

IIChE NEWSLETTER 2022

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DR. H.L. ROY BUILDING, RAJA S.C. MULLICK ROAD, KOLKATA 700 032

WEBSITE: WWW.IICHE.ORG.IN, E-MAIL: IICHEHQ@IICHE.ORG.IN, TELEPHONES: (033) 2414 6670, 2412 9314

Publication Committee for e-Newsletter

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President's Corner



On the onset of the New Year, let me start with Happy and Healthy 2022 to you and your family. It is 75th year of IICChE – the Platinum Jubilee year. The previous year and days gone faced the 2nd wave of Corona pandemic, posing challenges to health care, Govt. preparedness and to Indian Chemical Industry. That was the year which showed determination of Indian Pharma sector to work with firm commitment that “We can do”. To vaccinate more than 150 crores doses in a country like ours, having diverse culture and beliefs, is a Herculean task but successfully done. If we look to raw materials and their supply chain, production, logistic of transportation and delivery to remote places, this has given a message fitting to honourable PM’s “Atma Nirbhar”. The message is clear: Devotion, Out of Box Thinking, Determination and Commitment are keys to achieve the goals.

The year 2022 has also begun with lot of challenges and expectations from the Indian Industry, particularly CPI. There are issues like Covid third wave, steady availability of supply chain for raw materials, increasing cost trend, deployment of skilled millennial youth power at right place, spiralling energy cost, resource efficiency, sustainability and so on.



The world is facing big challenges of environment. We are custodian of environment and natural resources. We have commitment to leave environment clean and natural resources for Gen Next. Energy is another major factor to honour. Fossil fuels have problem of environment, calling dire needs for alternative source of energy. Efforts are targeted for Green Hydrogen, Blue Hydrogen, conversion of Hydrogen into fuel cells, development of sustainable EV batteries, Circular Economy etc. All these measures do consume energy in one or other form. What is important is the net output, translated in single energy balance equation: $\text{Output} - \text{Input} = \text{Net available}$ without damage to ECO system.

The last century saw a phenomenal growth of Indian CPI in many sectors like Refinery, Petrochemicals, Fertilizers, Pharmaceuticals, Manmade Fibres, Performance & Fine chemicals, Paints, Dyes etc., but the 21st century has bigger road map ahead. All these sectors have a large environmental footprint. The Make in India & Atma Nirbhar campaign plans to increase overall manufacturing share of GDP from the current 16% to 25% over the next five years. The chemical Sector is the base of key manufacturing economy. The business and policy fundamentals for domestic manufacturing are oriented at growth of Chemical sector. Industry has largely imported chemicals to meet its requirement. All these have a large environmental footprint. They are energy and water intensive, consume hazardous materials, emit noxious gases and produce a significant amount of hazardous waste. Logistics for transportation and storage of chemicals involves health and safety hazards.

Efficient utilization & recycle / reuse of resources (circular economy) are great challenges. The life cycle of resources is important from resource & their impact on Environment, Cost & economic benefits derived, Creation of jobs, Social impact & Social benefits, Prodigious and unequitable consumption (developed countries V/s developing countries), Reuse / recycle of products.

I believe, Chemistry & Chemical Engineering have an important role to play in achieving a sustainable growth & environment on earth. We as Chemical Engineers have Challenging & Interesting times ahead. Chemical Process Industry will become more dominant and will be the driver of sustainability and growth. Let us all at IIChE together put efforts to tackle challenges in frontier areas :

- Safe, Sustainable and Eco friendly alternative Energy Sources
- Nano Manufacturing mechanisms at nanoscale for production of high quality with zero wastage
- Efficient use of Novel Materials - Memory alloys, New fibres, etc.
- Biocatalysts – Application of Microorganisms and enzymes as catalysts for reactions without severity of operating parameters and any harmful or toxic releases
- Genetic Reforestation - Production of healthier and fast-growing trees involving principles of genetics and biotechnology for food chain and wood for biomass
- Optimum and efficient Recycling of waste materials for their productive use
- Educating the next generation chemical engineers with focus on sustainability, to overcome the problems created in the past, with system approach and life cycle thinking understanding environmental, economic and social aspects.

The profession faces challenges ahead but has to accept the responsibility for Impact of pollution and depleting resources coupled with safety as a whole. This is a grand challenge of our own making and we at IIChE have major role to play.



Indeed, I am excited that I am President of IIChE in its 75th year - the Platinum Jubilee year with year-long celebrations, coinciding with “*Amrut Mahotsav*” Celebrations of our beloved country’s 75th Independence Year. I invite you all to plan and participate in the programme of activities to celebrate our profession. In this 75th year – Platinum Jubilee Year – let us endeavour to make IIChE a flag bearer in terms of skill enhancement of freshers, meeting industry expectations, strong industry – academia – R & D bond and turning ideas into reality.

The Platinum Jubilee is the right time to acknowledge the contributions of those who have been part of IIChE’s 75 years history and paved the way to bring our institute at today’s level. As there is no more to pen, I thank heartily to members, volunteers and staff, who work together to achieve the IIChE goals.

D.M. Butala

Dmbutala27@yahoo.com

OBITUARY

With profound grief, we announce the sad demise of our following respected Members:

Dr. M.C. Chabaria (LM 06392): The late Dr. Chabaria was a member of IIChE since 22 August 1981.

Prof. R. Kumar (HF 01851): The late Prof. Kumar was a member of IIChE since 17 February 1968.

Dr. K.J. R. Sarma (LF 00768): The late Dr. Sarma was a member of IIChE since 30 June 1974.

We offer our heartfelt condolence to the bereaved families of the departed Members.



ANNOUNCEMENT

Nominations for Some IIChE Awards/Prizes for 2022

- ◆ Lala Shriram National Award for “Leadership in Chemical Industry”
 - ◆ Herdillia Award for “Excellence in Basic Research in Chemical Engineering”
 - ◆ NOCIL Award for “Excellence in Design or Development of Process Plant and Equipment”
 - ◆ Jubilant Award for “Outstanding Contribution in the area of Chemical Process Design”
 - ◆ IPCL Award for “Safety/Hazard Management in Petrochemical Industry”
 - ◆ ONGC Award for “Excellence in Design and Development of Oil/Gas related Process Plant and/or Chemicals”
 - ◆ Hindustan Lever Biennial Award for ‘The Most Outstanding Chemical Engineer of the Year’ under the age of 45 Years as on 31st December 2021.
 - ◆ Hindustan Dorr-Oliver Award for “Excellence in Use of Science and Technology in Rural Development”
 - ◆ ICI India Limited Award for “Excellence in Process or Product Development”
 - ◆ Amar Dye-Chem Award for “Excellence in Research and Development” – for Chemical Engineer below the age of 35 years as on 31st December 2021
 - ◆ P K Nair Biennial Memorial Award for “Excellence in Design or Development of Process Plant and Equipment”
 - ◆ Lupin Industries Best Chemical Engineering Teacher Award for the Faculties in Private Colleges below the age of 50 years as on 31.12.2021
 - ◆ Dr A V Rama Rao Foundations Best Ph.D. Thesis and Research Award in Chemical Engineering/Technology for the Year 2022
 - ◆ Prof Shyamal Kanti Sanyal Memorial Award for the “Best PhD Thesis in the area of Membranes Research with Significant Commercial Potential”
 - ◆ The Chemical Weekly Prize for “Best Research Paper Published in a High Impact Factor International Journal by an Undergraduate Chemical Engineering Student” (First and Second Prize)
 - ◆ “Padmashri Professor G D Yadav and Dr (Mrs) Vasanti G Yadav Awards for the most versatile Chemical Engineering/Technology Students in India”
 - ◆ Professor Ashutosh Sharma Award for the Best Research Paper Published in a National/ International Journal by an Undergraduate Chemical Engineering Student (Male/Female alternative year).
- * The forms, duly filled-in should reach the IIChE Office on or before 30th June 2022.**

- ◆ Ambuja’s Young Researcher’s Awards for Doing Post-Graduate Studies in India for the Year 2022 (10 awards)

The forms, duly filled-in should reach the IIChE Office on or before 31st August, 2022

- ◆ Shah-Schulman Award ‘for the best Ph.D. thesis in the area of Colloid and Interface Science’.
- ◆ Dr K Anji Reddy Innovator of the Year in Chemical Engineering and Technology in India by publishing in Reputed International Journal in Chemical Engineering & Biotechnology/ Patents of merit.

Both the forms, duly filled-in should reach the IIChE Office on or before 31st May 2022.

The Institute also invites nomination for:

- ◆ Acharya P C Ray Award (First and Second Prize) and Ambuja’s Best Home Paper or Design Project Report Award (First, Second and Third Prize)

Nomination Forms for these two awards have to be endorsed by the Head of the Department of Chemical Engineering, of the concerned institution. Forms, duly filled-in along with the Project Report should reach the IIChE Office on or before 17th July 2022.

**All Nomination forms for Awards and Prizes are available in the Website of the Institute:
(www.iiche.org.in).**



Prof. S. Basu, Director, CSIR-IMMT and the Chairman, Local Organising Committee, CHEMCON-2021 welcomed the dignitaries and delegates to CHEMCON-2021. He briefly made a presentation about the R&D activities of CSIR-IMMT. He also presented an outline of the four-day event, to be unfolded.

Prof. M. K. Jha, IIChE President, delivered a brief Presidential Address. Dr. Abhijit Ghosh, Honorary Secretary of the Institute, briefly underlined the activities of IIChE.

Dr. C. Eswaraiah, Organizing Secretary of CHEMCON-2021 and Senior Principal Scientist, IMMT proposed the Vote of Thanks at the end of the inaugural function.

Lectures: CHEMCON-2021 featured three (03) Memorial Lectures, 14 Chemcon Distinguished Speaker (CDS) lectures and five (05) Plenary Lectures, delivered by eminent academics, renowned scientists and top industry professionals from the national and international arena.

Joint Symposia: Two joint International Symposia were organised during the event. The first one was on 'Clean Coal Technologies', which was organized with the South African Institution of Chemical Engineers (SAIChE) on 28 December 2021. Organized under the Chairmanship of Prof. A.B. Pandit and Prof. Milan Carsky, the Joint Symposium was inaugurated by Mr. Vidya Rattan Sharma, MD, JSPL, who delivered his inaugural address on the theme. There were five speakers from India and four from South Africa.

The second joint symposium was on 'Sustainable Energy and Environment', which was organized with the Canadian Society for Chemical Engineers (CSCChE) on 29 December 2021. It was held under the chairmanship of Prof. Suddhasatwa Basu and Prof. Ajay K. Dalai. There were five speakers from India and five from Canada, speaking on various aspects of the central theme.

Shri Dirubhai Ambani Commemoration Day: As customary, on 28 December 2021, Shri Dirubhai Ambani commemoration day was celebrated. The session was chaired by Padmashri Prof. G.D. Yadav, Former Vice Chancellor of ICT Mumbai. Dr. Shekhar C. Mande, Director General, CSIR & Secretary, DSIR, delivered the Shri Dirubhai Ambani Commemoration Day Oration on 'Integrated Approach towards Understanding of Mycobacterium Tuberculosis'. Prof. Samir Mitragotri, Harvard University delivered a talk on 'Ionic Liquids in Therapeutic Applications' as a UPL Smt. Sandra R Shroff Chemcon Distinguished Speaker. Mr. Virendra Rathod, Reliance Industries Limited, also spoke on the occasion.

Technical Sessions: were held in the thematic areas of mineral processing, green energy, process intensification and novel separation processes, process modelling and simulation, green industrial sustainable chemistry and engineering, advanced techniques in chemical engineering, environmental engineering with a focus on solid waste management, waste water treatment, and safety-health-environment, nano science and technology, petroleum and polymer, computational fluid dynamics, biochemical engineering and food technology, process safety and responsible care, hydro & electro metallurgical processes, catalysis and reaction engineering, transport phenomena and fluid dynamics and other areas of chemical engineering. 314 oral presentations, including, keynote talks and more than 100 posters were presented in parallel sessions.



Exhibition: Considering the huge potential of Indian Chemical Industry in the national and global landscape, Indian Chamber of Commerce (ICC) in collaboration with IIChE organized a four-day virtual exhibition, 'CHEMCON EXHIBITION 2021' from 27 to 30 December 2021 during CHEMCON. The major exhibitors were Aditya Birla Chemical, Excel Industries, MCPI Pvt. Ltd, Cabcon India Limited, Berger India and Ozpec Chemical Industrial Pvt. Ltd., Central Institute of Fisheries Technology, Central Salt and Marine Chemicals Research Institute, GPC India and Central Marine Fisheries Research Institute.

There were visitors from renowned companies and institutes like Haldia Petrochemicals Limited, Deepak Nitrate Ltd, Hindon India Private Limited, DCM Shriram Ltd., UPL Limited Haldia Institute of Technology, Puducherry Technological University, etc. There were also visitors from Venezuela, Peru, Argentina, Turkey, Saint Vincent, Japan and Canada.

Valedictory Ceremony: The Valedictory Ceremony of CHEMCON-2021 on 30 December 2021 was graced by His Excellency Hon'ble Prof. Ganeshi Lal, Governor of Odisha as the Chief Guest and Shri. Hemant Sharma, IAS, Principal Secretary Industries, Odisha as the Guest of Honour. The conference ended with a resolution to ensure sustainable growth of petroleum, petrochemicals including implementation of PCPIR at Paradip and mineral processing industries, including, downstream and ancillary sectors of the existing industries in Odisha with active involvement of the Indian industries, Central and State governments, academic and R&D Institutes of Odisha.

Sponsors of Chemcon-2021: Notable sponsors for this mega event were Reliance Industries Limited, Indian Oil Corporation Limited, Aditya Birla Chemicals, Tech Mahindra, National Aluminium Company Limited, Excel Industries Limited, UPL Limited, Deepak Nitrite Limited, L&T Hydrocarbon Engineering Limited, NMDC Limited, IFFCO, Paradeep Phosphates Limited, IREL Limited, Tata Steel Limited, Aarti Industries Ltd., Dharamsi Morarji Chemical Co. Ltd., Transpek Silos Industry Pvt. Ltd. and JSPL Ltd.



SCHEMCON 2021



The 17th annual session of the Students' Chemical Engineering Congress (SCHEMCON-2021) was held in hybrid mode at Bhopal, Madhya Pradesh on 22 and 23 October 2021. It was jointly organized by the IIChE Students Chapters at Maulana Azad National Institute of Technology (MANIT) Bhopal and Indian Institute of Science Education and Research (IISER) Bhopal along with the IIChE Headquarters, Kolkata. The central theme for SCHEMCON-2021 was 'Global Advancement in Technology for Environment (GATE 2021)'.

During the inaugural function of SCHEMCON2021, Sadhvi Pragya Singh Thakur (Member of Parliament) was present as the Chief Guest for the event along with other dignitaries, including, Prof. M.K Jha (President, IIChE), Dr. Avijit Ghosh (Honorary Secretary, IIChE) and Mr. Praveen Saxena (Vice President, IIChE).

The inaugural ceremony started with Saraswati Vandana and a welcome address by Dr. S. Suresh, Co-Organizing Secretary of SCHEMCON2021 and the Students Chapter Coordinator of MANIT-IIChE. Around 185 participants participated (online and offline). A total 125 abstracts were received for presentation at the event. The participants presented their papers at different technical sessions, including, Separation Process, Energy & Environment, Nanotechnology, Wastewater Treatment, Process Modeling & Simulation, and, Industrial Waste Management. The students presented their through virtual mode. Also, two keynote lectures were there from industry.

In the inaugural function, the Chief Guest Sadhvi Pragya Singh Thakur (Member of Parliament) spoke about various schemes implemented by the Indian Government to promote science in the country for the benefits of the society. She has also suggested use of technologies for exploring the natural resources as well as focussing on the renewable and eco-friendly techniques for building the Nation.



Prof. M. K. Jha welcomed the gathering and motivated the young minds to bring in creative ideas for solving the real-life problems in the process industries and its allied areas. Prof. Jha also briefly discussed about various activities of IIChE, undertaken during the COVID-19 pandemic. In his address, Mr. Praveen Saxena encouraged the young talents to apply their engineering knowledge in the real fields to overcome the ever changing environmental issues. He also suggested that the young students must be mentored and nurtured by the experienced faculty members and the industry professionals to tackle emerging problems, encountered by the industry in India and abroad. Dr. Avijit Ghosh acknowledged active participation from all over the country by an impressive number of participants even in this pandemic situation. He also appreciated competent management of the two-day event by the local organizing team from the Department of Chemical Engineering of MANIT Bhopal and IISER Bhopal.

On the second day (23rd October, 2021) of SCHEMCON 2021, there were five technical sessions, held simultaneously all day long. Later, the valedictory function was held in the presence of Prof. D. P. Tiwari (Dean of Academic, Chotu Ram University of Science and Technology Murthal; Former Director, Government Engineering College Bharatpur, Rajasthan and Government Engineering College, Nagrota, Himachal Pradesh) as the Chief Guest. It was followed by a panel discussion and the award presentation ceremony. Finally, names of the best presenters from each technical session, including, the M.P. Chary Award session, were declared and each of the recipients was awarded with certificate. The M.P. Chary Award was jointly presented to Mr. Anupam Mukherjee (CSIR-IICT, Hyderabad) and Mr. Khantesh Agrawal, (Indian Institute of Science, Bangalore).

The Vote of Thanks was offered by Dr. Sankar Chakma, the Co-Organizing Secretary of SCHEMCON 2021. He expressed his gratitude to one and all, who have actively participated from across the country. On behalf of the organizing team, he also acknowledged the financial support from the organizations, including, Blast Carboblocks Pvt. Ltd.; Channel Ten; Northern Regional Centre, IIChE; Toshvin Pvt. Ltd.; BVS Enterprises Bhopal and Technical Systems. He also acknowledged the continuous support from the technical team, National Advisory Committee, the Student Coordinators and the volunteers for making SCHEMCON 2021 a great success.

The organizers also expressed their gratitude for enormous support received from the Chief Patron, Padma Shri Prof. G. D. Yadav; Patrons, Prof. Siva Umapathy (Director, IISER Bhopal) and Prof. N. S. Raguwanshi (Director, MANIT Bhopal); the Vice President, Shri Praveen Saxena and the Honorary Secretary, Dr. Avijit Ghosh. The organizing team also appreciated the major effort, made Mr. Sandeep Ghosh and Ms. Subha Samajadar from the IIChE Headquarters in Kolkata. Finally, the organizing team of the SCHEMCON2021 also conveyed sincere thanks to the media person for covering the event.



ACMS 2022



Glimpses of the inaugural function of ACMS 2022 on 14 April 2022: Top: Release of the book of Proceedings being released in presence of the dignitaries and Senior Members of IICChE. Below left: Chief Guest, the Union Minister, Shri Rameswar Teli addressing the guests and participants. Below right: Guest of Honour, Padmashri Prof. (Dr.) G. D. Yadav speaking on the occasion.

To mark the beginning of its Platinum Jubilee celebration, the Indian Institute of Chemical Engineers (IICChE) organised an International Conference, titled, 'Advances in Chemical and Material Sciences' (ACMS-2022) during 14 – 16 April 2022 at the Heritage Institute of Technology (HIT), Kolkata. The conference was held in association with three premier technological institutes of India, namely, HIT, Kolkata; NIT, Jalandhar and Osmania University, College of Technology, Hyderabad.

The inauguration of the conference was a grand affair in the presence of the Chief Guest, Shri Rameshwar Teli, the Union Minister of State for Petroleum & Natural Gas and Labour & Employment; the Guests of Honour, Smt. Annpurna Devi (in absentia), the Union Minister of State for Education; Padmashri Prof. (Dr.) G. D. Yadav, National Science Chair (Govt. of India), Former J C Bose National Fellow and Former Vice Chancellor, ICT Mumbai; Shri Subhesendu Chatterjee, Whole-time-Director, Haldia Petrochemicals Ltd, who sent a video message; Prof. (Dr.) A. S. K. Sinha, Director, Rajiv Gandhi Institute of Petroleum Technology, Amethi, U.P. and Shri. Vikram Swarup, MD, Paharpur Cooling Towers Ltd. and Vice Chairman, Kalyan Bharti Trust. The Authorities of IICChE and HIT, Kolkata were also present on the podium during the inaugural event. The President of IICChE, Shri D.M. Butala, and the Honorary Secretary of IICChE, Dr. Avijit Ghosh, who was also the Organising Secretary of ACMS-2022, as well as the authorities of HIT, Kolkata were also present on the podium during the inaugural event.



The three-day conference, ACMS-2022, was planned with a view to bring together acclaimed scientists and academics, promising research scholars and top-notch industry personnel, involved in the multi-dimensional fields of Chemical Science and Material Science, for exchanging the knowledge and for enlightening all concerned about the latest research outcomes as well as their application in the industry field. Chemical Science and Material Science cover a vast area of knowledge and the horizon is changing fast. The objective of this meet was to touch upon as many spheres as possible so that certain priority areas could be shortlisted for the coming days.

Over the three days of the meet, five Key Note lectures, 23 Invited Lectures and as many as 32 Parallel Sessions were conducted with over 550 papers being presented, which were selected out of a total submission of 670 papers.

Key Note Lectures were respectively delivered by the following renowned academics:

i. Dr. U. Kamachi Mudali, Vice-Chancellor, VIT Bhopal & Former Chairman of Heavy Water Board, Govt. of India; ii. Dr. Vilash Sapkal, Vice-Chancellor, MGM University, Aurangabad, Maharashtra; iii. Prof. Suddhasatwa Basu, Director, CSIR-Institute of Minerals & Materials Technology Bhubaneswar & Professor, Department of Chemical Engineering, IIT Delhi; iv. Prof. (Dr.) Dinesh O Shah, Professor Emeritus of Chemical Engineering & Anesthesiology, Director Emeritus, Center for Surface Science & Engineering and Founding Director, Shah-Schulman Centre for Surface Science and Nanotechnology, Dharmsinh Desai University, Gujarat and v. Dr. Diganta Bhusan Das, Reader in Porous Media, Department of Chemical Engineering, School of AACME, Loughborough University (LU), Loughborough, Leicestershire, UK.

The respective title of their lectures was, 'Effective Materials Design, Structure, Property and Performance via Artificial Intelligence', 'Advance integrated Membrane Bioreactor and Nanofiltration for Enhanced Performance of Effluent Treatment Process', 'Hydrogen Production in 3D-Printed Microfluidic Electrolyzer with an Asymmetric Electrolyte Configuration', 'Interface Science and Nanotechnology: Two Sides of a coin?' and 'Enabling technology Using Concepts of Porous Media'. Just a glance through the titles proves the diversity of the areas covered by the Key Note speakers.

Invited Lectures as well as the technical papers were presented under five broad heads, namely, i. Material Science and Engineering, ii. Advanced Chemical Engineering, iii. Biochemical Science and Engineering, iv. Chemistry and Environment and v. Carbon, Polymer and Composite. Those delivering the Invited Lectures were acclaimed academics or industry experts, affiliated to premier universities, technological institutes, research organizations and corporate enterprises in India and abroad. For the sake of brevity, we are listing names of only a few of the Invited Speakers in this note.

The Invited Speakers included Prof. Ljiljana Damjanovic-Vasilic (University of Belgrade, Serbia), Dr. M. V. Reddy (Nouveau Monde Graphite, Montréal, Québec, Canada), Prof. Anil Verma (IIT, Delhi), Prof. Dipankar Bandyopadhyay (IIT Guwahati), Dr. Tanveer Rasool (NIT Srinagar), Dr. Prakash V. Mehta (Vice President, Tawata Inc, Varoda), Dr. Manas Kumar Panda (Jadavpur University), Prof. Jarka Glassey (Newcastle University), Mr. Mainak Ray (Assistant Manager, HPCL-Mittal Energy Ltd.), Prof. Nader Mahinpey (University of Calgary), Dr. Debashis Kundu, (ICT-Mumbai, Jalna Campus), Mr. Dao Van Tri (Vietnamese-German University, Vietnam), Prof. Sunil K. Maity (IIT Hyderabad) and Prof. Somnath C. Roy (IIT Madras). Many of these presentations were treasure trove of knowledge, enlightening the audience with the latest happenings in the ever-expanding domain of Chemical and Material Sciences.



During these three days, faculty members, research scholars and students from academic institutes and research organisations across the country simultaneously presented papers offline as well as online, sharing ideas and knowledge and engaging in stimulating deliberations with other participants.

On the final day, Invited Lectures were delivered by Prof. Anil K Mehrotra, University of Calgary; and Mr. Lalit M. Kapoor, Founder and CEO of NGO “Plant Based Wellness Foundation. Even though highlighting completely different aspects and from altogether different perspectives, the audience got acquainted with very stimulating concepts and brand new ideas from both of their presentations.

Like the Inaugural Session, the Valedictory Session was an equally big event with the presence of the esteemed guests, including, the Post Master General, (Kolkata region), who released a first day cover to mark the occasion; Prof. Saikat Maitra, Vice-Chancellor, Maulana Abul Kalam Azad University of Technology, West Bengal and Sreejit Banerjee, Chief Operational Officer [G&L], Balmer Lawrie & Co. Ltd. Also present on the podium were IICChE President, Shri D.M. Butala, IICChE Honorary Secretary and Organising Secretary (ACMS-2022), Dr. Avijit Ghosh and the IICChE Vice Presidents, Prof. (Dr.) C. Karthikeyan and Prof. (Dr.) M. Venkateswara Rao.

In a nutshell, the refrain in this concluding session was to increasingly explore the newly developing areas of Chemical Engineering and Materials Sciences, such as, Nanotechnology, Bioengineering, Advanced Chemical Engineering, Chemistry and Environment, Artificial Intelligence, etc., translate the knowledge into practicable technology so that it would ensure creation of employable work force and in the long run contribute to the global mission of development and prosperity with a human face.

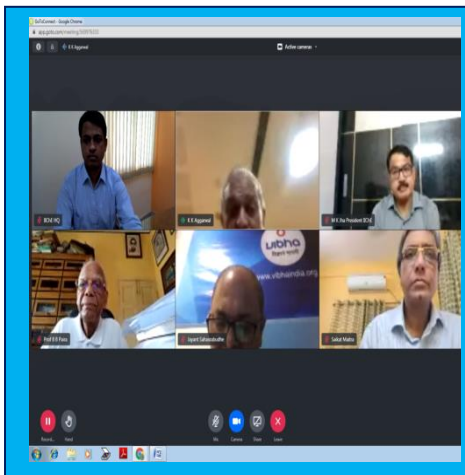


Valedictory Session

On 16 April 2022, at the Valedictory Session of ACMS-2022, the Post Master General (Kolkata region) released a First Day Cover to mark the Platinum Jubilee of IICChE.



WEBINAR ON ROLE OF PROFESSIONAL BODIES UNDER NEW EDUCATION POLICY



The IIChE Headquarters organised a webinar on the New Education Policy 2020 (NEP 2020) on 25 September 2021. The programme, coordinated by IIChE President, Prof. (Dr.) M.K. Jha and Honorary Secretary, Dr. Avijit Ghosh, was virtually attended by around 80 people from various fields of relevance. Mr. Jayant Sahasrabudhe (National Organising Secretary, Vijnana Bharti) was the Chief Guest. Other Guests / Speakers included Prof. (Dr.) Saikat Maitra (VC, MAKAUT, West Bengal), Mr. K.K. Aggarwal (Chairman, NBA), Padma Shri Prof. (Dr.) G.D. Yadav (President, Indian Chemical Council) and Prof. (Dr.) L. K. Awasthi (Director, NIT Jalandhar). The welcome address was given by Dr. Avijit Ghosh. He also acknowledged the efforts, made by the IIChE Headquarters Office staff in organising the event.

The Chief Guest, Mr. Sahasrabuddhe was introduced by Prof. Vivek Kumar, Centre for Rural Development and Technology, IIT Delhi. Mr. Sahasrabuddhe mainly focussed on the term ‘National’ and spoke about the role of IIChE in the field of education and spread of knowledge. In the process, he also emphasised on ‘learning in one’s own language’.

Mr. Aggarwal spoke about different aspects of the education policy and its impact on the professional bodies. Prof. (Dr.) Maitra also explained about the benefits and implications of the NEP. Padma Shri Prof. (Dr.) Yadav touched upon several aspects of the education policy with a smart presentation. He spoke about the role of the professional bodies as well in promoting and improving professional standards for greater technical competence and ethical practice. Finally, he also emphasised the need for “learning in one’s own language”.

Prof. (Dr.) Saikat Maitra primarily dwelt upon the benefits and outcome of the NEP 2020. Padmashree Prof. (Dr.) G.D. Yadav made an interesting presentation on different aspects of the education policy. He also spoke about the functions of the professional bodies in advancement of knowledge and chemical engineering profession by developing, regulating and promoting professional standards for high degree of technical and ethical competence.

Prof. (Dr.) L.K. Awasthi presented his views on the benefits of the NEP. He also commended IIChE for organising a webinar on such an important issue.

The webinar came to an end with Prof. (Dr.) M.K. Jha offering a vote of thanks.



CLIMATE CHANGE AND SUSTAINABLE MANUFACTURING - I

Concept of Climate Change and Approach of Chemical Engineers

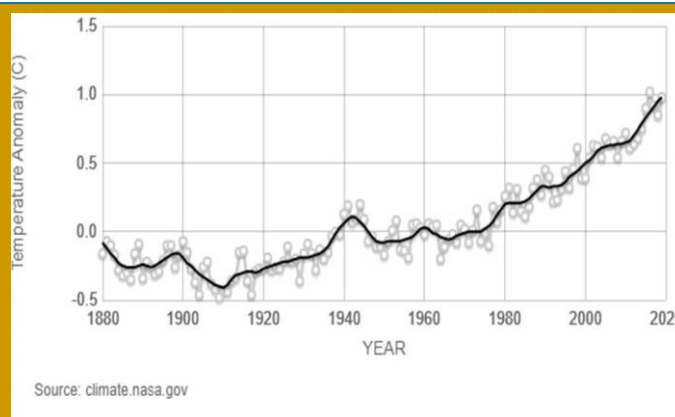
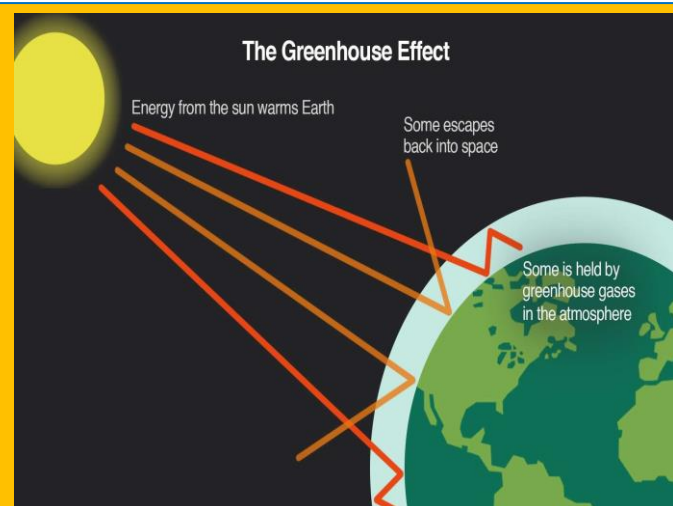
Joy M. Shah¹

Climate change is no longer some far-off problem. It is happening here and it is happening now. –Barak Obama#

Nowadays impact of climate change is visible in each and every part of the world, whether it is melting of glaciers, heavy rainfall and flood at one part of the world or severe draught in another part, wild forest fire and/or severe cyclone at some other corner of the world. Agricultural season have been showing great variation due to changes in the precipitation pattern. It is expected that if this trend continues, the sea level will rise by more than 1 ft and can be up to 4 ft by 2100. In various national and international conferences, it was discussed and the conclusion was that it is due to the Greenhouse gas effect. All of us know that one of the greenhouse gases is Carbon Dioxide. The change observed in earth climate is called greenhouse gas effect and climate change.

It has been identified by the scientists that although planet mercury is the nearest to the sun, the hottest planet is Venus, where temp is almost 470 Deg C. It has been attributed to a very high Carbon dioxide level in the atmosphere of the Venus. The same can happen for earth if the Carbon Dioxide level continuously increases. On earth, due to excessive consumption of fossil fuels as well as various industrial activities, Carbon Dioxide equivalent concentration has increased from 320 ppm in 1960 to almost 420 ppm in 2020.

The picture below shows how an increase in Carbon Dioxide equivalent level increases the temp of the earth. Most of the energy of sunrays is reflected by earth and released back in space. However, Greenhouses gases redirect the escaping sun energy to earth, which is called trapping of the heat of sun rays. An increase in concentration of the Greenhouse gas increases the heat trapped in the earth atmosphere, which, in turn, increases its temp. The graph shows the increase in earth temp by almost 1 deg C as compared to the pre-industrial era.





So far, the scientists have identified seven types of Greenhouse gases which are responsible for such effects. All these gases have different global warming potential although their concentration in atmosphere is lower than Carbon Dioxide. The details are given below in Table 1. Carbon Dioxide equivalent is calculated by considering global warming potential and their concentration in air.

Greenhouse Gases	Lifetime (years)	GWP (100 years)
Carbon dioxide	variable	1
Methane	12.4	28
Nitrous oxide	121	265
Hydrofluorocarbons	15 – 29	138
Perfluorocarbons	50000	6630
Sulphur hexafluoride	3200	23900

Table 1 Global Warming Potential

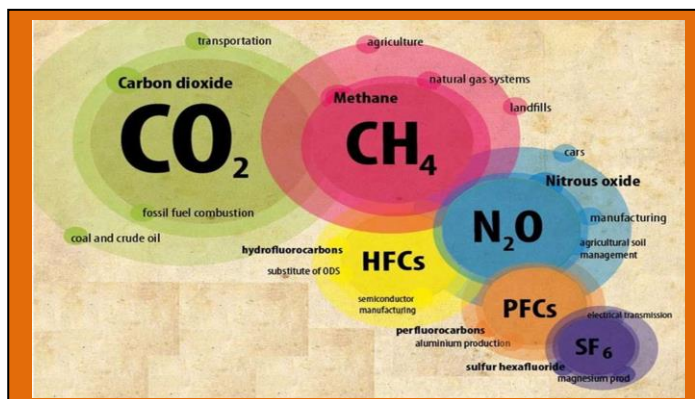


Figure 3 Green House Gases

In order to mitigate the impact of climate change, it was agreed by nations at the Kyoto Conference in 1997 to reduce the emission of Greenhouse gases, which is called Kyoto Protocol. It came into force in 2005. India has developed a National action plan for Climate change in 2008 consisting of eight missions, which include mitigating measures, adaptive measures as well as financial instruments to implement the action decided.

To review and control the emission of GHG, Conference of parties is held every year. Moreover, every five years, they review the progress of action, taken by various countries. The 21st COP met in 2015 in Paris and set an objective to limit the increase in global temp by less than 2 deg C as compared to preindustrial era as further increase in temp can be irreversible. They voluntarily agreed that they will pursue an effort to limit the global temp rise below 1.5 Deg C as compared to pre-industrial era.

Most of the Greenhouse gases are emitting from industries and due to the use of fossil fuel. India has also committed to a goal in 2015 COP in Paris as well as 2021 COP in Glasgow. India has fulfilled its commitment of 2015 well in advance and is committed to a very aggressive goal in 2021.

Although, everyone needs to contribute to the mission Climate change, I foresee a major role for the chemical engineers to support this mission. Below is a list of approaches, to be taken by a chemical engineer, to deal with every Greenhouse Gas.

1. Carbon Dioxide – It is emitted due to the use of fossil fuel, e.g., coal, crude oil in combustion in industries, domestic fuel, transportation as well as generation of electricity, etc. The following approaches can be adopted while planning design and operation of plants and industries.



- a. Energy audit for energy conservation,
- b. Energy efficiency improvement program for equipment and processes,
- c. Pinch analysis of the heat integration of a plant as well as the entire site to effectively utilise each heat source,
- d. Design for net zero carbon processes,
- e. Substitute fossil fuel-based energy or renewable energy, e.g., Solar, Bio, Wind, Hydro, etc.,
- f. Hydrogen generation, storage, transportation and usage,
- g. Development of alternative use of Carbon Dioxide as well as design of carbon capture and sequestration system.

2. Methane – As on today, Methane contributes almost 30% of the Global warming. Almost 40-50 % of methane emission is from agriculture and cattle. In industries, it is emitted by leakage of natural gas systems, gas wells, coal mining and land fill by solid waste. Moreover, domestic and other industrial practices as well as waste water generate methane. The following approaches can be adopted.

- a. Identification and minimisation of Methane leakages from gas systems, gas wells, coal mines as well as various industrial activities.
- b. Development of alternative use of domestic and industrial waste products to avoid solid waste to landfill activities.
- c. Bio fuel plants to utilise agriculture, domestic and cattle waste as well as other solid and liquid wastes and to generate bio gas, ethanol, etc.

3. Nitrous Oxide – Nitrous Oxide is emitted due to agriculture soil management as well as during combustion of various fuels in vehicles, furnaces, boilers as well as heaters. The following approaches can be adopted.

- a. Use of low NOX burners for various combustion,
- b. Design of low NOX system to reduce flame temp., e.g., steam and water injection, flue gas recirculation, staged combustion, etc.
- c. Use of catalytic NOX removal system for vehicles, furnaces, etc.

4. Hydrofluorocarbons – Hydrofluorocarbons are a substitute of ozone depleting substances and are used in various industries for refrigeration, insulations, aerosols as well as fire-fighting. The following approaches can be adopted.

- a. Use of substitute HFCs, i.e., non-HFC substances, for refrigeration, fire fighting
- b. Minimising leakages and streamlining of the accounting system as almost 60% of HFC use is for topping up of the system inventories.



5. Perfluorocarbons – Perfluorocarbons have the highest life time and is emitted mainly as a by-product from aluminium industries, solvent in electronic and semiconductor industries. The following approaches can be adopted.

- a. Substituting PFC solvent in electronic and semiconductor industries
- b. Leak detection and repair strategies
- c. Capturing PFC in aluminium industries from waste gases.

6. Sulphur Hexafluoride. – Sulphur Hexafluoride is also a synthetic chemical and has the highest global warming potential. It can be emitted from electrical transmission and distribution equipment, manufacture of semiconductors and electronics as well as in production of magnesium. Steps to minimise the harmful effects include:

- a. Use of SF₆ free circuit breakers
- b. Recycle of SF₆ from old equipment
- c. Leak detection and repair strategies for electrical equipment
- d. Capture of SF₆ from waste gas in magnesium industries

7. Nitrogen Trifluoride – Nitrogen Trifluoride is the latest addition of the GHGs in the list. It can also be emitted from electronic and semiconductor industries, solar panels as well as chemical lasers. Preventive steps include:

- a. Substitute use of NF₃
- b. Leak detection and repair strategies

We can see from the above list that most of the greenhouse gases having very high potential for global warming are man-made. Their release into the atmosphere needs to be stopped by engineering and administrative controls as well as by substituting their use by non-GHG chemicals. Chemical engineers have a better molecular-level understanding of these greenhouse gases. Therefore, they may have to play a significant role in mitigating the use of the greenhouse gases and their emission.

*# Fighting climate change calls for Innovation, Cooperation and Will-power to make changes that world needs – **Narendra Modi** #*

¹ The author Joy M. Shah is the Founder and Chief Consultant, Innov8 ProTech Solutions, Sustainability and Management Consultant. Formerly, he was Senior Vice President (Head- Technical) at Reliance Industries Ltd. He has also been a member of the IIChE Chemical Process Safety, Energy and Environment Committee since 2018. For the last three years, he is consulting for Energy and Water Management as well as Green company advice, branding and sustainable manufacturing.
Email: shahjoyim@hotmail.com. Mob: +919374715109



Opportunities and Challenges for Chemical and Pharmaceutical Industry in India

Shyam Bang*

Before 1960, chemical industry in India was insignificant. There were oil refineries meeting fuel requirements. There were a few companies like Bengal Chemicals etc. making some dyes, some other basic chemicals in small capacities. Then Government of India promoted PSUs to kick start industries. Some fertilizer plants were set up. In 1961 Union Carbide set up first ethylene cracker in Mumbai with alcohol as feedstock. In 1964 NOCIL set up a naphtha cracker in Thane with collaboration of Royal Dutch Shell. In 1970s IPCL was promoted and their first integrated cracker was commissioned in 1978 in Vadodara, which gave thrust to the growth of Chemical Industry.

The chemical industry can be put in six verticals:

1. Refining
2. Petrochemicals
3. Fertilizers
4. Bulk Chemicals
5. Specialty Chemicals and
6. Performance Chemicals

Based on technologies, chemical industry can be divided in two verticals, viz.,

1. Continuous process plants
2. Batch process plants

In first four categories i.e. refining, petrochemicals, fertilizers and bulk chemicals, continuous process is deployed. In the remaining two categories viz. speciality chemicals and performance chemicals, mostly batch process is deployed. However, as the volumes increase, continuous process is being adopted in these sectors also.

One thing typical about chemical industry is that the product does not have any brand value, except performance chemicals. Performance chemicals include paints, adhesives, emulsion polymers, inks, formulated products etc. Most of the chemicals go from one producing industry to another consuming industry. They don't go to consumers directly except products like diesel, petrol, LPG, fertilisers and some performance products like paints, adhesives etc. Most other products like shoes, televisions, tyres, automobiles, clothing etc., have a brand value. The customer is willing to pay some premium in price for the brand, because it gives him confidence about quality. In case of chemicals, producer must meet the specifications of consumer and compete on price. Till 1990 industry was controlled by licensing regime and protected by high customs duties. Today we cannot even imagine that we were paying customs duties like 120%, 150% depending on the product. The plant capacities were small as determined by the license. With the result industry was inefficient and uncompetitive.



As a result of deregulation and liberalization of trade policies in 1991, chemical industry was the most affected. As I said earlier since chemical industry does not have a brand value and customer loyalty, import of chemicals increased and low capacity, inefficient chemical plants were threatened. Many companies took exit from chemical business. Examples are Polychem, NOCIL, PIL, Synthetics and Chemicals, etc.

Then large capacity plants were built. Overseas companies started investing in India. Large refineries, crackers, petrochemical complexes came up. The chemical industry became globally competitive and registered high growth rate year on year. In last ten years capacity of major petrochemicals has increased from 20.9 MMTPA in 2010 to 48.9 MMTPA in 2020. Similarly capacity of major chemicals has increased from 10.3MMTPA in 2010 to 15.2MMTPA in 2020. Investment in chemical sector has steadily grown at a CAGR of 10.6% in last ten years. Easy availability of petrochemicals and bulk chemicals supported in growth of downstream products, speciality chemicals and performance chemicals. The domestic consumption has steadily increased and export of chemicals has grown simultaneously.

Today India ranks 6th in the world and 4th in Asia for chemicals sales, 2nd largest manufacturer and exporter of dyes, 3rd largest consumer of polymers globally and 4th largest producer of agrochemicals globally. Chemical industry employs 2 million people and contributes 1.3% to national GVA, 9% to manufacturing GVA and 13% in India's exports.

The contribution of different verticals to total Indian market is,

Bulk Chemicals- 25%

Petrochemicals- 20%

Fertilizers and agrochemicals- 15%

Speciality chemicals- 20%

Biotech, Pharma API, and other performance chemicals- 20%

In Financial year 2019-20, Indian chemicals industry market, (excluding refining products) is like this;

Production- 175billion USD

Demand- 187 billion USD

Exports- 39 billion USD

Imports- 51 billion USD

The projection is that the demand of chemicals should be 254 billion in the pessimistic scenario and 286 billion USD in optimistic scenario by the year FY 25. Growing domestic demand and exports, calls for, additional capacities to be built in India practically in all verticals. Currently India contributes only 3% of the global chemicals sales and per capita consumption is among the lowest. This clearly indicates the potential for growth of chemical industry in India.



Let us take verticals one by one.

Refining Industry - The installed capacity is adequate to meet India's demand. The industry meets global quality standards. They produce diesel and petrol as per Bharat VI standards which are comparable to European standards. The technologies are licensed by global companies and plants are designed by large engineering companies who design similar plants in other countries. So technically we do not have any major gap. Because of large volumes to be handled, logistics is a major contributor to product cost. Transportation of feed stock and finished products both are to be considered. Therefore location of a refinery is a critical factor, determining its economic performance. With the expectation of electric vehicles increasing, we may not see growth in automobiles fuels demand at the same rate in future, however, the demand of feedstock for petrochemicals and bulk chemicals will continue to grow and support the economic viability of refining industry.

Petrochemicals – A large number of chemicals are included in this group. Petrochemicals have to compete globally. Initially Indian plants were handicapped with small capacities. However, plants built in last 20 years are of capacities comparable to plants in other countries. The most important factor is availability of feedstock, which can come either from refining industry or from natural gas. The trend now is to integrate petrochemical plants with refineries, which not only ensures availability of feedstock but also improves economic performance. If promoters of petroleum and petrochemical plants are separate entities, there has to be long term supply and pricing agreement. Standalone petrochemical plants cannot sustain. With growing demand, there is a deficit in supply of many products. However, whenever a large capacity plant of any product is set up, there is excess supply for some time. Currently petrochemical plants with total capacity of about 7MMTPA are under implementation with an investment of 15 billion USD. Technologies for all petrochemicals are well established, and therefore plants built in India are globally competitive. However cost of logistics, that is cost of transport of feedstock and transport of products to market place can affect the economic performance of petrochemical plants, therefore location of plant is very important.

Bulk Chemicals - There is a major supply deficit in case of bulk chemicals. The refining industry or petrochemical industry is not enthusiastic about setting up bulk chemical plants. Chemical companies setting up bulk chemical plants face the challenges of consistent supply of raw materials, its price, storage, transport cost etc. Performance of bulk chemical plants also depends on logistics cost. Technologies for several bulk chemicals are not available easily. Some global companies want to retain their monopolies in global market. Several barriers have been created for growth of bulk chemical industry in India, like technology agreement, blocking capacity expansion in license agreement, blocking exports, catalyst supply agreements, insist on import of expensive machines etc. Currently we have huge supply deficit of products like Acetic acid, VAM, methanol, styrene, EDC, MEG, LAB, IPA etc. To give an idea about their deficit in the country, let me give you some numbers;

1. Acetic acid- 1.6 million tons
2. LAB- 260,000 MT
3. IPA- 150,000 MT
4. Polyamides- 225,000 mt
5. Maleic Anhydride & Phthalic Anhydride- 180,000 MT



6. Bisphenol- 60,000MT
7. Aniline- 70,000MT
8. Acrylic acid- 50,000MT
9. Methyl methacrylate & PMMA 90,000MT
10. Methyl amines 70,000MT

These are large quantities and justify setting up large capacity plants. However, getting right technology and commitment on feedstock is a key.

Fertilizers- Fertilizer industry is still controlled by Government. Feedstock (natural gas) is not available (for urea). Nobody would like to set up a plant based on imported LNG due to uncertainty on supply and pricing. There is scope to set up new fertilizer plants subject to availability of feedstock and Government policy.

Speciality Chemicals- Speciality chemicals production in India has steadily grown. As mentioned earlier most of the speciality chemicals are produced in batch process operations. Plant capacities are small. Most plants were set up as small scale industry. These plants involve manual operations. Due to low labour cost in India, these plants are economically viable. Due to higher manpower cost, European and American companies started outsourcing these products.

However, large capacity plants for speciality chemicals were set up in China and that threatened the survival of plants in India. The technology for speciality chemicals is not traded freely in the world market. In most cases companies develop their own technologies with in-house team, sometimes with outside support. The plants are designed by engineering companies based on such developed technologies. These speciality chemicals plants in India have big scope for improvement. Due to low productivity, the product cost goes up reducing competitiveness of the industry. On one side there is huge opportunity for this sector to grow and take market share in the global market, but on the other side, it has a challenge to make their operations efficient and competitive.

The suggested steps for the industry are:

- (i) Technology upgrade- Every plant small or big must have a technology upgrade programme. There must be a dedicated team which is studying developments in R&D, developments in global industries and preparing plan and executing the same to keep pace with changing technology.
- (ii) Quality systems- All industries must have quality systems in place. Quality assurance team must be set up independent of quality control and production.
- (iii) Internal Audit- All industries must have internal audit system in place. The Scope of internal audit should cover financial, commercial and technical activities.
- (iv) Quality by design- Plant must be designed and machines/equipment must be selected to deliver desired product quality.
- (v) Scale of operations- Small capacity plant has a limitation. It is difficult to be competitive. Scale of operation must be increased which can justify investment in good machines, in quality systems and employ competent persons, which can improve quality and productivity. Higher capacity makes recovery of by-products viable, thereby reducing cost of product. It also gives good negotiating position for prices of raw materials and other inputs



If speciality chemicals industry in India takes these steps, global customers will develop confidence in them and they can supply products all over the world.

Performance chemicals- Most of the things mentioned in the case of speciality chemicals are applicable to performance chemicals also. Unlike other chemicals there is a customer loyalty and some brand value in case of performance chemicals. They are known not for their specifications but for their performance. First and foremost, manufacturer of performance chemicals must have an application development facility where performance can be tested and demonstrated. Customer acceptance takes time, but once accepted customer will stay for long time.

Performance chemical industry needs continuous product development and application development programme to meet changing customer requirements. Like packaging adhesives need to be modified to suit the packaging machine used by customer. People have to be trained for proper application to get good results. (Examples of wood polish, construction chemicals).

Pharmaceutical Industry

Now, let me talk a little about pharmaceutical industry. It has two segments API and dosage form (formulations like tablets, capsules, injectables, ointments etc.). API industry is like a speciality chemicals industry and all those things mentioned for speciality chemicals industry are applicable to API industry also. Dosage form industry is a very specialized area and needs different approach.

In pharmaceutical industry both API and dosage forms, QA and regulatory compliance are two important requirements. Every country has a drug regulatory authority giving approvals for manufacturing and selling of products. While exporting products from India, approval is required from the regulatory authority of every country where the product is to be sold. This is a very tough thing. It involves lot of cost and time.

Innovator of product is granted a patent which gives him monopoly for a certain period. Most global pharma companies spend lot of money on R&D to develop new products, take patents and do profitable business. After the product is out of patent, it becomes generic and several producers all over the world get into manufacturing that product and take a share in the market. Needless to say that when the product goes out of patent, there is a huge erosion in its price.

When there is price erosion global pharma companies are not able to manufacture at lower cost and therefore they are looking for contract manufacturer who can supply them the product at a lower cost. They start outsourcing. Besides several marketing companies all over the world are looking for low cost suppliers.

Globally the contract manufacturing activity is increasing and India has a good share in that segment. Several companies in India are developing and manufacturing generic medicines and exporting all over the world besides meeting domestic requirement.



The changing paradigm in global pharma industry is clearly visible. Increasing cost burden has forced everybody including Government, industries, medical professionals, banks, insurance companies and consumers to radically change the management of healthcare. The expenditure on R&D is increasing but the number of new products coming out is not, which means that the cost of developing a new product is continuously increasing. The global pharma companies are struggling to maintain their positions by acquisition, outsourcing and cutting costs.

What does this mean for India? As the products go off patent, and prices are affordable, the demand for these products in India would increase. This will create an opportunity to manufacture new generic products for Indian demand. Besides, there is an opportunity to export generic products to regulated markets. The development activities has picked up in last two decades in India.

The good news is that global outsourcing market has grown at a CAGR of more than 10% in last decade. Contract research and contract manufacturing both have grown. The outsourcing from India has grown 4times faster than the global outsourcing market. The point to note is that outsourcing market is growing and in that market the share of India is rising. Two things together mean that the manufacturing of pharma products in India is growing at a much higher rate.

The reason is obvious. The capital cost for setting up a pharma plant in India is much lower than that in USA or Europe. Even if we presume, the raw material cost remaining same all over the world, we still have an advantage of lower operating cost and fixed cost, which makes end product cost 30 to 40% lower. Availability of highly qualified talent in the region can bring substantial savings in the R&D costs.

In several countries, healthcare care cost is borne by Government. Due to budgeting constraints Governments are keen to reduce the costs. They are able to achieve this by sourcing pharma products from low cost countries.

Indian pharma industry has very well utilized the opportunity. Export of pharma products has consistently increased in last 20 years. Last year pharma industry has exported products worth 25billion USD which is more than half of total chemical exports from India. India is globally recognized for generic medicines. If any country in the world wants to import medicines, product from India is their first choice. India is called pharmacy of the world. India has highest number of US FDA approved plants outside USA.

There is a huge potential for growth of Indian pharmaceutical industry and industry must use it. Contract research itself is a big business opportunity for chemical and pharmaceutical industry. The talent available in India is comparable to any other place in the world and it is available at a lower cost which can make the activity competitive.

To summarize I would say that, growth of chemical industry in India is imminent. For petrochemicals and bulk chemicals, some policy support is necessary to ensure consistent supply of feedstock. For speciality chemicals, performance chemicals and pharmaceuticals, industry must increase scale of operation. There are about 80000 chemicals in commercial production. May be 5% of them are produced in continuous process plants. Remaining 95% are produced in batch process plants. Transition from batch operation to continuous operation is a technical challenge. Chemical engineers and technologists have a major role in it. Design and engineering capabilities in India have also grown in last 30years. All global engineering companies are operating in India. Several chemical plants, coming up in different countries, are designed in India. Utilizing all that strength available in India, scale of



operation in speciality chemicals segment must be increased that can make India a dominant player in the global market.

Government of India has announced a production linked incentive (PLI) scheme, which will also support the growth of industry in coming years. The discussions and commitments made in COP26 recently, will also trigger a major change in chemical industry. To achieve net-zero emissions, industry will have to adopt new technologies in the coming years. I just wanted to make brief mention about these points without elaboration.

***The author Shyam Bang is Retired Executive Director, Jubilant Life Sciences Ltd.**



REGIONAL CENTRE ACTIVITIES

Amaravati Regional Centre

A two-day **International Webinar on Global Warming and Climate Change** was organized on **12 and 13 November 2021** in association with all the Student Chapters under the Amravati Regional Centre. The Webinar was inaugurated by **Dr. K. Krishnaiah**, Professor in Chemical Engineering and former Dean, Academic Affairs, Indian Institute of Technology, Tirupati. **Dr Krishna Achuta Rao**, Professor & Head, Centre for Atmospheric Sciences, IIT Delhi graced the occasion as the Guest of Honour. **Dr. V. Govardhana Rao**, former professor, IIT Bombay and Chairman of the Amravati RC presided over the inaugural function and conducted the proceedings.

The following eminent speakers delivered lectures during the two-day meet:

12 November 2021:

Dr Krishna Achuta Rao, whose lecture was titled, 'Salient findings of the IPCC's 6th assessment report on climate change'.

Dr. A. Gangagni Rao, Chief Scientist, CSIR- Indian Institute of Chemical Technology, Hyderabad, whose lecture was titled, 'Bioconversion as potential route for the treatment of organic waste for climate change mitigation: Assessment of technologies translated from lab to land'.

Dr. Chirag Dhara, Climate Physicist, Krea University, Sri City, Andhra Pradesh, presented his lecture on 'If Electric vehicle is the answer, what is the question?'

Dr. Nagasree Garlapati, Department of Chemical and Biomedical Engineering, West Virginia University, USA, title of whose lecture was 'Numerical modeling of fluid & heat transport in geological reservoirs'.

13 November 2021:

Mr. Marlan Pillay, Expert in Global Warming & Climate Change, Bonn, Germany, presented his lecture on 'Reporting by developing country parties to the Convention & Paris agreement'.

Dr. N. S. Srinivas, Consultant – UNDP & Certified Energy Manager, Consultant – UNDP & Certified Energy Manager, New Delhi, whose lecture title was 'Importance of green technologies for energy production & usage'.

Dr. Balararam Vysetti, Former Emeritus Scientist National Geophysical Research Institute (NGRI) Hyderabad. He delivered his lecture titled 'Global warming & Climate change – What lies ahead?'

Dr. Gangadhar Andaluri, Department of Civil and Environmental Engineering, Temple University, USA, making his presentation, titled, 'Mitigating climate change – Waste to energy'.

In the valedictory function, **Prof. (Dr.) V.V.Basava Rao**, Principal, OU College of Technology, Hyderabad and Immediate Past President, IIChE was the Chief Guest and Dr. Gangadhar Andaluri, was the Guest of Honour. **Dr. N. Sambasiva Rao**, Vice Chairman, Amravati RC presided over the function. At the end of the valedictory function **Prof (Dr.) M. Venkateswara Rao**, Honorary Regional Secretary, Amravati RC summed up the webinar proceedings and proposed the vote of thanks.

Coming Event: As part of the Platinum Jubilee celebration of IIChE, on **22 May 2022**, a **Webinar**, titled, '**Growth, Challenges and Opportunities for Indian Pharma Industry**' will be held online in association with the IIChE Student Chapters under the aegis of the Amravati RC.



Chennai Regional Centre

The first **Endowment Lecture in the memory of Late Shri C.P. Saranathan** was delivered by **Mr. S Ilanahai**, Managing Director, Cetex Petrochemicals and President, Chemical Industries Association on **23 March 2022**. Earlier, the welcome address was made by **Prof. (Dr.) R Parthiban**, Chairman, Chennai RC and Professor of Chemical Engineering, SSNCE. The Felicitation address was made by **Mr. R Kalidas**, Vice Chairman, Trust Chemical Industries, Egypt, (Chemplast Sanmar Group). The citation was read out by **Mr. R Narasimman**, Director, Protech Consultants Pvt. Ltd., Chennai. This was followed by the introduction of the Chief Guest, **Mr. S Srikanth**, son of the Late Shri C P Saranathan. The Vote of Thanks was given by **Dr. N. Balasubramanian**, Director, Centre for Technology Development & Transfer, Anna University, Chennai.

The **Late Dr. B. Jagannadhaswamy Memorial Lecture** was delivered on **10 May 2022** by **Mr. Sunil Kumar Singh**, Plant Manager, Liquid Environmental Solutions, Texas, USA, delivered the online lecture. The topic was '**Liquid Environmental Solutions in the Current Global Scenario**'.

Mr. N. Sankar, Chairman Sanmar Group, was felicitated on the occasion. **Dr. B. S. Lakshmi**, Director, Centre for Biotechnology, Anna University and daughter of the Late Prof. B S Jagannathaswamy, addressed the gathering. **Prof. (Dr.) R Parthiban** gave the welcome address. **Mr. Sunil Kumar Singh** was the Chief Guest for the programme.

Concluding remarks were made by **Dr. R. Baskaran**, HOD, Chemical Engineering, St. Joseph's College of Engineering. Vote of Thanks was given by **Dr. N.P. Kavitha**, Treasurer, IICHE, Chennai RC and Assistant Professor, SVCE.

Jaipur Regional Centre

To celebrate the platinum Jubilee year of IIChE, Jaipur Regional Centre organised an **Invited talk**, titled, '**Engineering Nano-based Fertilizers: A Life-cycle Approach**' on **26 March 2022**. **Prof. Achintya Bezbaruah**, Gehrts Presidential Professor of Environmental Engineering, North Dakota State University (NDSU) and the Director of NDSU NAE Grand Challenges Scholars Program, delivered the lecture.

A second programme of **Invited Talk** was organised in hybrid mode on **9 April 2022** as a part of the Platinum Jubilee celebration. **Prof. Ajay K. Dalai**, Distinguished Professor of Chemical Engineering, College of Engineering, University of Saskatchewan, Canada delivered the lecture.



Kochi Regional Centre

An **Online Certificate Course in Chemical Plant Operations** was held during **28 November – 3 December 2021** for the students of Government Polytechnic College, Kozhikode. Accomplished and experienced industry personnel were the resource persons, who covered various topics of relevance in Chemical Plant operations. **Mr. Anujan.S**, DGM (Rtd.), BPCL-Kochi Refinery led the team of resource persons as Head Faculty. **Dr. Babu Jose**, Chairman, Kochi RC, **Mr. Suresh Kumar. J.S**, Principal, Government Polytechnic College, Kozhikode; **Mr. Mohan.N.**, Hony. Secretary, Kochi RC and **Mr. Chanramohan.T**, Jt. Secretary, Kochi RC were present during the inaugural program.



The titles for the topics covered were: i. Fluid Transfer Equipment, ii. Refinery Operations, iii. Heat Transfer Equipment, iv. Chemical Process Equipment, v. Mass Transfer Equipment, vi. Hydro Treating, vii. Process Control Equipment, viii. Industrial Pollution and Its Remedies, ix. Utilities, and, x. Industrial Safety.

The Valedictory programme was conducted in dual mode in the presence of Mr. Sajan. M, Vice Chairman, Kochi RC; Prof. Manoj.N, GEC, Kozhikode and Executive Committee member; Ms. Jayarani, Head of the Department of Chemical Engineering and Mr..Aneesh, faculty, Govt. Polytechnic College, Kozhikode, besides the Chairman, Hony. Secretary and Jt. Secretary of the Kochi RC.

Certificates were distributed at the end of the programme.

Dr. Babu Jose, Chairman, Kochi RC presented an online **Talk** on ‘**Disaster Management**’ on **23 November 2021** to the Chemical Engineering students of **Toc H Institute of Science and Technology, Arakunnam** as a part of the Orientation Program.

The first **Distinguished Lecture Program (DLP)** was organised in association with **FACT Technical Society** on **17 December 2021**.

The topic of the DLP was ‘**An Introduction to Block Chain Technology & Crypto-currency**’. The distinguished speaker was **Mr. Dileep. R**, General Manger (Maintenance), FACT. The participants interacted with the speaker in detail. Dr. Babu Jose and Mr. Mohan. N, the respective Chairman and Hony. Secretary of the Kochi RC, spoke on the occasion.

A **Talk** was organised on **27 December 2021** where **Dr. Jayachandran K**, Corporate General Manager (Corporate Planning) FACT made a presentation to the students and faculty members of Chemical Engineering, **Government Engineering College, Trichur** on the topic ‘**Engineering & Industry**’ as a part of the Industry –Institution Interaction program .



Northern Regional Centre

Under the '**Learning with Leaders Online**' series, the following **Lectures** were organised by the Northern RC.

18 December 2021: A Lecture titled, '**Sustainability of Chemical Industry through Carbon Rainbow Concept of Green to Purple; Opportunities and Challenges**' was delivered by **Prof. (Dr.) R.K. Khandal**, President, R&D and Business Development, India Glycols Ltd.

19 February 2022: A Lecture titled, '**Nanotechnology for sustainable and precision agriculture: current state and future perspective**' was delivered by **Dr. Ramesh Raliya**, General Manager & Head - Research & Development, Indian Farmers Fertiliser Cooperative Limited (IFFCO).

19 March 2022: A Lecture titled, '**Membrane Bio-Reactors Technology**' was delivered by **Mr. Ajay Popat**, President, Ion Exchange (India) Ltd.

The **Foundation Day** of the Northern RC was observed with a **Lecture** was organised on **15 January 2022**. The title of the lecture was '**Building a net zero future: the outlook of energy and emissions in India**'. It was delivered by **Mr. Siddharth Singh**, Lead India Analyst and Coordinator (Consultant), International Energy Agency (IEA).

On the occasion, the **IIChE (NRC) Golden Jubilee Scholarship 2021-22** was awarded.

A **Workshop and R&D Conclave** was organised on **4 March 2022** in association with **Lovraj Kumar Memorial Trust (LKMT)** on '**Energy Storage (Battery & Hydrogen)**'. **Federation of Indian Petroleum Industry (FIPI)** was also a collaborator for the conclave.

Coming Event:

A **Seminar** will be organised on **24 and 25 June 2022**, titled, '**Production and Use of Green Hydrogen and Green Ammonia in Process Industry**'. The seminar will be divided into the following sessions:

i. **Production Technologies for Green Hydrogen/Green Ammonia**, ii. **Storage and Transportation of Hydrogen**, iii. **Safety in Hydrogen Value Chain**, iv. **Techno-Economic Considerations in Use of Green Hydrogen/Ammonia**, and, v. **Recent Policy Initiatives for Promotion of Production and Use of Green Hydrogen: Panel Discussion**.



STUDENT CHAPTER ACTIVITIES

Indian Institute of Science Education and Research, Bhopal

A **National Conference**, titled, ‘**Advances in Chemical Engineering and Science**’ (ACES-2022) was organised in association with **Ujjain Engineering College** on **25 and 26 March 2022** at Bhopal. The event included several keynote lectures, invited lectures, workshops, paper and poster presentations, etc.

RVR & JC Engineering College, Guntur

ChECK – 2022, (Chemical Engineering Contest for Knockout-2022), was organized in association with the Amaravati Regional Centre of IChE on **14 and 15 March 2022**. The event comprised Plenary Lectures, Paper Presentations and Elocution. The central theme was ‘**Challenges & Opportunities in Chemical and Allied Engineering & Technology**’.

Prof. (Dr.) K. Ravindra, Principal, RVR & JC College of Engineering (A) presided over the inaugural session of ChECK 2022, which was inaugurated by the IChE President, **Mr. D.M. Butala**. On the occasion, Mr. Butala spoke about ‘Challenges in Chemical Engineering’. **Dr. I.N. Bhattacharya**, Former Chief Scientist & Head, Hem Division, CSIR-IIT, Bhubaneswar graced the function as Guest of Honour. Dr. Bhattacharya made his presentation on ‘Solid-Liquid Separation - An Overview’. **Prof. (Dr.) V. Govardhana Rao**, former Professor, IIT Bombay, Mumbai and Chairman, IChE Amaravati RC also spoke on the occasion. **Prof. (Dr.) M. Venkateswara Rao**, Honorary Regional Secretary, IChE Amaravati RC, Professor & Dean, Examinations, RVR & JC College of Engineering (A) and Chairman ‘ChECK 2022’ welcomed the guests and participants.

Lectures were also delivered by **Prof. (Dr.) S. V. Satyanarayana**, Past President, IChE and Professor, Chemical Engineering, JNT University Anantapuramu, on the topic, ‘Applications of Membrane separations in Circular Economy’. **Professor (Dr.) A Sarath Babu**, Department of Chemical Engineering, NIT Warangal, Telangana also presented a lecture, titled, ‘CO₂ Capture, Storage & Utilization - An Overview’.

A total of 245 students participated. Certificates, mementos and cash prizes were given away to selected students for their paper presentation.

The valedictory programme was presided over by **Dr. V. Govardhana Rao**. **Dr. S V Satyanarayana**, Past President, IChE and Professor, JNT University, Anantapuramu was the Chief Guest while **Dr. Avijit Ghosh**, Honorary Secretary, IChE and Asst. Professor, Heritage Institute of Technology, Kolkata was the Guest of Honour.

Government Engineering College, Bharuch

A **Faculty Development Program** was held during **20 to 24 December 2021**, sponsored by AICTE Training and Learning (ATAL) Academy on ‘**Waste Technology**’ via the Microsoft Teams platform.

Faculty members from different engineering colleges and institutes from across India participated in this programme.



A **Lecture** was delivered on **10 March 2022** by **Mr. D. K. Patel** on the Importance of Waste Treatment. He discussed the primary, secondary and tertiary methods of waste water treatment. Mr. Patel also explained about the Environmental impact assessment, Sludge drying using solar energy, Cost saving by waste water treatment. Students were able to understand the significance of effluent treatment and protection of environment in the field of Chemical Engineering.

A **Quiz competition 'Hydrosphere 22'** was held on **22 March 2022** to celebrate the **World Water Day**. A total of 21 students participated, making seven teams and each team comprising three members.

G H Patel College of Engineering & Technology, Anand

The following **Expert Talks** were presented during the period under cover.

13 August 2021: On **Process Design of Heat Exchangers and Distillation Column**. The online talk was presented online by **Dr. S. B. Thakore**, a renowned author in the field of Chemical Engineering, presented the talk.

17 August 2021: On **Student Startups and Innovation Policy**. The talk was presented by **Dr. Dharmendra Mandalia**, Joint CEO, Gujarat Knowledge Society & SSIP, Government of Gujarat.

26 November 2021: On **Career Opportunities after CAT Exam**. The talk was presented by **Mr. Digant Purani**.



8 December 2021: On **Indian Fertilizer Scenario: Scopes and Future Prospect**. The talk was presented by **Mr. Rupesh Sarkar**.

10 December 2021: On **Journey towards More Sustainable Operations**. The talk was presented by **Dr. Hemant Vyas**.

13 December 2021: On **Career Opportunities after GATE Exam**. The talk was presented by **Mrs. Sejal Christian**.



The **National Chemistry Week Celebration** was celebrated with an offline event, **AL-CHEMY'21**, on **18 October 2021**. The event included different activities, such as, Poster Competition, Quiz Contest, Palabras Periodicas, etc.

G.V.P College Of Engineering, Visakhapatnam

Picturesque, A Question-Answer session was held on **5 December 2021**, in which each participating student was asked 20 questions in 15 minutes regarding various equipment and symbols related to Chemical Engineering.

The following **Live Interaction Sessions** were held:

5 December 2021: Mr. S. Subrahmanyeswara Reddy, a successful GATE candidate, spoke to the GATE aspirants regarding preparations for the test.

18 December 2021: Mr.Santosh Kumar Gubbala, an Executive Engineer at ONGC, spoke about Exploration and Production of Oil and Gas.

29 December 2021: Vamsi Reddy spoke on Career Planning for Chemical Engineers.

On **11 December 2021**, an online **Lecture** was delivered on '**Basic Chart Types in MS Excel**' by Dr. C.V. Nageswara Rao, Associate Professor, G V P College of Engineering.

On **22 December 2021**, an international conference, titled, '**Recent Advances in Mathematical Sciences and Applications**' was held. **Dr. P.V. Suresh**, Associate Professor, Dept. of Chemical Engineering, NIT Warangal delivered a lecture on '**4-E Analyses of Chemical Looping Combustion Based Coal Fired Power Plants for Sustainable Thermal Power and Hydrogen Production**'.

National Institute of Technology, Srinagar

16 – 20 August 2021: An online **Workshop** on '**Advances in Chemical and Process Industries**'. Held in five sessions, the topics covered were 'Engineering and Catalysis challenges in CO₂ utilization', 'Challenges Ahead for Chemical Engineers', 'Application of Chemical Engineering for Oil and Gas Recovery Process' and 'Chemical Reaction Engineering – How it came into being'. The Speakers were **Prof. Indra Mani Mishra** (IIT-ISM, Dhanbad), **Prof. Jitendra Sangwal** (IIT, Madras), **Prof. V.C. Srivastava** (IIT, Roorkee), **Prof. Anantharaman (HAG)** (NIT, Trichy) and **Junaid Shah** (Haldor Topsoe).



Saveetha Engineering College, Chennai

The following two **National Seminars** were organised for the students of Chemical Engineering.

26 February 2022: Under the central theme of ‘**Emerging Trends in Chemical Engineering Domain**’, two sessions were held, i.e., **1. ‘Role of Green Solvent in Energy and Environmental Applications’** (Dr. A. Brinda Lakshmi, AC Tech, Anna University, Chennai) and **2. ‘Recent Trends in Chemical Reaction Engineering’** (Dr. S. Venkatesh Babu, JCT College of Engineering and Technology).

11 March, 2022: The central theme was ‘**Solutions to Real Time Chemical Engineering Problem Using ANN and Primavera P6**’.

SSN College of Engineering, Chennai

11, 12 March 2022: An online national Conference, titled, ‘**Sustainable Trends in Energy and Environment Resources**’ (STEER) was organized, which focussed on the recent developments in Chemical Engineering and allied areas in a wide spectrum.

Mr. Ramasubramanian Arunachalam, General Manager, Process Design Department, Technip Energies India Ltd., Chennai inaugurated the conference and delivered the technical talk.

Vishwakarma Government Engineering College, Ahmedabad

15 September 2021: As part of the **National Engineers’ Day celebration**, an online **Talk** was presented on ‘**Important Aspects of Process Safety Management**’ by **Mr. Amit Dave**, Senior Technical Advisor, ISOCYANATES, Sadara.

On the occasion, an online **Poster Presentation Competition** was also organised. A total 120 students across the Gujarat participated in this event and submitted their posters under five major themes.

24 September 2021: An online **Workshop** was held on ‘**Understanding of Process Flow Diagram (PFD) & Process and Instrument Drawing (P&ID) in Chemical Process Plant**’. **Mr. Bhavish Desai**, Deputy Manager-Technology, ATUL Ltd., Valsad conducted the workshop.

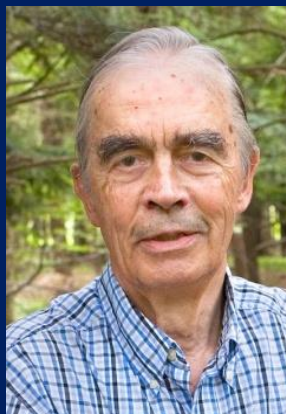
Annamalai University, Annamalai Nagar

INChES 2K22, the 32nd national level inter-university Chemical Engineering students’ seminar was held on **20 and 21 April 2022**.



PROF. PETER HARRIOTT

1927 - 2021



Peter Harriot, an Emeritus Professor of Chemical Engineering at the Cornell University, USA, where he taught for 48 years, passed away on 23 September 2021 in Ithaca at 94 years of age. “He was a founding father of the department and a pioneer who helped to define the attributes of the chemical engineering mindset,” said Susan Daniel, a distinguished faculty member of Chemical and Biomolecular Engineering at the University.

Prof. Harriott graduated from Cornell with a degree in Chemical Engineering in 1949. He attained his doctorate from Massachusetts Institute of Technology in 1952.

Prof. Harriott briefly worked for General Electric in Schenectady, New York before joining the Cornell University as an Assistant Professor in 1952. He was an Associate Professor there during 1954 – ’54 and became a Professor in 1965. In 1975, Prof. Harriott became the Fred Hoffman Rhodes Professor of Chemical Engineering.

Prof. Harriott is best known for the 1956 text book, Unit Operations of Chemical Engineering, which is considered by many as one of the most comprehensive introductory text books on Chemical Engineering. In 2008, he was presented with the Warren K. Lewis Award for Chemical Engineering Education by the American Institute of Chemical Engineers in honour of his deep commitment to his students and to the field of Chemical Engineering.

With inputs from <https://news.cornell.edu> and <https://www.encyclopedia.com/arts/educational-magazines/harriott-peter-1927>



IICHE UPDATES

♦ **MoU with RGIPT:** On 14 April 2022, **IIChE** signed a Memorandum of Understanding (MoU) with **Rajiv Gandhi Institute of Petroleum Technology (RGIPT)**, Jais, Amethi (Uttar Pradesh) for collaborating in the areas of education, research and innovation in Chemical, Petrochemical and Allied Fields.

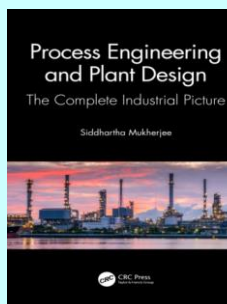
Accordingly, one '**IIChE-RGIPT Scholarship**' will be offered to a Research Scholar for undertaking Ph.D. courses at RGIPT. IIChE will contribute Rs. 5,000/- per month towards the IIChE-RGIPT Scholarship and the balance amount will be provided by RGIPT.

♦ **Honour for Prof. (Dr.) G.D. Yadav:** **Padma Shri Prof. (Dr.) G.D. Yadav**, Emeritus Professor of Eminence, former Vice Chancellor, Institute of Chemical Technology, Mumbai and Past President, IIChE has been elected to the **US National Academy of Engineering (NAE), USA** for his contributions to research, innovation, and teaching in Green Chemistry, Catalysis, Nanotechnology and Chemical Engineering. Prof. Yadav will be formally inducted into the NAE in Washington on 2 and 3 October, 2022. Till date, only 23 Indian nationals have received this prestigious membership in the history of NAE.

Back in India, Prof. (Dr.) Yadav has been selected as a **National Science Chair** by Science and Engineering Research Board (SERB), Government of India.

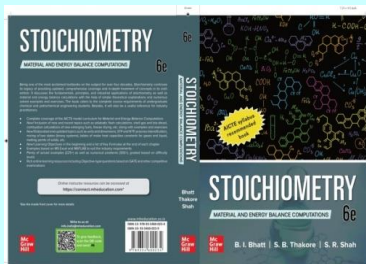
IIChE earnestly wishes that Prof. (Dr.) Yadav earns many more accolades in his scholarly journey ahead.

♦ Book publications:



A 430-page book, titled, ***Process Engineering and Plant Design - The Complete Industrial Picture***, authored by **Dr. Siddhartha Mukherjee**, Fellow, IIChE and Technology Advisor, Air Liquide, New Delhi, has been published by **CRC Press**.

The book covers the whole horizon of process engineering and plant design from the concept phase through the execution to commissioning of the plant in the real practice. Web link: <https://www.routledge.com/Process-Engineering-and-Plant-Design-The-Complete-Industrial-Picture/Mukherjee/p/book/9780367248413>



Dr Satish Shah (Hony. Treasurer, IIChE-Ankleshwar RC), **Mr. B. I. Bhatt** (a senior IIChE member) and **Prof. Suchen Thakore** have authored a book, titled, ***Stoichiometry - Materials and Energy Balance Computations***, Sixth Edition. The book discusses the fundamentals, principles and industrial applications of Stoichiometry as well as presents material and energy balance calculations with the help of simple theoretical explanations and numerous solved examples and exercises.

Publisher: **McGraw Hill Pvt. Ltd.**



◆**Publication of Paper:** A research paper, titled, ‘**Study of Antibacterial Effects on Indian Currency**’, has been jointly authored by **Mr. Aniruddha Hore** and **Mr. Saptarshi Mitra**, both students of Chemical Engineering, Heritage Institute of Technology, Kolkata and Student Member of IIChE; **Mr. Sandip Ghosh**, Asst. Secretary, IIChE and **Dr. Sujoy Bose**, Asst. Manager, IIChE as well as **Dr. Avijit Ghosh**, Assistant Professor, Department of Chemical Engineering, Heritage Institute of Technology, Kolkata and Hony. Secretary, IIChE. The paper has been submitted to the acclaimed research journal, ***Materials Today: Proceedings*** for publication.

The process to hold Council Election 2022 has been initiated. Accordingly, the election notification, the valid list of voters and the Nomination Form have been uploaded on the IIChE website (www.iiche.org.in) under ‘Council Election’ in the main menu bar.

The last date for receiving the Nomination Form is 30 June 2022.



PROFILE: IIChE LIFE ORGANISATIONAL MEMBER

Sant Longowal Institute of Engineering and Technology, Punjab

We are introducing this Section for academic, research or industrial organisations, which join IIChE as Life Organisational Member.

Newly inducted Life Organisational Members may send their brief profile (around 300 words) to IIChE (iichehq@iiche.org.in), which will be published in the E-Newsletter.



Sant Longowal Institute of Engineering and Technology (SLIET), Punjab, established in 1989, is a prestigious centrally-funded Technical Institute (CFTI) under the Ministry of Education (MoE), India. The institute was declared deemed-to-be-university in April, 2007 by the Government of India. The institute has a sprawling campus of 451 acres. The campus presents a spectacle of harmony and natural beauty. It is equipped with all the amenities required for being a complete township.

SLIET is an autonomous body, established with a vision to develop technical competence in academic field. Besides catering to the needs of formal education, SLIET prepares skilled and qualified manpower for self employment. The institute follows the concept of flexible, modular and multi-point entry/exit system and aims to provide technical manpower requirements at all levels of the industries as per the NEP-2020 declaration.

At present institute is offering integrated certificate & diploma (ICD), B.E., M. Tech, MSc. and Ph.D. programmes in various disciplines of Science, Engineering and Technology. It has highly experienced and internationally renowned faculty. Recently, six faculty members were listed in Indian Researchers in Stanford University's top 2% Most Influential Scientists list.

The Department of Chemical Engineering at SLIET comprises an active group of faculty members and research scholars, doing the highest-quality research in a vibrant, multidisciplinary environment, which shapes and defines the future direction of chemical engineering and related areas. There is a creative interface with applied mathematics, physics, chemistry, biology and medicine to solve challenges, faced by industry and society. The alumni of this department are placed in managerial and R&D positions in various leading companies of India and abroad, as faculties in various IITs, NITs, and state-funded colleges. Further, the department has been successful enough in instilling a multi-disciplinary research culture among the students of the department. This has enabled the undergraduates in getting selected for various research internships under the faculties and as post-docs at IITs, NITs, IISERs, TIFR, IMSc, Boston University, UC Berkeley, Imperial College London, University of Canterbury, University of Waterloo, etc.



IIChE COUNCIL 2022

Mr. D. M. Butala
dmbutala27@yahoo.com

Prof. (Dr.) M. K. Jha
jhamkin@yahoo.co.in

Prof. (Dr.) C. Karthikeyan
drcktech@rediffmail.com

Prof. (Dr.) M. Venkateswara Rao
mvrao79@gmail.com

Dr. Avijit Ghosh
avijitghosh.che@gmail.com

Mr. Shashikant Pokale
sspokale@yahoo.co.in

Prof. (Dr.) Bishnupada Mandal
bpmandal@iitg.ac.in

Mr. Praveen Saxena
praveensaxena1951@gmail.com

Dr. Madhu Agarwal
madhunaresh@gmail.com

Prof. (Dr.) Suddhasatwa Basu
drsbasu@gmail.com

Dr. M. P. Jain
mpjain2000@yahoo.com

Prof. (Dr.) Alpana Mahapatra
alpana1mahapatra@gmail.com

Prof. (Dr.) K. S. Rajanandam
ksrajamamd@gmail.com

Prof (Dr.) S. V. Satyanarayana
svsatya7@gmail.com

Mr. Sushanta Kumar Roy
roy.sushantak@gmail.com

Dr. G. S. V. Ratnam
gsvratnam@gmail.com

Prof. (Dr.) Anil Kumar Saroha
aksaroha@chemical.iitd.ac.in

Prof. Narendra M. Surana
nmsurana@yahoo.com

Prof. (Dr.) S. K. Gupta
skjee@yahoo.com

Prof. (Dr.) Asit Kumar Saha
asit_k_saha@yahoo.com

Prof. (Dr.) R. Saravanan
trsaravanan@yahoo.co.in

Prof. (Dr.) G. M. J. Raju
gmjraju@gmail.com

Prof. (Dr.) G. D. Yadav
gdyadav@yahoo.com

Prof. (Dr.) A. S. K. Sinha
asksinha@rgipt.ac.in



Fees for Different Categories of IIChE Membership

Life Fellows
(For all age groups)

Compound Fees
Rs. 10,000/- + GST@18%
(Including Registration Fee Rs. 100/- and Admission Fee Rs. 600/-)

Life Members

Compound Fees
(Including Registration Fee Rs. 100/- and Admission Fee Rs. 400/-)

Age: 26 – 50 years
51 – 60 years
Above 60

Rs. 7,000/- + GST@18%
Rs. 6,000/- + GST@18%
Rs. 5,000/- + GST@18%

Life Associate Members
(For all age groups)

Compound Fees
Rs. 5,000/- + GST@18%
(Including Registration Fee Rs. 100/- and Admission Fee Rs. 400/-)

Student Members

Compound Fees
Rs. 500/- + GST@18%
(Including Admission Fee Rs. 100/-)

Interested candidates have to apply online for Membership. Please visit: www.iiche.org.in