRI among the global peers.

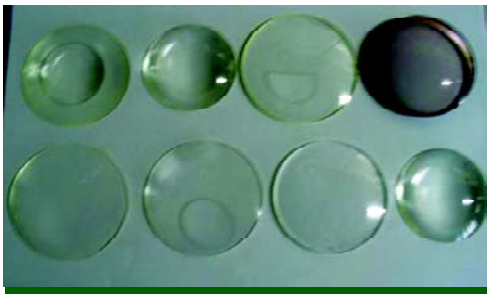
Today the Institute is engaged in various frontier R&D areas in as many as 11 overseas programmes with Italy, UK, USA, Japan, Mexico, Australia and Portugal. Besides, the Institute continuously served the domestic societal and industrial sectors. In a renewed surge, two outreach centres at Naroda (Gujarat) and Khurja (UP) were opened to serve the small-scale sector as well as rural pottery clusters.



Specialty optical glass block supplied to BARC, Mumbai

Glass frit nodules

Carbon impregnated silicon carbide jet vanes



CR-39 ophthalmic lenses with hard coating developed at CGCRI

Hydration resistant lime refractory blocks

Today, CGCRI is a premier organization pursuing R&D in glass and various aspects of ceramics and ceramic-based composite materials. The Institute is engaged in six technology sectors of national priority: Communication & Photonics, Energy & Environment, Health Care, Materials, Minerals & Manufacturing, Rural Development and Water Technology.

Specialty Glasses: CGCRI is the only R&D organisation in the country that has unique capabilities and knowledge in the field of specialty glasses. The activities are grouped under Glass Technology and Specialty Glasses. Glass melting and processing facilities available in the Institute are unique in the country. Over the past decade, the Institute has supplied 16 tonnes of high density Radiation Shielding Window (RSW) glasses in various dimensions and sizes to the Department of Atomic Energy, Government of India.

The glass provides the visual window through which operators keep watch on operations inside the nuclear reactors. Due to very high density, the RSW cuts off nuclear radiations that are harmful to the operators. The glass is cut out in shapes of a variety of dimensions from the finished chunks. The supplies from CGCRI contributed significantly to boost the country's nuclear programme. A special kind of glass called low expansion glass-ceramic, which shows practically no expansion, was also supplied to the country's defence establishment for the missile programme.

In 2010, CGCRI signed an agreement with M/s H R Johnson (India), a Division of Prism Cement Limited, Mumbai for utilizing the knowhow for manufacture of glass beads and nodules used for nuclear waste immobilization.

High-temperature Non-Oxide Ceramics: CGCRI has also developed and supplied carbon impregnated silicon carbide jet vanes for application in the naval battle ships for defence organisations. CGCRI has also developed aluminium nitride based armour tiles that have successfully passed the projectile test for an ordinance factory in India.

Nanostructured Materials: Nanostructured materials have been developed on glass and plastic substrates through sol-gel route. CGCRI has achieved notable scientific & technological breakthroughs in hard and abrasion resistant coating followed by commercialization of technology.

CR-39® (polyallyl bicarbonate) or polycarbonate (PC) grade plastics are of safe use for optical applications. Being transparent, the material can withstand high impact compared to glass but is not scratch resistant enough which deteriorates its optical property. CGCRI has developed processes for scratch resistant coatings. The technology has

Coin cells of Li-ion Battery

Exotic tiles fabricated from EAF slag of Essar Steel

Designs of standard clutch friction plates made of carbon fibre reinforced silicon carbide

Coin cells of Li-ion Battery

been transferred to two Advanced Surface Technologies, Gurgaon and Kumar PolyLenses, Chandigarh.

Refractory Products: CGCRI has conducted basic R&D on Indian bauxite to develop value added aggregates on lab scale. The high temperature properties of the CGCRI processed Indian bauxite are comparable to those of the imported bauxite. The indigenous bauxite contains high impurities whose removal is tedious and costly. The process developed by CGCRI does not require any benefaction; the impurities are converted into high temperature phases or entrapped within the crystal structure of newly developed phases.

Hydration resistant sintered lime and lime refractory have been developed by CGCRI with exotic properties of density, porosity and strength and upscaled at OCL India Ltd.

CGCRI's refractory group has also developed low cost tiles from freely available wastes of Electric Arc Furnace slag of Essar Steel, Gujarat. A good number of construction materials such as solid and hollow bricks, pavement blocks of different designs and vitrified ceramic tiles have been developed from iron ore tilings under a project sponsored by Tata Steel, Jamshedpur.

Non-Oxide Materials for Civilian Use: CGCRI has developed Silicon Nitride balls for hybrid ceramic metal bearing. The bearings passed the stringent qualifying tests conducted by Tata Steel (Bearing Division, Kharagpur). Further work on application of the balls for hybrid bearing for advanced aircrafts is in progress.

Commercial EDFA module for CATV

CGCRI has developed carbon fibre reinforced silicon carbide ceramic clutch friction plate for automotive use in collaboration with Clutch Auto India Limited, Faridabad. The new generation material has been passed to the industry partner for a real life experiment.

Energy & Environment: The Institute has demonstrated for the first time in India the working of a 10-stacked SOFC in India. The R&D experience gained has been sold offshore to Energy Research Institute at Riyadh, Saudi Arabia through a collaborative programme. Collaboration with CSIRO's Energy Technology, Australia for novel membrane materials and methods for separating hydrogen for use as an energy carrier is a major ongoing project.

Development of energy-efficient refractory kiln furniture and enhancement of kilns and furnace designs are also among the activities being carried by Khurja Outreach of CGCRI to effect energy conservation and protect environment from energy intensive ceramic industries.

Encapsulated in specially designed SS-mount for monitoring of health of structures like bridge dam and other civil engineering structures

Terracotta pottery

Trainees of glass beads at work at CGCRI's Khurja Outreach

CATV EDFA in operation at Cablecom, Saltlake, Kolkata

Rural folk making Bone China tableware at CCRD, Panchmura, Bankura

Portable furnace

In the area of ceramic sensor & actuator, extensive research on oxide based ceramic sensors have led to development of LPG and CNG leakage alarms for domestic, industrial and automobile sectors.

Bioceramic & Coatings: CGCRI's research has resulted in the development of hydroxiapatite based hip joint prosthesis and implants at prices within the common man's reach. The whole range of activities consists of basic R&D in the laboratory followed by in-vitro and in-vivo animal studies and finally human trials in a number of medical hospitals and institutions.

Orbital Eye Ball Implants: CGCRI has developed an artificial eye in the form of a light porous orbital implant that looks natural and also moves naturally. An alumina peg fixed with the implant facilitates synchronised movement of the eye implant with respect to the other eye ball which was previously not possible. The light and porous nature of implant helps in movement of the implant and facilitates tissue growth through the pores. The CGCRI made item costs much less as compared to the imported orbital implant.

Ceramic Membrane Technology for Water Purification: CGCRI has developed and demonstrated process technologies for water purification using low cost (Rs 0.3 -1.0 per litre) ceramic membranes for mass application. The membranes enable simultaneous removal of arsenic and iron from highly contaminated ground water for producing sparkling quality drinking water with arsenic content as per World Health Organisation's recommended limit.

Blue Pottery of Jaipur developed by CGCRI's Outreach Centre, Norada

Arsenic and Iron removal plants: Six arsenic and iron removal plants (2500 LPD capacity- 3 nos., 5000 LPD capacity – 3 nos.) were installed in West Bengal and Tripura largely with the financial assistance of CGCRI and Government of West Bengal. Twenty two iron removal plants have been installed and are under active operation in West Bengal, Sikkim and the northeastern states of Meghalaya, Mizoram, Tripura, Assam, Manipur, Nagaland and Arunachal Pradesh. CGCRI has upscaled its membrane technology with modular designs that enable water purification in larger volume.

Communication: CGCRI developed the erbium doped fibre for use in amplifiers. The optical fibre based amplifier called EDFA was developed through public-private partnership with NeST, Cochin for application in Cable TV network. The instrument is the first indigenously developed fibre optic product and has been exported to USA by the company.

For the first time in India, CGCRI has developed a special variety of photonic crystal fiber (PCF) having very high nonlinearity and its operation has been demonstrated in generating wide band supercontinuum (SC) source required for various applications such as optical coherence tomography, spectroscopy, metrography, etc.

Rural Development: CGCRI has made tremendous contribution to rural pottery. The two outreach centres of CGCRI at Naroda and Khurja offer awareness programmes. A notable development in this regard has been the development of a cluster for terracotta pottery for the rural artisans of Wankaner region of Gujarat.

CGCRI is the only organization in the country to offer training in glass beads and beaded jewelry thereby helping women and low income group people

resort to self employment schemes.

CGCRI has developed low cost sanitaryware using lean variety of locally available China clay and red burning common clay in and around Bankura district of West Bengal. Sanitary ware is manufactured utilising a combination of good quality kaolinitic clay in the organised industrial sector as a high value product. Experiments by CGCRI have successfully showed inferior grade china clay as well as red burning illitic clays, abundantly available throughout the country, could be incorporated in the clay-quartz-feldspar triaxial composition to produce ceramic products with properties comparable to the conventional white clay based porcelain ware.

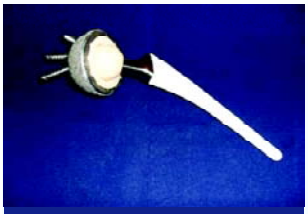
Resurrection of Blue Pottery of Jaipur: The Naroda Outreach of CGCRI has come up with a suitable lead-free engobe matching technology that has set toxicity complaints to rest. CGCRI's blue pottery innovation has helped in resurrection of the technology and its manufacturers and also the large section of potters and artisans who would have become extinct without the intervention.

Common Facility Centre at Panchmura: Black terra-cotta horse is the hallmark of the Bankura region. CGCRI established a 'Ceramic Centre for Rural Development' (CCRD) at Bankura and developed technology packages to produce articles that have relevance to the local and rural needs. By utilizing the local raw materials and skills, CGCRI's technology has brought exotic tableware products like Bone China cups, saucers, mugs, etc. within reach of the poor.

Ceramic Clusters in Gujarat and UP: Four ceramic clusters of Gujarat with a coverage of as many as 437 ceramic units (153 sanitary ware, 143 ceramic tiles, 65 crockery and tablewares and 76 other producer units of electrical porcelain, water filter candles, bone china etc.) were taken up by the CGCRI Outreach at Naroda. CGCRI's intervention created strong quality consciousness among the sanitaryware industries at Thangadh, tiles industries in Morbi, crockery and tableware industries in Naroda respectively.

Glass beads of Purdilpur, UP: About 4 Lakh people in India are engaged in the manufacture of glass bead/beaded products that lead to direct or indirect annual export worth of Rs. 1600 crores. Traditionally artisans use wood fired kilns and kerosene fired wick burners for beads making. CGCRI's Outreach at Khurja developed energy efficient and environment friendly portable LPG fired kiln and bench burners developed to address the problem.

Innovation in Healthcare: CGCRI has developed an improved version of hip prosthesis that comprises of acetabular cup and femoral head both made of ceramic material. The hydroxyapatite coated femoral stem along with ceramic acetabular cup and ball makes the prosthesis system an all ceramic combination. The advantages are reduced friction between the femoral head and cup, lesser wear debris, improved mechanical properties and minimised revision strategies which offer enhanced life of the artificial hip joint.



All ceramic hip joint prosthesis specimen

A beneficiary of CGCRI's prosthesis technology

For further details contact:

Director
CSIR-Central Glass & Ceramic Research Institute
196, Raja S.C. Mullick Road,
Kolkata – 700 032
West Bengal, India
Website: www.cgcri.res.in

Appointments

Dr. K. Muraleedharan takes charge as Director, CSIR-CGCRI

Dr. K. Muraleedharan has taken over charge as Director of CSIR-Central Glass & Ceramics Research Institute, Kolkata.

Dr. K. Muraleedharan earned his B.Tech and PhD from Banaras Hindu University-Institute of Technology (BHU-IT), Varanasi. He joined the Defence Metallurgical Research Laboratory (DMRL), Hyderabad as a Scientist in the year 1984 after a short tenure as Graduate Engineer Trainee at the Mishra Dhatu Nigam (MIDHANI), Hyderabad. Dr. Muraleedharan worked as Research Associate at the Carnegie Mellon University, Pittsburgh, USA during 1995-1997. He headed the Electron Microscopy Division at DMRL during 1989-2010 and was the project leader of the project 'Science and Design of Materials at Atomic Scale' during 1999-2004.

Later, he became the leader of a project for the 'Development of Specialty Steels for Naval Applications'. The team led by him developed the various steel products for use in the Warship construction for Indian Navy. The country's first Aircraft Carrier, INS Vikrant II, commissioned recently was built by these steels.

Dr. Muraleedharan has also been the member of DRDO Think Tank during 2003-2005. He rose to the level of Director of Materials, DRDO, New Delhi in 2011 where he coordinated the NBC Defence and the Nano Science and Technology activities as well as the activities of Materials Cluster laboratories. He was the Director Technical (Materials), Technical Core Group at DRDO HQ (2013-15).

Research interests of Dr. Muraleedharan include the Science and Design of Advanced Materials, and Multi-scale Microstructural Characterization using techniques such as Transmission Electron Microscopy and 3D Atom Probe Field Ion Microscopy, as applied to the study of electronic materials and solid-state phase transformations. His research at DMRL and CMU concentrated on the Process-Structure-Property relationships in a variety of materials systems such as alloys based on Ti and its intermetallics Ti_3Al and TiAl; specialty steels; Ni base superalloys; high energy rare-earth permanent magnets; and ceramic matrix composites.

He has received many awards and recognitions. Some of the recent ones are: DRDO Agni Award in 2005 for the 'Development of Complete Ore-Product Cycle for Titanium' and again in 2007 for the 'Development of Specialty Nava Steels'; Eminent Engineering Personality by the Institution of Engineers in 2012; and the Distinguished Alumni Award from the Dept. of Metallurgical Engineering, BHU, Varanasi in 2013.

Dr. Muraleedharan is a member of many professional bodies and has been the Vice President (2011-2013) and President (2013-2015) of the Electron Microscopy Society of India.

Printed and Published by

Deeksha Bist on behalf of CSIR-National Institute of Science Communication And Information Resources
Dr K.S. Krishnan Marg, New Delhi -110 012 and printed at NISCAIR Press
Dr K.S. Krishnan Marg, New Delhi -110 012
Editor: Hasan Jawaid Khan; **Editorial Assistance:** Neelima Handoo
Design: Neeru Sharma & Sarla Dutta; **Production:** Supriya Gupta
Phone: 25848702; Fax: 25847062; E-mail: csirnews@niscair.res.in; hjk@niscair.res.in
Website: http://www.niscair.res.in
Please direct all Subscription-related queries to:
Sales & Distribution Officer, NISCAIR; E-mail: sales@niscair.res.in; Phone: 25843359
Annual Subscription: Rs 500; Single Copy: Rs 50.00
RN 4512/57