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6th Industrial Green Chemistry World Convention & Ecosystem

16th & 17th October, 2019

Venue: Victor Menezes Convention Center (VMCC), IIT Bombay

Co-organisers

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EVENT PROCEEDINGS & OUTCOME REPORT

CO-ORGANISERS

SUPPORTERS

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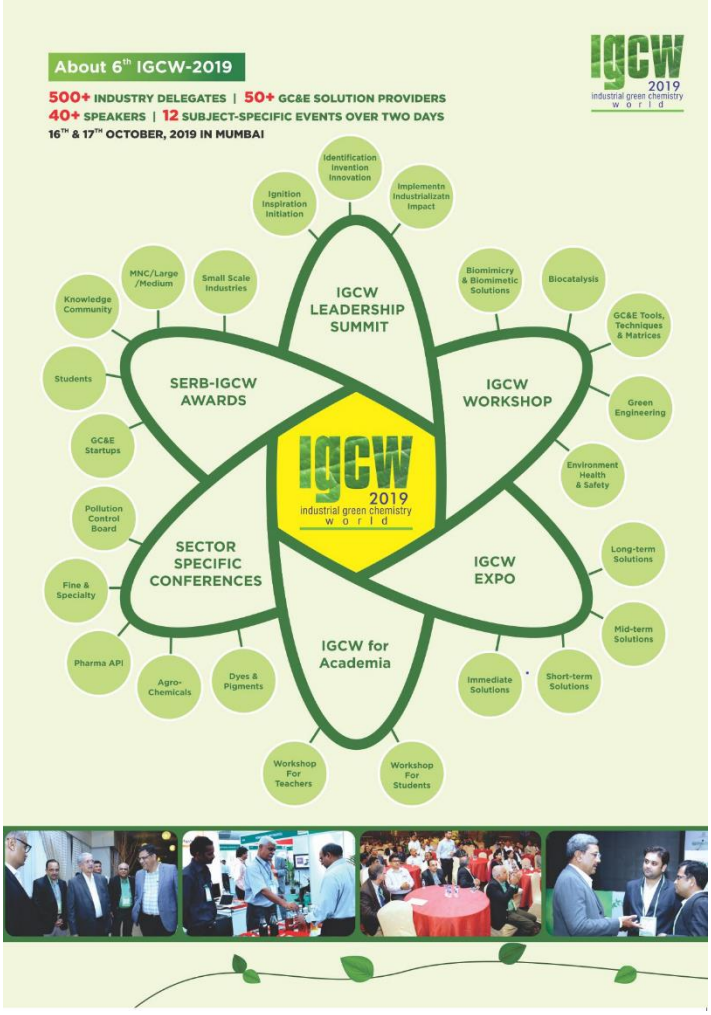
Introduction

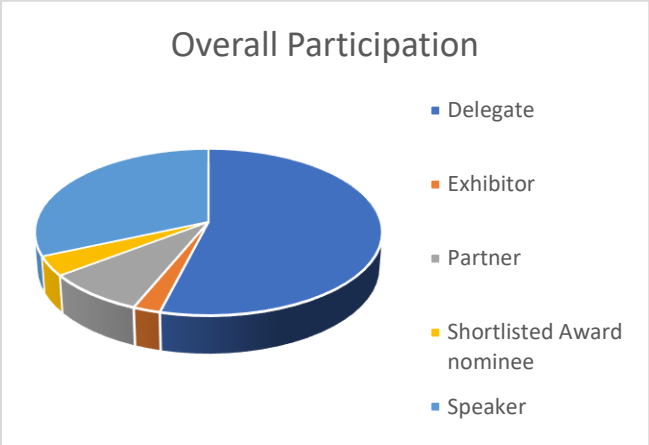
The 6th Industrial Green Chemistry World- Convention and Ecosystem (IGCW-2019) was successfully held from 16th to 18th October 2019 at Victor Menezes Convention Centre, IIT-Bombay, Mumbai. It marked a decade of green chemistry facilitation in India. The key objective of 6th IGCW-2019 was to facilitate the shift from awareness to implementation of Green Chemistry in India. The convention was a two-day convention exclusively for industrial participants, followed by one day workshop for PG & PhD Students , Chemistry Teachers and budding Sustainable Chemistry Entrepreneurs. The scope and scale of the 6th IGCW 2019 was designed taking into account the feedback and suggestions received from past participants, emerging trends and topics, sector-specific events and target audience oriented interventions. The at-a-glance structure of the Convention can be viewed in Annexure 1 of the report.



The sectors tapped on during the convention included:

- Chemical Industry Management & Key stakeholder such as Govt. bodies, Regulatory agencies and Industry Associations.
- Environmental Health and Safety
- Fine and specialty sector
- Agro-chemical sector
- Pharmaceutical sector
- Dyes and Pigments sector

The sector- specific approach was undertaken to understand the barriers that each sector is facing in the implementation of Green Chemistry and then addressing it at the sector level. The convention witnessed more than 80 industrial experts and speakers, more than 350 participants from the chemical industry which included top management, pollution control board authorities, research and development professionals, Environmental Health and Safety professionals. The list of participants is mentioned in Annexure 3 of the report.



The total footfall of the two-day convention was more than 400 including all sectors mentioned above. The convention was a great success as it was graced by Green Chemistry experts, including the fathers of Green Chemistry – Dr. John Warner and Prof. Paul Anastas, to name few. The Convention also facilitated one-of-its-kind IGCW EXPO where-in solution providers across the globe showcased their green chemistry solutions and capabilities to the participants of Indian Chemical Industry. The list of exhibitors is mentioned in Annexure 4 of the report.

The Convention would not have been a great success without the support of our co-organizers, partners and supporters. The convention was co-organized by Department of Chemicals and Petrochemicals, Ministry of Chemicals & Fertilizers, Government of India. The association of the chemical industry played a big role in having industrial participants to participate in the conference by creating importance of the platform for their member industries. The supporters and partners thus played an important role in making the convention a success. The list of partners and supporters is mentioned in Annexure 5 of the report.

The reports thus aim in sharing the convention highlights, overall participation statistics, key takeaways, indicators that highlight green chemistry & engineering awareness and implementation in India, acknowledging our supporters and partners for their priceless contribution.

6th IGCW-2019 Convention: Day I

The convention started with a welcome note by the convener Mr. Nitesh Mehta, Co-found & Director Green ChemisTree Foundation along with Ms. Krishna Padia, Executive Director Green ChemisTree Foundation. The event started with welcoming the Green Chemistry experts and Industrialists on dias. The Conference was inaugurated by Chief-Guest Shri. P. Raghavender Rao (IAS), Secretary – Dept. Chemicals & Petrochemicals, Govt. of India; Shri Sudhir Shrivastava, IAS, Chairman - Maharashtra Pollution Control Board (MPCB), Shri. E. Ravendiran, Member Secretary, MPCB; Dr. P Anabalagan, IAS, CEO- Maharashtra Industrial Development Corporation and Mr. Rene Van Berkel, UNIDO, India Representative. The above dignitaries graced the occasion as the Guess of Honour for the event.

This was followed by keynote address by Prof. Paul Anastas (Director, Centre for Green Chemistry & Green Engineering at Yale, USA) and John Warner (President & CTO, Warner Babcock Institute of Green Chemistry, USA). The keynote was to set up the context for the convention and then the stakeholders were directed to respected seminar halls for the parallel session. The parallel sessions are illustrated in table below.

The parallel sessions held on 16th October, 2019 are discussed below in the report for the readers to get a clear picture of what they aimed at, what was the target audience, speakers and topics addressed.

Day I, 16th Oct.: Event 01 - Leadership Summit on "Sustainability Through Green Chemistry":

The leadership summit was conducted with a mindset to address the senior decision makers from the industry, academia, research institutes, government bodies, MDs, Directors, CXOs, Presidents, VPs. The leadership summit was aimed to address following objectives

- To bring-forth global realities and local realities faced by Chemical Industry in the domain of environment and sustainability,
- To discuss various business, regulatory, supply chain dynamics happening at global level
- To present emerging Green Chemistry initiatives and global trends, successful case studies, tools and techniques, best practices to achieve sustainability through implementation of Green Chemistry and Engineering
- To inspire and empower Indian Chemical Industry to adopt Green Chemistry to fulfill their sustainability goals
- To identify and discuss challenges, gaps, mindset issues and way forward.
- To share expectations from supply chain in India

This event was conducted under the mentorship of Prof. Devang V. Khakhar, Professor and Ex-Director, IIT-B India. The welcome note by Dr. Devang was followed by a talk from Dr. Dietmar Hueglin (Director, Innovation Campus Mumbai & Vice President - Advanced Materials & Systems Research, BASF Chemicals India Pvt. Ltd., India) on *Sustainability in the Chemical Industry*. This talk was then followed by a talk on *sustainable chemistry from lab bench to business* given by Dr. Claudio Cinquemani (Director Science & Innovation, International Sustainable Chemistry Collaborative Center (ISC3), Germany). The participants were then sent for interaction with the Green Chemistry and Engineering solution providers at the IGCW-EXPO. The networking and the lunch break were followed by a talk on *Total economic value in agrochemical industry: Approaches and Challenges* by Dr. K. V. S. Ram Rao (CEO - CSM Division, PI Industries, India). After

this address to the participants, successful case study from Solvay and its take on green and sustainable development was shared by

Ms. Bijal Mathkar (Research & Innovation Director, Solvay Research & Innovation Center, India). The informative case study was followed by another case study elaborating concept of Lifecycle approach to circularity by Dr. Ashok Menon (Global Technology Leader, Life Cycle Assessment, Corporate Sustainability Division, SABIC, India.). The case studies discussed by these two giant companies were to just give the participants a practical exposure of how to overcome the barriers and move towards sustainable growth by implementing Green Chemistry and Engineering tools and techniques.

The case study session was followed by a talk on *Sustainability a global growth driver, Pharmaceutical Supply Chain Initiative (PSCI) contribution & sustainability practices in the pharmaceutical supply chain* which was delivered by Mr. Manjit Singh (Associate Director - Corporate Sustainability, Centrient Pharmaceuticals, India). This was then followed by a talk from Dr. Guy Humphery (Distinguished Scientist, Merck, Sharp & Dohme (MSD), USA) where Dr. Guy Humphery discussed on '*The Importance of Collaboration in Green Chemistry Innovation: An MSD Perspective'.*

The overall outcome of the leadership summit was that it gave a fresh perspective to the decision makers, made them aware of different barriers, addressed the urgency of incorporating Green Chemistry and Engineering tools and techniques if they want to sustain in market for following rules and regulations laid for manufacturing and supply chain across the globe.

Consented presentations by speakers in this event can be referred at http://www.industrialgreenchem.com/archive.php

Day I, 16th Oct.: Event 02 – Conference on Green Chemistry for "Pollution Prevention at source" – for State PCBs and Other Government Bodies:

One of the features introduced to the IGCW Ecosystem in 2013 was the exclusive conference for state Pollution Control Boards. This event has been receiving encouraging response from the senior officials of State PCBs since its launch in IGCW-2015.

The 6th IGCW-2019 hosted the 4rd PCB Conference on "Green Chemistry for Pollution Prevention at Source" for PCB officers & other Government Bodies, on 16th Oct, 2019. The said conference was supported and sponsored by Maharashtra Pollution Control Board (MPCB) and Maharashtra Industrial Development Corporation (MIDC). The IGCW-PCB Conference was attended by around 36 senior officers from state PCBs including Maharashtra and Telangana. The Conference was also attended by 10 senior representatives from the Environment Division of Maharashtra Industrial Development Corporation (MIDC).

The panel of Speakers for the PCB Conference included distinguished leaders and subject-experts from relevant Government bodies, Research Institutes and Industry. The topic discussed during the Conference aptly addressed the concerns and challenges of state PCBs in driving regulations while ensuring sustenance and growth of the chemical manufacturing sector.

The two inaugural speaker provided global perspectives on the subject “Green Chemistry and the Future”.

Prof. Paul Anastas, Director, Centre for Green Chemistry & Green Engineering at Yale USA, and Dr. John Warner, President & CTO, Warner Babcock Institute of Green Chemistry, USA. Further Mr. P. K. Mirashe, asst. Secretary, MPCB shared recent initiatives of MPCB. Further in Key note speech Prof Paul Anastas, introduced concept of Green Chemistry and how it is a tool for Pollution Prevention, its relevance for Regulatory bodies. Next Mr. Rene Van Berkel, UNIDO representative shared the Initiatives of UNIDO including Eco-Industrial Parks, Retrofitting existing parks, Successful case studies of Industrial Symbiosis.

Whereas, Dr. Sukumar Devotta, Formar Director, CSIR-NEERI, shared Background and latest development around persistent organic Pollutants (POPs), Stockholm Conversation & its provisions & obligations. Followed to which Dr. Rakesh Kumar Director CSIR-NEERI, shared the Supreme Court & Government orders on regulatory bodies facilitating Green Technologies.

Mr. Philip Krook, Communication officer, Chemsec, Sweden. Introduced about Market place, access to safer alternatives for Hazardous Chemicals. Dr. Chetan Chavan, Sr. Product Manager-ICSP Products, Thermo Fisher Scientific India Pvt Ltd. shared *Use of analytical tools for monitoring air and water quality*.

Dr. David Constable, Science director ACS-Green Chemistry Institute, USA, shared Green Chemistry Initiative of US Environmental Protection Agency (US EPA) other best practices of regulatory bodies, innovative models of engaging with Industry.

In the panel discussion the panellists discussed about *Role of Regulatory Body from Command and Control to Role of Facilitator and Advisory.*

The outcome of the event was that the participants who were from the regulatory bodies of Indian Chemical Industry were exposed to the role the regulatory bodies can play to catalyse green chemistry and engineering implementation in chemical sector of India.

Consented presentations by speakers in this event can be referred at http://www.industrialgreenchem.com/archive.php

Day I, 16th Oct., Event 03: ACS-GCI Workshop on “Green Chemistry Tools, Techniques and Metrics”

The said Workshop was organized and sponsored by the American Chemical Society - Green Chemistry Institute’s Pharmaceutical Roundtable (GCIPR); and conducted under the mentorship of Dr. Debabrata Maiti (Associate Professor, Chemistry Department, IIT- B).

The objectives behind arranging this workshop were:

- To share about ACS-Green Chemistry Institute Pharmaceutical Roundtable, their commitment & initiatives for Pharmaceutical Industry.
- To introduce Green Chemistry Metric system including PMI (being used by global pharmaceutical companies).
- To introduce Green Chemistry tools like Solvent Selection Guide & Reagent Selection Guide.

- To share successful case studies of Green Chemistry implementation at Merck, Pfizer & Bristol Myers-Squibb.

The event was conducted mostly for participants from a group of; President-R&D, VP - R&D, Head-R&D, GM-R&D, Senior Scientsts, Process Chemists & Engineers

After the welcome note by Dr. Maiti, Dr. Guy Humphery (Distinguished Scientist, Merck. Sharp & Dohme (MSD), USA) delivered a keynote on *Introduction to the ACS Green Chemistry Institute Pharmaceutical Round Table (ACS GCIPR): MSD Perspective*. The keynote was then followed by Dr. Rakeshwar Bandichhor (Head Chemistry-API-PR&D, Dr. Reddy's Laboratories Ltd. And Vice Chair, ACS - India Chapter (South), India) gave a talk on *Practical case studies of implementing Green Chemistry &Engineering Tools & Metrics.* This was then followed by a networking break for the participants to interact with the Green Chemistry and Engineering solution providers.

After the break, the session was continued by Dr. David Constable (Science Director, ACS Green Chemistry Institute, USA) were Dr. David gave a talk on *Measures of Green Chemistry Performance* where in Green Chemistry measurement tools were demonstrated followed by a talk on *Solvents and Reagents- Making more sustainable choices* wherein solvent selection guides and tools were discussed. This was then followed by a networking break. Post networking break the participants were addressed by Dr. Vaidyanathan Rajappa (Group Director – Chemical, Synthetic & Analytical Development , Bristol-Myers Squibb, India) wherein Dr. Rajappa gave a talk on *Applications of Green Chemistry Principles in Chemical Development.*

Then, Dr. Rajesh Kumar (Chair- Pfizer WRD Green Chemistry Team & Associate Research Fellow, Biocatalysis Group, Pfizer Inc., USA) gave a talk on Green Chemistry Tools and Technologies for Chemical Synthesis. This was then followed by the discussion round.

The overall outcome of the event was that the participants now had a hands-on experience of Green Chemistry Tools, Techniques and Metrices for implementation of Green Chemistry and Engineering in their respective workspace.

Consented presentations by speakers in this event can be referred at http://www.industrialgreenchem.com/archive.php

Day I, Event 04 – Workshop on Green Engineering Workshop for Greener Processes:

This workshop was one of the parallel events on 16th October, 2019. The Workshop was conducted for participants belonging to a group of stakeholders belonging to President/VP-Technology, Head/GM-Tech. Transfer, Technical Services Engineers, Process Engineers, etc. The objectives for conducting the workshop were:

- To introduce the basic concept & Principles of Green Engineering.
- To introduce various Green Engineering tools e.g. process intensification, flow reactors, etc.
- To share importance of process safety & Green Engineering as a tool to achieve inherent safety.

- To share successful case studies & introduce new innovative solution providers in the domain of Green Engineering.

The workshop was conducted under the mentorship of Prof. R. D. Gudi (HOD, Dept. of Chemical Engineering, IIT-Bombay). After the welcome address by the mentor, a keynote was delivered by Dr. David Constable (Science Director, ACS Green Chemistry Institute, USA) where the topic of discussion was *Green and sustainable chemistry and engineering- the two are inseparable.* This talk was followed by a session by Dr. Chuck Orella (Director Chemical Engineering R&D, Merck & Co. Inc. USA) which was on *Examples of Intensified Separations for Greener Processes.* This session was followed by a networking break where the participants were introduced to the Green Chemistry and Engineering solution providers participating in IGCW EXPO- 2019.

Post the break the workshop was led by Prof. Anil Kumar (Chair Professor, Continuous Flow Chemistry Lab, Chemistry Department, IIT-B, India) where he discussed on *Continuous Flow Process: A new paradigm in Green Chemistry.* This was then followed by a session led by Mr. Vijay Kriplani (CEO, Pi- Process Intensification Experts, LLP, India) where the topic of discussion was *Flow Chemistry leading to Re-Engineering of Chemical Plant.* The third session after the break was led by Dr. Deepak Palekar (Head Strategy &Technology, STEP Pvt. Ltd., India) wherein the topic of discussion was *New Developments in Process Intensification – Reactors & Chromatographic Separations.*

After a short break, the workshop was continued by presentations from solution providers where they not only discuss about a concept but also discussed its practical implementation. The sessions started by a talk from Prof Ravindra Gudi discussing on *design /retrofit of chemical processes to be done through concept of Sustainability and using Green Engineering as a tool* which was then followed by a talk from Dr. Prashant Waske , Sr. Manager -IMSG (AutoChem), Metler Toledo India Pvt. Ltd. India) where Dr. Waske discussed on *Process optimization and industrial scale-up : Metler Toledo Solutions.* The next session was conducted by Mr. Vineet Shroff (CEO, Standard Engineers, India) which was on *Smashing the shackles of Mass Transfer.*

The workshop was concluded by our Industrial Mentor Dr. Deepak Palekar.

The overall outcome of the workshop was that the participants after the workshop were left with practical examples of implementation of Green Engineering and its advancements globally.

Consented presentations by speakers in this event can be referred at http://www.industrialgreenchem.com/archive.php

Day I, 16th Oct., Event 05- Workshop on Biomimicry – A Natural Green Chemistry Tool:

After the keynote address by Prof. Paul Anastas and Dr. John Warner, the participants were routed to attend their respective workshops. One of the workshops was on Biomimicry, conducted by Mr. Mark Dorfman, Principal Chemist with Biomimicry 3.8, USA; and mentored by Prof. Bapat from Industrial Design Centre, IIT-Bombay. The said workshop was attended by over 30 participants from Industry, Academia and few students. The major objectives of having this as a parallel session were:

- To introduce the basic concept, fundamentals and potential applications of Biomimicry.
- To learn how Nature does chemistry and the possibility of solving our challenges using Nature's principles.
- To get aware of case studies on Green Chemistry solutions through Biomimicry.
- To share the Biomimicry methodology and how it can be used to innovate products & processes.

The workshop was characterized by participation from group of stakeholders belong to group of Presidents/VPs-Innovation, Head-Innovation, Innovation Managers, Process Chemists, Design team, etc.

The session started with a welcome note by Prof. Bapat which was then followed by a talk from Dr. John

Warner (Co-founder and CTO Warner Babcock Institute if Green Chemistry, USA. The talk delivered by him was on *Nature's Molecular Mechanism of the Circular Economy*. The talk majorly comprised of the mechanisms which are change, collaborations, alignments, multi-tasking and diversity. These mechanisms are ways the nature operates. All these were illustrated with great examples of industrial applications and also how these innovations were thought off. With the lecture, Dr. John Warner also explained how to go about having it implemented in the industrial setup. After this tremendous knowledge outburst, the next lecture in the workshop was delivered by Mr. Mark Dorfman (Sr. Principal & Lead Chemist, Biomimicry 3.8, USA). Dr. Mark Dorfman delivered a lecture on *Roles and key features of chemistry in the living natural world*. The lecture gave an insight on how animate world works over how inanimate version works. The lecture had excellent examples of how nature works and what could be the possible approach for biomimetic solutions

The lecture was then followed by a talk from Dr. John Warner which was a continuation of his earlier lecture wherein Dr Warner shared biomimetic success stories. Dr. Warner also shared an insight of facilitators for biomimicry solution approach with regards to methodology, environment at workspace etc. This was then followed by a legendary interview and discussion between Dr. John Warner and Dr. Mark Dorfman.

The lecture was followed by a networking break and then the workshop continued with talk from Mr. R.K. Mohanty (President Pidilite Industries Ltd.). The talk gave an insight of approach of industries to biomimicry application and biomimetic adhesives. The talk was a great compilation of industry related biomimetic innovations.

The last but not the least was the next talk by Dr. Mark Dorfman which was on Biomimicry Methodology. The talk gave a practical insight on biomimicry implementation.

The outcome of this workshop was that it enabled the participants to understand the upcoming field of biomimicry and its importance for Green and Sustainable Development. They were also exposed to some successful Industrial Biomimetic solutions and also helped develop a mindset of how to get it implemented in their Industrial Setup.

6th IGCW-2019 Convention: Day II

The convention started with a welcome note by the convener Mr. Nitesh Mehta, Director Green ChemisTree Foundation along with Ms. Krishna Padia, Director Green ChemisTree Foundation. The event started with welcoming the Green Chemistry experts and Industrialists on dias. This was followed by keynote address by

Dr. Johannes Benkhoff, Sr. Vice President - Group Chemical Research, Clariant Produkte (Deutschland) GmbH, Germany. The keynote was to set up the context of how industries are taking up green chemistry initiatives, what are the global trends, dynamic regulatory policies, expectations from the chemical supply chain. This gave an insight of what drive industries to get the green chemistry initiatives implemented.

After the keynote address the stakeholders were moved on to parallel chemical industry sector specific workshops. The structure of day two is as illustrated in the table below. The main intension behind the sector specific workshops was to facilitate implementation of Green Chemistry in a more focused manner.

The parallel sessions held during the second day of the convention were as follows:

Day II, 17th Oct., Event 06 - Workshop on Biocatalysis for Accelerating Green Chemistry Processes:

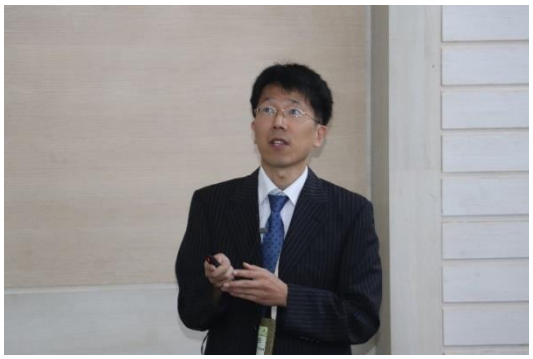
Introduction to Biocatalysis Workshop was given by Dr. Santosh Noronha (Asst. Prof. Department of Chemical Engineering IIT-Bombay, India) who contributed not only as a speaker but also as a mentor to the workshop.

The objectives behind constituting this workshop as a parallel event were:

- To introduce the basic concept, fundamentals and potential applications of Biocatalysis.
- To share readily available & latest innovations on bio-catalysts, bio-catalysis technologies with successful case studies.
- To share bio-catalysis initiatives, best practices and case studies from industry.

- To discuss challenges of scaling-up biocatalysis processes and how to overcome them.

After the introduction, Keynote speaker Prof. John Woodley (Department of Chemical and Biochemical Engineering, Denmark Technical University, Denmark) addressed the stakeholders on methods for evaluation and improvement of biocatalytic processes to enable industrial implementation. This excellent talk covered biocatalysis right from the basics to the economic metrices for biocatalytic processes. The talk also mentioned process engineering parameters.



After the talk was a lecture by Dr. Young Sung Yun (Head Biotech Lab Amicogen Inc., South Korea) where the stakeholders got exposed to engineering of penicillin G acylases for production of β-lactam antibiotics on an industrial scale.

This was the followed by talk delivered by Dr. Santosh Noronha on production of Chiral drug intermediate via

biocatalysis. The talk was then followed by a lunch and networking break where the stakeholders had a chance to interact with the solution providers providing industrial solution in biocatalytic field.

After the networking and lunch break the session continued by talk delivered by Dr. Rajesh Kumar (Chair Pfizer WRD Green Chemistry Team & Associate Research Fellow, Biocatalysis group , Pfizer Inc., USA) where Dr. Rajesh shared on Biocatalysis application to Pfizer's portfolio.

The talk was followed by a talk delivered by Mr. Suresh Kumar K. (Project leader- Biocatalysis, Advanced Enzymes Technologies Ltd., India) who shared a compilation of Industrial case studies and introduced stakeholders to Advanced Enzyme Technologies Ltd. The compilation delivered was comprehensive and had examples from each enzyme class.

Dr. Swapnil Mohile from Novozymes then conducted the next lecture where he gave an insight to application of biocatalysis in industrial setup and shared practical examples on how Novozymes along with Industrial partners have developed innovative solutions. The talk was then followed by a talk delivered by Dr. Alessandra Basso from Purolite Lifesciences UK. In the talk, importance and application of immobilized enzymes in pharmaceutical, chemical and food application was discussed with relevant examples from the industry.

The session was then taken further by Dr. Dinesh Nair from Iosynth Labs, wherein current toolbox of available enzymes and technologies were discussed. This talk was followed by talk from KCat Enzymatic Pvt. Ltd., by Mr. Pravin Kumar, who gave a practical demonstration of computational biocatalysis and talked on scale up framework for Biocatalysis.

The session was then concluded by a panel discussion led and moderated by Mr. Wolfgang (Director Iosynth Technologies) and the panelist were Dr. Guy Humphery (Distinguished Scientist Merck, Sharp & Dohme (MSD), USA), Dr. Mofazzal Husain (Deputy GM & Head Bioprocess Lab (R&D) Lupin Ltd., India) and Dr. R.P. Gaikaiwari (CMD Hi Tech Biosciences Ltd.). The panel discussion gave a clarity and an opportunity to discuss barriers to implementation of biocatalysis and also how to overcome those to accelerate working towards Greener Industrial Processes.

The overall outcome of the workshop was that the participants not only got exposed to basics of biocatalysis but also its advancement as fields. They got aware of how different MNCs are making it a part of their process strategies and how integration of chemistry and biocatalysis can lead to green and sustainable development.

Consented presentations by speakers in this event can be referred at http://www.industrialgreenchem.com/archive.php

Day II, 17th Oct.: Event 07 - Workshop on Green Chemistry for Environment, Health and Safety (EHS):

This workshop was introduced as a parallel event for the first time in IGCW convention after understanding how people from EHS department are potential stakeholders for implementation of Green Chemistry and Engineering in the Industrial setup. The workshop was sponsored and co-organized by MIDC and MPCB. The workshop was conducted under the mentorship of Dr. Sandip Roy (Associate Professor, Dept. of Chemical Engineering, IIT-Bombay, India).

The objectives behind conducting this workshop were:

- To share global environmental realities, changing regulatory landscape & relevance of EHS in today's business scenario.
- To share context, framework, initiatives & best practices in the domain of EHS.
- To share importance of Process Safety & possibility to achieve inherent safety using Green Chemistry.
- To share successful case studies & introduce new innovative solution providers in the domain of EHS.

The workshop was characterized by presence of Vice President-EHS, Head/GM-EHS. EHS Experts, CETPs Members, etc.

The workshop started off with a welcome note by Dr. Sandip Roy which was then followed by a keynote

from Mr. Harish Verma (Vice President & Global Head - EHS, Cipla Ltd., India) where Dr. Verma addressed the topic- *EHS Management System through Best Practices at Cipla Limited.* This talk setup a reference for the participants as to how EHS department can cause and catalyze implementation of Green Chemistry in an Industrial setup. After the keynote address, the next session was conducted by Mr. Sushil Kharakwal where Mr. Kharakwal delivered a talk on *Best EHS practices for sustainable operations in chemical industry.* The session was continued by Mr. Alok Kumar (Managing Director, Narmada Clean Tech, India), where the topic of discussion was *Diverse ideas for sustainability and an overview of CETPs.* This was then followed by a networking break which enabled participants to interact with Green Chemistry and Engineering solution providers participating in IGCW-EXPO 2019.

After the break, the session on *Sustainable Chemistry is Safer Chemistry -Linking Inherent Safety and Green Chemistry for more sustainable chemistry* was taken up by Dr. David Constable. The next workshop session was conducted by Mr. Siddalingesha (Director, Indian Process Safety Centre, India) where *Basis of Safety* was the topic of discussion. After these informative sessions, Mr. Vijaya Sarathy (Manager EHS, West Pharmaceutical Service, India) discussed on *Zero Accident Vision – A pathway to Positive Sfety culture.* The sessions were then followed by a brief break post which Dr. Chuck Orella addressed the participants by delivering a talk on *Improved Containment Journey for Powder Handling in Pharmaceutical Pilot Plant.*

The session was then followed by presentations from three solution providers who not only discussed a concept but also demonstrated through their success, how EHS department plays an important role in achieving green and sustainable development in an Industrial setup. The first presentation was by Prof. Sandip Roy where the topic of discussion was *Process Safet Management: The question of Culture.* This was then followed by a presentation by Mr. Philip Krook (Communications Officer, Chemsec, Sweden) wherein the topic of presentation was *Finding safer alternatives to hazardous chemicals on Chemsec Marketplace.* The next presentation was from Mr. Vikram Dhumal (Chief Technologist, GIEST research Pvt. Ltd., India where the topic of discussion was *Wealth out of waste- A sustainable solution for waste management.* The workshop was the concluded by Dr. Sandip Roy.

The major outcome of the workshop was awareness creation as to how EHS department can play a catalyst role in getting Green Chemistry and Engineering concepts implemented in an industrial setup.

Consented presentations by speakers in this event can be referred at http://www.industrialgreenchem.com/archive.php

Day II, 17th Oct.: Event 08 - Conference on Green Chemistry for Pharma/API Industry Sector:

Conference on Green Chemistry for Pharma/API sector was conducted on the second day of the convention i.e. on 17th October 2019. Before the workshop the stakeholders were introduced to MNCs take on Green Chemistry and its implementation. This address was made by Dr. Johannes Benkhoff (Sr. Vice President-Group Chemical Research, Clariant Produckte (Deutschland) GmbH, Germany). Dr. Benkhoff also Clariant's innovation journey in Green Chemistry.

Following it was the welcome address which was delivered by conference mentor Dr. Rahul Purwar (Associate Professor, Dept. of Biosciences and Biotechnology, IIT -B, India). The conference partner were ACS-GCI and PSCI.

The objectives behind constituting this conference as a parallel event were:

- To share various business, regulatory, supply chain dynamics happening globally in Pharma Industry related to sustainability.
- To share Green Chemistry initiatives, successful case studies, tools, techniques & best practices by large pharma companies.
- To discuss need & relevance of Process Safety in Pharma Industry and share best practices.
- To share recent innovations like Flow Chemistry & its successful implementation in Pharma Industry.
- In Green Chemistry, identify challenges, gaps, mindset issues and discuss learnings from experiences of India & China.

After the introduction, Keynote speaker Dr. Guy Humphery (Distinguished Scientist Merck, Sharp & Dohme (MSD), USA) setup a context by discussing on the topic *Business case for Green and Sustainable Chemistry Development at MSD*.

After the talk was a lecture by Dr. Rajesh Kumar (Chair Pfizer WRD Green Chemistry Team & Associate Research Fellow, Biocatalysis group, Pfizer Inc., USA) where the stakeholders got exposed to *Pfizer's Green Journey: Working for a sustainable future.* This was the followed by talk delivered by Mr. Anil Kumar Jain (CEO-API Business, Sun Pharmaceutical Industries Ltd., India) on *Sustainability & Green Chemistry Initiatives at Sun Pharma - solvent & water savings, fow chemistry, waste reduction, etc*.

After the networking and lunch break the session continued by talk delivered by Dr. Ganesh Sambasivam (Co-founder& CSO, Anthem Biosciences Pvt. Ltd.) where Dr. Sambasivam shared on *Anthem's Approach Towards Greener Chemistry.* The talk was followed by a talk delivered by Dr. Rakeshwar Bandichhor (Head Chemistry-API-PR&D, Dr. Reddy's Laboratories Ltd. And Vice Chair, ACS -India Chapter (South), India) on *Chemistry Connect between flow and green: An industrial perspective*.

Dr. Chuck Orella then conducted the next lecture on *Process Safety journey- Learn from the past and improve the future*. The session was then taken further by Mr. Harish Verma (Vice President & Global Head - EHS, Cipla Ltd., India), by discussing on the topic- *Role of EHS in scaling-up API Manufacturing from Lab to plant*.

The session was then concluded by a panel discussion led and moderated by Dr. Dhileep Krishnamurty (CSO, Zhejiang Nhu Company Ltd., China) and the panelist were Mr. Paul Guo (President, Astatech-Chengdu, China), Mr. Steve Feng (Chairman, Zhejiang Nhu Company Ltd., China), Dr. Sudhir Nambiar (President – R&T, Hikal Ltd., India). The panel was on *Green Chemistry Implementation in Industry-luxury or necessity? Building from experiences from India and China.*

The overall outcome of the workshop was that the participants not only got green and sustainability approach followed by MNCs but also got to know the view point of the industry experts on why Green Chemistry and Engineering implementation is a necessity and not a luxury.

Day II, 17th Oct.: Event 09 - Conference on Green Chemistry for Agro-Chemicals Industry.

This conference was held as a parallel event along with other events in IGCW convention 2019 under the mentorship of Dr. Yogendra Shastri (Assistant Professor, Dept. of Chemical Engineering, IIT-Bombay, India). The conference partner was Pesticides Manufacturers &Formulators Association of India.

The objectives behind conducting this conference were:

- To share various business, regulatory, supply chain dynamics happening globally in Agro Chemicals Industry related to sustainability.
- To share Green Chemistry initiatives, successful case studies, tools, techniques & best practices by large Agro companies.
- To share recent innovations like Flow Chemistry & its successful implementation in Agro Chemicals Industry.
- To introduce new innovative green chemistry & engineering/environmental solution providers.
- To identify challenges, gaps & mindset issues in implementing Green Chemistry and way forward for Agro Industry.

The conference was characterized by presence of CEO, Directors, President, VP, GM, Senior Representatives from Agro Chemicals Industry.

The conference started off with a welcome note by Dr. Yogendra Shastri which was then followed by a talk from Dr. K. Nagarajan (Corporate Advisor, Hikal Ltd., India) where Dr. K. Nagarajan addressed the topic- *Crop Protection Chemicals - Green Chemistry and Beyond.* This talk setup a reference for the participants. After the keynote address, the next session was conducted by Dr. Sudhir Nambiar (President - Research & Technology, Hikal Ltd., India), where Dr. Sudhir Nambiar delivered a talk on *The Kaleidoscopic Green shades of Crop Chemistry*. The session was continued by Dr. Bhanu Manjunath (Director - Research & Technology Centre, Syngenta Biosciences Pvt. Ltd., India), where the topic of discussion was *Sustainability trends in Agrochemical Chemical Research and Development.* This was then followed by a networking break which enabled participants to interact with Green Chemistry and Engineering solution providers participating in IGCW-EXPO 2019.

After the break, the session on *India Environmental Regulations- from compliance to excellence* was taken up by Mr. Mahesh Chandak (Head of HSE – South Asia & HSE Business Partner for Crop Science Division-APAC, Bayer Cropscience, India). Next session was conducted Dr. Mritunjan Chaubey (Global Vice President - Environment & Sustainability, UPL Ltd., India) where a *case study on ensuring environmental sustainability in Agro Chemical Industries* was taken up. After these informative sessions, Mr. Vijay Kirpalani (CEO, Pi- Process Intensification Experts LLP, India) discussed on *Flow Chemistry in Agro Chemicals Industry.*

The sessions were then followed by a brief break post which Dr. Yogendra Shastri addressed the participants by delivering a talk on *Renewable bio-hydrogen production using tar-free microalgae gasification.*

The session was then followed by presentations from solution provider. The presentation was by Mr. Hiren Panchal (Director, S.B. Panchal & Company, India) where the topic of the presentation was *Review on Technologies for reducing environmental impact of Agochemicals Production.*

The major outcome of the conference was that it addressed the issue faced by agro-chemical sector and also gave the participants of how green chemistry is being implemented by Agrochemical sector giants.

Consented presentations by speakers in this event can be referred at http://www.industrialgreenchem.com/archive.php

Day II, 17th Oct.: Event 10 - Conference on Green Chemistry for Speciality and Fine Chemicals

This conference was held as a parallel event along with other events in IGCW convention 2019 under the mentorship of Dr. Rahul Nabar (Dept. of Chemical Engineering, IIT-Bombay). The conference was co-organized by Indian Specialty Chemicals Manufactures Association (ISMA).

The objectives of conducting this conference were:

- To share various business, regulatory, supply chain dynamics happening globally in Speciality & Fine Chemicals Industry related to sustainability.
- To share Green Chemistry initiatives, successful case studies, tools, techniques & best practices by large Speciality & Fine Chemicals companies.
- To share recent innovations like Flow Chemistry & its successful implementation in Speciality & Fine Chemicals Industry.
- To introduce new innovative green chemistry & engineering/environmental solution providers.
- To identify challenges, gaps & mindset issues in implementing Green Chemistry and way forward for Speciality & Fine Chemicals Industry.

The conference was characterized by presence of CEO, Directors, President, VP, GM, Senior Representatives from Speciality & Fine Chemicals Industry. The conference started off with a welcome note by Dr. Rahul Nabar.

The workshop was inaugurated with a Keynote talk by Dr. Achala Danait (Vice President, Regional Innovation Centre, Clariant Chemicals (India) Ltd.,), where Dr.

Achala Danait addressed the topic- *Innovating for a Sustainable Future.* After the keynote address, the next session was conducted by Dr. Steve Thomas Pannakal (Principal Scientist & Head (Bio-technology), Center of Excellence for Natural Extracts - Asia, Research & Innovation, L'Oreal India Pvt. Ltd., India)), where Dr. Pannakal delivered a talk on *Green Sustainable processes to generate Bio-based Ingredients*.

The session was continued by Dr. Dhananjay Deulgaonkar (EHS Manager Innovation Campus Mumbai and Sub Regional Environment Safety Manager- South Asia, BASF India Ltd., India) where the topic of discussion was *Sustainability and Responsible care excellence at BASF.* This was then followed by a networking break which enabled participants to interact with Green Chemistry and Engineering solution providers participating in IGCW-EXPO 2019.

After the break, the session on *Green Chemistry initiatives in Process developments at Excel Industries Ltd.* was delivered by Dr. Laxmikant Patil (Chief Manager - R&D, Excel Industries Ltd., India) and Dr. Krishnendu Sil, (Chief Manager - QA, Excel Industries Ltd., India).

Next session was conducted by Dr. Balakrishnan Ganesan (Research Director - Chemical Development Group, Syngene International Ltd., India) where the topic discussed was *My Experience with flow chemistry*. After these informative sessions, Mr. R. N. Mohanty (President - Technology, Pidilite Industries Ltd., India) discussed on *Biopolymers & Adhesives.*

The session was then followed by five presentations from solution provider. The presentation was by

Dr. Rahul Nabar (Dept. of Chem. Engg., IIT-Bombay, India) where the topic of the presentation was *Green Chemistry through effective Industry-Academia Collaborations: Challenges and Opportunities.* The next presentation was by Mr. Shirish Paranjpe (Marketing Manager, Godavari Biorefneries Ltd. India) on *Bio-based Chemicals: Future of the Chemical Industry*. The next presentation as presented by Dr. Paresh L. Dhepe (Principal Senior Scientist, Catalysis & Inorganic Chemistry Division, CSIR-National Chemical Laboratories, India) was on *Contributions from NCL in Green Catalysis*. The next presentation was presented by Mr. Alok Pandit (CEO, Equinox Sofware & Services Pvt. Ltd., India) and the topic of presentation was *Recent trends in IT enabled Process Engineering*. Next up was a presentation by Mr. Prashant S. Dravid (Director, Systems Sales, SPXFlow Technology (India) Pvt. Ltd., India) and it was on the topic- *Close Circuit Spray Dryers for Pharmaceutical & Chemical Industry, highlighting energy effciency & modern Safety features.*

The conference was characterized by excellent successful case studies which gave a glimpse of direction in which Green Chemistry and Engineering implementation is heading towards in Indian Chemical Industry.

Consented presentations by speakers in this event can be referred at http://www.industrialgreenchem.com/archive.php

Day II, 17th Oct.: Event 11 - Conference on Green Chemistry for Dyes and Pigments Industry:

This conference was held as a parallel event along with other events in IGCW convention 2019 under the mentorship of Prof. V. R. Kanetkar and Prof. Sanjay Mahajani. The conference was co-organized by The Dyestuff Manufacturer's Association of India.

The objectives of organizing this conference were:

- To share various business, regulatory, supply chain dynamics happening globally in Dyes & Pigments Industry related to sustainability.

- To share Green Chemistry initiatives, successful case studies, tools, techniques & best practices by large Dyes & Pigments companies.
- To share recent innovations like Flow Chemistry & its successful implementation in Dyes & Pigments Industry.
- To introduce new innovative green chemistry & engineering/environmental solution providers.
- To identify challenges, gaps & mindset issues in implementing Green Chemistry and way forward for Dyes & Pigments Industry

The conference was characterized by presence of CEO, Directors, President, VP, GM, Senior Representatives from Dyes & Pigments Industry.

The conference started off with a welcome note by Prof. V. R. Kanetkar and Prof. Sanjay Mahajani which was then followed by a talk Dr. Rajiv Banavali (Global Vice President - Research & Technology, Huntsman Corporation, Singapore) where Dr. Rajiv Banavali addressed the topic- *Sustainability and Innovation in Textile Dyes & Chemicals.* After the keynote address, the next session was conducted by Mr. John Frazier (Senior Technical Director, Hohenstein Institute America, USA), where Mr. John Frazier delivered a talk on *Green Chemistry Drivers - from regulations to innovations*. The session was continued by Mr. D.K. Rana (Director, Heubach Colours Pvt. Ltd. India) where the topic of discussion was *Environmental Management & Sustainability- Heubach Case Study.* This was then followed by a networking break which enabled participants to interact with Green Chemistry and Engineering solution providers participating in IGCW-EXPO 2019.

After the break, the session on *Practicing Green Chemistry Principles in manufacturing of Dyes and Intermediates* was delivered by Dr. Pankaj Desai (R&D Head, Colortex Industries Pvt. Ltd., India).

Next session was conducted by Dr. Amol Kulkarni (Scientist, Dept. of Chem. Engg. & Process Dev., CSIR-National Chemical Laboratories, India) where the topic discussed focused on *Case studies on Process Intensifcation tools applied to Dyes & Pigments Industry.* The talk was then followed by a talk from Dr. Surendra Bhatia (Senior Technical Advisor, Ascenza, India) on *Case Study of implementation of Flow Chemistry in Dyes and Pigments Industry.*

The session was then followed by a networking break. Post break the conference was continued by a talk by Prof. (Dr.) G. S. Shakarling (Head, Dept. of Dyestuf Technology & Co-ordinator, Perfumery & Flavor Technology, Institute of Chemical Technology (ICT), India), which focused on *Ready to implement technologies/solutions with Dept. of Dyestuf Technology, ICT. Some case studies of successful commercialization*. The talk was then followed by a presentation by Dr. Biswajayee Airaraj Patra (Senior Product Manager, Thermo Fisher Scientifc India Pvt. Ltd., India). The presentation was on *Innovative Analytical Technologies for analysis of metals*. This was followed by presentation on *Recycle@Source TM Solution: An effective alternative to reduce end-of-pipe treatment* which was presented by Mrs. Ashwini Gunnal (R&D Incharge, Newreka Green SynthTechnologies, Pvt. Ltd. India).

The conference was concluded by Prof. Sanjay Mahajani. The conference was characterized by practical examples and different green alternatives for dyes and pigments manufacturing.

Consented presentations by speakers in this event can be referred at http://www.industrialgreenchem.com/archive.php

IGCW 2019 Awards

After the parallel events discussed above, IGCW Green Chemistry award function was conducted. The award function was graced by experts from Green Chemistry field. The Award nominees were acknowledged for their excellent efforts for implementation of Green Chemistry in their projects.

To briefly share, the IGCW Award is India's first-of-its-kind recognition of individuals and organisations (from Industry and Academia) towards their contribution in advancing the field of GC&E in India. The IGCW Awards, since 2009, has been recognizing outstanding research initiatives and industrialization stories by Industry and non-industry groups.

The Scientific Engineering Research Board (SERB), Dept. of Science and Technology, Govt. of India, had collaborated with Green ChemisTree Foundation to present the 5th Industrial Green Chemistry World (IGCW) Awards under the prestigious title of "SERB-IGCW 2017 Awards"

The IGCW Awards aims to acknowledge outstanding initiatives, incorporating the principles of GC&E into chemistry routes, chemical designs and manufacturing practices; and steps taken towards pollution prevention while meeting the triple bottom line of People, Planet and Profit.

The IGCW 2019 Awards in different categories were announced in January 2019 to spread the awareness regarding the upcoming IGCW 2019 Convention and the awards.

Nominations for IGCW 2019 were invited in the following categories:

1. MNC, Large and Medium Scale Companies
2. Small-Scale Industries
3. Green Chemistry Start-ups
4. Knowledge Community
    - 4A -Technology Development firms: Tools, Software, Process technology, equipment, Devices, Diagnostics etc.
    - 4B – Students
    - 4C - Guides/Researchers form Universities, Research Institutes

The online submissions for the IGCW 2019 Awards were open in March 2019 on the link mentioned below -

http://.industrialgreenchem.com/IGCW2019/awards/nomination/

The last date for the closing the online submission was 15th June 2019 and further extended this deadline on the interested participants' request and finally closed on 30th September 2019.

In this time span, over 1000 people clicked on the link to go through the entire idea and background of this initiative. Further, the registration and submissions were made by the interested participants in above mentioned categories.

Total Registered participants in all category - 120

Total participants who successfully submitted their case study - 72

IGCW 2019 awards surpassed the past highest number of 51 submission from all categories to 72, clearly indicating the amount of efforts being putting in the Green Chemistry implementations.

These 72 submissions were thoroughly evaluated by 5 juries and the juries shortlisted top three case studies from each category.

Category-wise Top Three Shortlisted Nominees:

Category	Name of the Nominee	Organization	Topic of case study
MNC/Large/Medium	Suresh Kumar K	Advanced Enzymes Technologies Pvt Ltd	Biocatalytic Process to Manufacture Pregabalin Using Lipase enzyme
	Padmadas Nair	Dow Chemical International Pvt Ltd	Breakthrough in water Conversation in Hand Laundry Cleaning with DOWSIL EASYRINSE GP-4633
	Sunil Divekar	Praj Matrix R & D Center	Improved Technology for Furfural
Small Scale Units	Dr. Abhay Chheda	Avik Pharmaceutical Ltd	Budesonide
	K Suresh Kumar	Aktinos Pharma Pvt Ltd	Development of Green process for the preparation of Benzimidazole derivative and its intermediates
	Swapneshu Baser	Deven Supercriticals Pvt Ltd	System for continuous feeding and discharging of solid material to and from a vessel operating under high pressure
Green Chemistry Start Ups	Dr. Vijay Yadav	SKRS Innovations	Clean technology: carbon dioxide neutralization technology
	Dr. Vaishali Kulkarni	KBCols Sciences Pvt Ltd	Microbial colorants: An alternative to waste generating and water polluting synthetic colors
	Jaydeep Deshpande	Amnium Technologies Pvt Ltd	Nanomaterials for agricultural sector

Knowledge Community: Technology Developers	Dr. Padma S Vankar	Bombay Textile Research Association	Regeneration of used frying oil
	Swapneshu Baser	Deven Supercriticals Pvt Ltd	Waterless Dyeing: Process of dyeing of textile materials using supercritical fluid
Knowledge Community: Academia- Researchers	Sirshendu De	Indian Institute of Technology Kharagpur	Fluoride removal from groundwater using chemically amended naturally available materials
	Prof. Bhalchandra Bhanage	Institute of Chemical Technology	Biocatalytic synthesis of diesel-blend compounds from biomass derived levulinic acid in supercritical carbon dioxide: Green metric evaluation study
	Pratyush Maiti	CSIR-Central Salt and Marine Chemicals Research Institute	Spent wash Management (SWM) Technology – a zero waste process for recovery of potash fertilizer, water and other value added by-product(s) from spent wash (effluent of sugarcane molasses based alcohol)
Knowledge Community: Students	Omprakash Sarkar	CSIR-SRF	Acidogenic Biorefinery for renewable energy and platform chemicals: upscaling and sustainability analysis
	Maya Mane	National Chemical Laboratory	A novel hybrid cavitation process for disinfection of water
	Pratik Vinayak Gholkar	IITB-Monash Research Academy	Conversion of microalgae into hydrogen-rich syngas
	Devendra Pisal	Institute of Chemical Technology	One-pot selective synthesis of nabumetone using novel multifunctional Ni promoted La-Mg oide/MCF catalyst

These top three candidates were announced on 23rd September 2019. The shortlisted case studies were evaluated by Dr. David Constable to choose the most inspiring and green chemistry-oriented case study. The winner from each category was declared based on the average points scored on certain pre-determined criteria. The shortlisted candidates were felicitated in Awards ceremony on 16th October 2019. The winners from each category was also declared on the same day.

The Winners list of IGCW 2019 Awards:

Category	Name of the Nominee	Organization	Topic of case study
MNC/Large/Medium	Sunil Divekar	Praj Matrix R & D Center	Improved Technology for Furfural
Small Scale Units	K Suresh Kumar	Aktinos Pharma Pvt Ltd	Development of Green process for the preparation of Benzimidazole derivative and its intermediates

Green Chemistry Start Ups	Dr. Vaishali Kulkarni	KBCols Sciences Pvt Ltd	Microbial colorants: An alternative to waste generating and water polluting synthetic colors
Knowledge Community: Technology Developers	Swapneshu Baser	Deven Supercriticals Pvt Ltd	Waterless Dyeing: Process of dyeing of textile materials using supercritical fluid
Knowledge Community: Researchers	Pratyush Maiti	CSIR-Central Salt and Marine Chemicals Research Institute	Spent wash Management (SWM) Technology – a zero waste process for recovery of potash fertilizer, water and other value added by-product(s) from spent wash (effluent of sugarcane molasses based alcohol)
Knowledge Community: Students	Devendra Pisal	Institute of Chemical Technology	One-pot selective synthesis of nabumetone using novel multifunctional Ni promoted La-Mg oide/MCF catalyst

We congratulate all the winners, shortlisted candidates and all the participants for their efforts towards the implementation of Green Chemistry and Green Engineering initiatives.

Day I & II – IGCW EXPO 2019

During both the days there was a EXPO held parallelly which was characterized by participation of Green Chemistry and Engineering Solution providers from all across the globe.The 6th IGCW-2019 EXPO is one of the key dimensions of the IGCW Ecosystem, and over the years a growing of number of Solution provider companies, both locally and internationally, are actively participating to showcase their Green Chemistry and Engineering relevant technologies, solutions and competencies. In this IGCW, 34 solution providers including Academia & Research Institutes participated in the EXPO, of which 15% were international exhibitors indicating India's growing potential for Green Chemistry and Engineering solutions.

The approach adopted by Green ChemisTree Foundation for reaching out to solution providers globally is by identifying immediate to long-term solution providers and their key positive impact of their solutions to make the ecosystem Green and thereby inviting them to the IGCW ecosystem for exploring the emerging GC&E market in India.

The IGCW EXPO offers opportunity to the exhibiting companies to engage in focussed networking and business interactions with the senior decision makers and their technical terms participating in the various features of IGCW Convention.

Around 50% of the participating companies at the IGCW EXPO have been regular exhibitors at earlier IGCW events indicating the business value and opportunity obtained from IGCW.

In IGCW-2019 we offer special attention towards start-up companies to support them and to encourage Start-ups in India the Start-up companies are incubated at institutions like IIT-B, CSIR-NEERI, NCL Venture Centre Pune. The 24% of the exhibitors were start-up exhibitors who showcased their technology solutions and innovations thus expanding the awareness among solution seeking organisations and furthering business opportunities through new partnerships.

Apart first time the presence of Heavy Water Board (HWD) Mumbai presence in IGCW a constituent unit of Industries and Minerals Sector under Department of Atomic Energy, Government of India.

Two CSIR institutes Viz. National Environmental Engineering Research Institutes (NEERI) and National Chemical Laboratories were represented in the CSIR Pavilion.

The feedback from the exhibitors is the Venue, overall multidimensional event co-ordination is good. They also mentioned that they got to interact with giants in the industry and even led to some fruitful business connections. The winners of the IGCW awards were given a complementary booths for exhibiting their technology to the industry, start-ups as were given special discounts to promote their technology said that it was a great experience being a participant at IGCW-EXPO as they could interact with not only potential solution seekers but also with guiding institutes like ISC3. The exhibitors were also given complementary registration for the whole convention which helped them update their knowledge is what was mentioned by the exhibitors in their feedback. The most common feedback that we received was the exhibitors found right set of audiences coming at the boot to know more and thus it was a great experience for them to exhibit in such a focused EXPO.

6th IGCW-2019 Convention: Day III

Day III, 18th Oct.: Workshop on Sustainable Chemistry Entrepreneurship

The entrepreneurship workshop was a part of the initiative which is conducted on 18th October, 2019 at Victor Menezes Convention Centre, IIT-B, India. The key though process of having the workshop done was to encourage entrepreneurs and introduce them to some facts and global experts on how to go about start-ups. The workshop was designed along with International Sustainability Chemistry Collaborative Centre (ISC3), an organization based in Germany.

The workshop started with a welcome note by Prof. Ravi Bhallamudi (Professor-In-Charge, Desai Sethi Centre for Entrepreneurship, IIT-B, India) The welcome note was followed by context setting of the workshop by Mr. Nitesh Mehta (Convenor of IGCW, Founder-Director Newreka Green Synth Technologies Pvt. Ltd., Director Green ChemisTree Foundation).

The session was then taken up by Dr. Silke Megelski (Senior Innovation Manager, ISC3 Innovation Hub), where the participants were introduces to ISC3 and their initiative name Global Start-up Service. During the session there was a quiz conducted by Dr. Megelski on what challenges do the participants face and what is the stop barriers they face while going for a start-up strategy.

This session was followed by a talk by Dr. Claudio Cinquemani (Director Innovation and Research ISC3 Headquater Germany). Dr Cinquemani gave an insight on the principle of Sustainable chemistry. This session was followed by a series of presentations by some successful start-ups in field of Green and Sustainable chemistry, the barriers they faced and how they overcome it. It was live demonstration of some successful case studies. These presentations were taken up by Dr. Vaishali Kulkarni (Founder Director KBCols Science Pvt. Ltd., Pune), Mani Vajipey (CEO, Banyan Nation, India), Dr. Vanita Prasad (Founder and CEO, REVY Environmental Solutions, An Environmental Biotechnology Company, India).

The next session was addressed by Dr. John Warner (President of Warner Babcock Institute for Green Chemistry, USA). In this session, Dr. John Warner shared how is the research team managed in his organization and also explained how chemistry between people is important to have the organization aligned and focused.

The session was then followed by an interactive session, which was then followed by a Panel discussion. The panel discussion was managed and moderated by Dr. Megelski and Dr. Cinquemani. The panel was formed by Dr. John Warner, Ms. Starlene Sharma (Connector at Clean Tech-WIN), Dr. Sarita Zele (Founder, Resha Technologies, India), Mr. Julian Zix (Bundesverband Deutscher Start-ups (GINSEP initiative)), Dr. V. Premnath (Secretary & Founding Director, Venture Centre Pune, India), Dr. Surendra Kulkarni (Former Head of Innovation from GE's Innovation Centre).

After the informative and brain storming panel discussion, the last session was taken up by Ms. Starlene Sharma who addressed the audiences how to go for funding, how to go about writing proposals, different funding organizations, etc. The session was a great learning with regards to economic aspects.

The session was concluded by concluding remarks by Dr. Love Sarin and was followed by felicitation of all the speakers for their excellent contribution.

Day III, 18th Oct.: Green Chemistry Workshops for Students and Teachers:

Workshop on Green Chemistry Tools, Techniques & Resource" for Students:

The students' workshop was held on 17th October, 2019 at Victor Menezes Convention Centre, IIT-B, India where the workshop was conducted to get students introduced to Green chemistry principles and tools from the global experts that addressed to the industrialists during the convention.

The objectives behind conducting this workshop were:

- To provide comprehensive understanding on the use of readily available Green Chemistry tools and guides.
- To get students introduced to tools like the solvent selection guide and reagent selection guide.
- To expand understanding on Green Chemistry matrices such as the Process Mass Intensity (PMI) calculator.
- To present industrial perspectives on opportunities for Green Chemists/ Chemical Engineers.

The workshop was characterized by presence of students and teachers. The overall footfall for the event was more than 500. With such kind of workshop, we as Green Chemistry Foundation aim to reach to students and instill the seeds of Green Chemistry at very early stage of knowing Chemistry.

The workshop started off with a welcome note and context setting followed by talk from Dr. John Warner (President & CTO, Warner Babcock Institute of Green Chemistry, USA). The talk was on 12 principles of Green Chemistry which was illustrated with examples.

This key talk was then followed by a talk from Mr. Nitesh Mehta (Co-Founder and Director, Green ChemisTree Foundation) where Mr. Nitesh Mehta addressed a talk on *21st Century's best time to be a chemist or a chemical engineer.* This talk was then followed by a talk on *Process Safety-Journey to inherently safer processes* which was delivered by Dr. Chuck Orella (Director Chemical Engineering R&D, Merck & Co. Inc. USA). The talk was then followed by an informative session delivered by Dr. V. Premnath (Secretary and Founding Director, Venture Centre Pune).

After the break, the session on *Sustainability as a fundamental thought process for next-generation chemists and chemical engineers* by Mr. Mahesh Chandak (Head of HSE- South Asia and HSE Business Partner for Crop Science- Asia Pacific). This was then followed by a talk by Dr. Mark Dorfman (Sr. Principal & Lead Chemist, Biomimicry 3.8, USA) on *Biomimicry- a Natural Green Chemistry Tool for Innovation.*

Next session was conducted by Dr. David Constable (Science Director, ACS-GCI) where the topic discussed was *GC&E Tools, techniques & Matrices Workshop*. The workshop was concluded by Dr. Yogendra Shastri.

Workshop on "Green Chemistry Tools, Resources & Guide" for Teachers:

The workshop for teachers was conducted parallelly along with the students' workshop and the entrepreneurship workshop on 17th October, 2019 at Victor Menezes Convention Centre, IIT-B, India. The workshop was characterized by presence of teachers who are responsible for teaching students from high school to graduation or post-graduation. The man objectives to conduct such kind of workshop were:

1. To provide comprehensive understanding on the use of readily available Green Chemistry tools and guides.
2. To get introduced to tools like the solvent selection guide and reagent selection guide
3. To expand understanding on Green Chemistry metrics such as Process Mass Intensity (PMI) Calculator.
4. To have a present industrial perspective on importance and urgency of Green Chemistry education.

The workshop started off with a welcome note and context setting followed by talk from Dr. John Warner (President & CTO, Warner Babcock Institute of Green Chemistry, USA). The talk was on 12 principles of Green Chemistry which was illustrated with examples. This talk was a context setting talk for both teachers and students' community. After the talk the participants were moved to their respective halls for further sessions.

After the context setting, the next session was conducted by Dr. Achala Danait (Vice President, Regional Innovation Centre, Clariant Chemicals (India) Ltd.). The talk was on *Emerging Industrial trends in Green Chemistry vis-à-vis next-generation of chemists and chemical engineers.* The following talk was led by Dr. David Constable (Science Director, ACS- Green Chemistry Institute) which was on *Green Chemistry and Engineering Tools, Techniques &Metrics Workshop.*

After the lunch break, the session was led by Dr. Surendra Kulkarni (Former R&D Head- GE Plastics), Dr. Kulkarni delivered a talk on *Inculcating culture amongst students for Green Chemistry driven Research and Innovation.* The next talk of the workshop was conducted by Dr. Chuck Orella (Director Chemical Engineering R&D, Merck & Co., Inc., USA) on *Global Industrial Trends in Green & Sustainable Chemistry.* After having a perspective of global trends Prof. Sanjay Mahajani (Dept. of Chemical Engineering, IIT-B Entrepreneurs) gave participants an insight on *Role of teachers to empower students in the direction of sustainability (Bio-fuel case study).*

After the informative talks the teachers were introduced to a new upcoming concept of Biomimicry. This session was led by Dr. Mark Dorfman (Sr. Principal & Lead Chemist, Biomimicry 3.8, USA). The talk was on *Biomimcry- a Natural Green Chemistry Tool for Innovations.*

The workshop was concluded by the mentors of the teacher's workshop Prof. Damodar Prabhu (Adjunct Professor , Department of Chemistry, Wilson College Mumbai) and Dr. Kiron Jathar (Vice Principal, RD National College, Mumbai, India).

The workhop gave an insight to teachers on various tools and techniques available for them to incorporate in the regular curriculum of chemistry and also to incorporate at the research level. It also gave an insight as to how Green and Sustainable Chemistry has been now of keen interest in Industrial setup and how they are going about it. The workshop also helped develop an understanding of Biomimicry as a concept. The

speakers of the workshop were same as those who addressed industrial participants which was thus an effort to bridge Industrial Academia gap and bring them on relatable terms.

Testimonials

"I would like to congratulate you and IGCW 2019 organizing team for doing an outstanding job in organizing a world class workshop and conference. " - Dr. Rajesh Kumar, Chair- Pfizer WRD Green Chemistry Team & Associate Research Fellow, Biocatalysis Group, Pfizer Inc., USA

"It is very noble initiative and very much needed to ensure a quality life for future generations" - Dr. Amol Kulkarni, Scientist, Chem. Engg. & Process Dev. Division, CSIR-National Chemical Laboratories, India

"I was happy to see a larger audience interested in the theme of the conference" - Dr. Chuck Orella***,*** Director Chemical Engineering R&D***,*** Merck & Co. Inc, USA.

"I thoroughly enjoyed IGCW 2019" - Dr. Johannes Benkhoff, Sr. Vice President - Group Chemical Research, Clariant Produkte (Deutschland) GmbH, Germany

"Thanks for the great conference and having us as key contributors. Looking forward to next upcoming events on our joint journey towards a sustainable economy"- Dr Deepak Palekar, Head - Strategy & Technology, STEP Pvt. Ltd., India

"As regards IGCW 19, I think the venue was convenient and impressive. Surely yours & your team's efforts to spread Green Chemistry & Technology across India is developing into a good movement as I could see from the increased number of participants. I am sure, you will have more success in the next IGCW and your green chemistry movement in coming years. Keep it up." - Dr. Swapnil S. Mohile, Market Development Manager - Biocatalysis (Life Sciences - Global), Novozymes South Asia Pvt. Ltd.

"Thanks for providing one more opportunity to be a part of IGCW." – Dr. Rene VAN BERKEL, UNIDO Representative, Regional Office India

"It was indeed my pleasure to contribute to IGCW2019" - Vijay Kirpalani, CEO, Pi-Process Intensification Experts LLP.

"Please accept by gratitude for letting us be a part of your event." – Dr. Bhanu Manjunath, Director,

Research & Technology Centre, Syngenta Biosciences Pvt Ltd.

"It was indeed a great experience." - Dr.Young Sung Yun, Head of Biotech Lab1, Amicogen Inc., South Korea

"It was good opportunity for sharing current technology on green chemical technology for sustained development." Dr. Biswajayee Airaraj Patra, Senior Product Manager, Thermo Fisher Scientific India Pvt. Ltd., India

Overall Outcome

The 6th IGCW 2019 Convention & Ecosystem was designed with the prime objective to facilitate subject-specific and sector-specific deliberations that can enable diverse groups of Chemical Industry stakeholders to accelerate GC&E practices in their respective roles and capacities.

With this context, 12 parallel events; one dedicated EXPO; and exclusive Workshops for Students, Teachers and Entrepreneurs were integrated in scope and structure of the 6th IGCW-2019 Convention. Based on the events, subject experts from Industry and Academia were invited to

contribute as Speakers, with inputs from subject mentors, topics were identified, and new features were integrated such that focussed interactions on subject-specific topics could be facilitated.

As one of the largest industrial gatherings on the subject of "Green Chemistry and Green Engineering", the IGCW 2019 Convention & Ecosystem brought forth following key outcomes:

1. Brought together 500+ Chemical Industry stakeholders including Senior decision makers from Industry, Government bodies, Regulatory bodies, Industry Associations, International facilitating groups, Research Institutes, Academia, Students, etc.
2. Participating companies expanded their technical know-how towards the implementation of Green and Sustainable chemistry and thereby initiate / integrate GC&E practices into their existing R&D / Manufacturing processes.
3. 85+ Speakers comprising of Global Green Chemistry experts, Industry stalwarts, renowned Academicians and Researchers, GC&E practitioners collectively contributed to deliver quality content in the Convention.
4. Received highest level of IGCW Award Submissions till date (72 entries).
5. Over 90% Solutions providers exhibiting at the EXPO received business value-propositions through the interactions and networking at IGCW Convention.
6. The first-evet sector-specific Conferences on Green Chemistry for Pharma, Agro-chemicals, Fine & Specialty Chemicals, Dyes & Pigment Sectors was well received by respective Industry sector participants.
7. Facilitated focused deliberations on emerging topics and trends such as Biomimicry, Sustainable Chemistry Entrepreneurship, etc.
8. Integrated active involvement of over 12 Regional Industry Associations, 5 Sector-specific Industrial Associations; and 3 International Associations.
9. Received support and partnership from 4 Government bodies (2 Central and 2 State level); and 10 leading Chemical Companies.
10. For the first-time Dept. of Chemicals & Petrochemicals, Govt. of India, partnered with the IGCW Convention in the capacity of a co-organiser.
11. The convention witnessed strong case studies of green chemistry and engineering implementation from different parts of world thus giving an overview of how the green chemistry approach is progressing across the globe
12. The distinguished panel discussions highlighted solutions with respect to barriers that currently industry is facing vis-à-vis green chemistry implementation and industrialization.
13. The non-industry participants – Students and Teachers community received unmatched value by interacting with Global GC&E experts and Industry speakers.

Conclusion & Way Forward

The 6th IGCW-2019 concluded with the promise to expand Green Chemistry implementation quotient of India. Two key developments in this direction post IGCW 2019 are:

- Dept. of Chemicals & Petrochemicals, Govt. of India; considering to collaborate with Green ChemisTree Foundation towards creating an online portal for connecting Research & Development based solutions to Chemical Industry for facilitating technology advancement and its implementation.
- Maharashtra Pollution Control Board considering initiating a Green Chemistry "Facilitation Cell" with the objective to ensure sustainable development for MSME industries in Maharashtra. Support and promote research & development and innovations in cleaner production technologies for MSME industries; and pro-actively facilitate awareness towards environmental compliances and cleaner – greener production for MSME

This apart, the Green ChemisTree Foundation will continue various interventions over the next two years to facilitate diverse sectors of Chemical Industry, this includes sector-specific deliberation for Pharmaceutical industry in October 2020.

One of the key deliverables post IGCW 2019 is the creation of a web portal giving access to a comprehensive e-database of Green Chemistry / Engineering and allied solution providers from across the globe.

In addition to the above, series of Customized Workshops on "Green Chemistry Tools and Techniques for Corporate R&D personnel" will be conducted with the objective to accelerate Green Chemistry adoption amongst chemical companies.

Annexures

1. List of Partner & Supporters
2. List of Speakers
3. List of Attendees
4. List of Exhibitors
5. Post-event Media Reports
6. Photo Report

IGCW 2019 industrial green chemistry world Convention & Ecosystem

6th Industrial Green Chemistry World Convention & Ecosystem

16th & 17th October, 2019

Venue: Victor Menezes Convention Center (VMCC), IIT Bombay

Co-organisers

Government of India
Ministry of Chemicals & Fertilizers
Department of Chemicals & Petrochemicals

Green Chemistree Foundation

Inauguration of 6th IGCW-2019 Convention & Ecosystem by Chief-Guest – Shri Raghavendra Rao, Secretary, Dept. of Chemicals & Petrochemicals, and other dignitaries from Industry and Academia.

Inaugural Keynote Address :- Green Chemistry and The Future

By Prof. Paul Anastas, Director, Centre of Green Chemistry & Green Engineering at Yale, USA ; & President & CTO, Warner Babcock Institute of Green Chemsitry, USA. (Founders of 12 Principles of Green Chemistry)

Welcome Address :Mr. Sudhir Srivasatav, IAS, Chairman, Maharashtra Pollution Control Board (MPCB)

Welcome Address:- Dr. P. Anbalagan, IAS, CEO, Maharashtra Industrial Development Corporation (MIDC)

Chemical Industry Leadership Summit DAY I, 16th Oct. 2019

Keynote Address By Prof. Paul Anastas, Director, Centre for Green Chemistry & Green Engineering at Yale, USA.
Dr. John Warner, President & CTO, Warner Babcock Institute of Green Chemistry, USA
Topic – Green Chemistry and The Future

Dr. Dietmar Hueglin, Director, Innovation Campus Mumbai & Vice President - Advanced Materials & Systems Research, BASF Chemicals India Pvt. Ltd., India.
Toipc: Sustainability in the Chemical Industry

Dr. Claudio Cinquemani, Director Science & Innovation, International Sustainable Chemistry Collaborative Center (ISC3), Germany Theme:
Topic: The particular difficult way for sustainable chemistry from lab bench to business

Dr. K. V. S. Ram Rao, CEO - CSM Division, PI Industries, India
Topic: Total Economic Value for Agri-Chemical Industry: Approaches and Challenges

Ms. Bijal Mathkar, Research & Innovation Director, Solvay Research & Innovation Center, India
Topic: Responsible Growth: Solvay and Sustainability

Dr. Ashok Menon, Global Technology Leader, Life Cycle Assessment, Corporate Sustainability Division, SABIC, India.
Abstract: Life Cycle Approach to Circularity

Mr. Manjit Singh, Associate Director - Corporate Sustainability, Centrient Pharmaceuticals, India
Abstract: Sustainability a global growth driver, Pharmaceutical Supply Chain Initiative (PSCI) contribution & sustainability practices in the pharmaceutical supply chain

Dr. Guy Humphery, Distinguished Scientist, Merck, Sharp & Dohme (MSD), USA
Abstract: The Importance of Collaboration in Green Chemistry Innovation: An MSD Perspective

Dr. Devang V. Khakhar, Professor, Dept. of Chemical Engg., IIT-Bombay (Former-Director, IIT-Bombay)
Closing Remarks & Acknowledgements

IGCW 2019 AWARDS, 16th Oct.

IGCW-PCB CONFERENCE, 16th Oct. 2019

Mr. Philip Krook, Communications Officer, Chemsec, Sweden
Topic:-Finding safer alternatives to hazardous chemicals on ChemSec's Marketplace

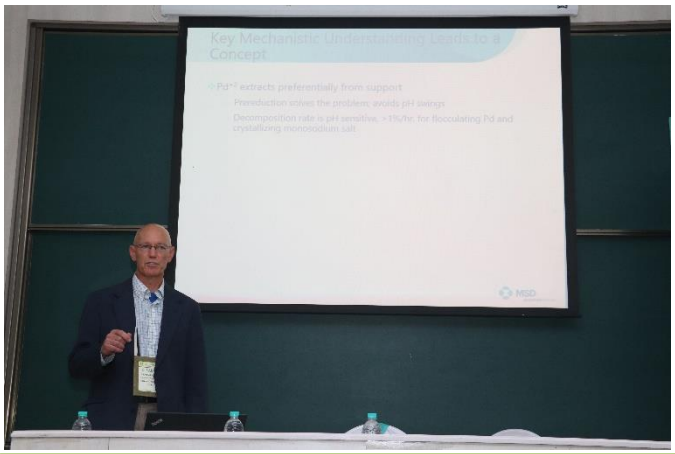
ACS-GCI Workshop on Green Chemistry & Engg. Tools, Techniques & Metrics, 16th Oct. 2019

Dr. Guy Humphrey, Distinguished Scientist, Merck, Sharp & Dohme (MSD), USA
Topic: Introduction to the ACS Green Chemistry Institute Pharmaceutical Round Table (ACS GCIPR): MSD Perspective

Dr. David Constable, Science Director, ACS-Green Chemistry Institute, USA
Measures of Green Chemistry Performance

Dr.Rajesh Kumar, Chair Pfizer WRD Green Chemistry Team & Associate Research Fellow, Biocatalysis Group, Pfizer Inc., USA
Topic:-Green Chemistry Tools and Technologies for Chemical Synthesis

Green Engineering for Greener Processes, 16th Oct. 2017



Dr. Chuck Orella, Director Chemical Engineering R&D, Merck & Co. Inc., USA
Topic:- Examples of Intensified Separations for Greener Processes

Mr. Vijay Kirpalani, CEO, Pi-Process Intensification Experts LLP, India
Topic:-Flow Chemistry leading to Green Re-Engineering of Chemical Plant

Prof. Ravindra Gudi, HOD, Dept. of Chemical Engg, IIT-Bombay
Role of Green Engineering/Chemistry in promoting sustainability practices

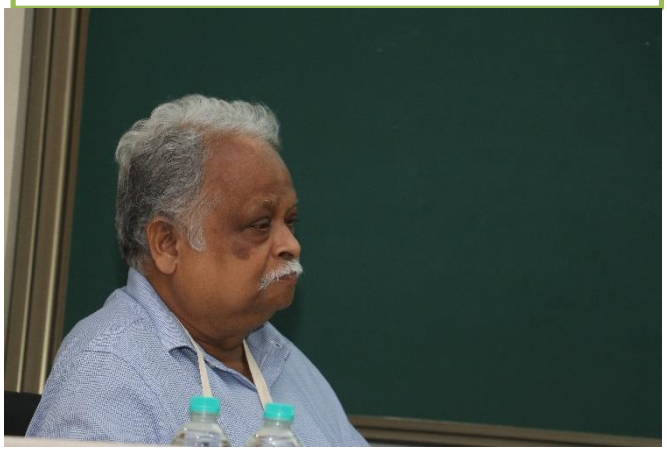
Prof. Anil Kumar, Chair Professor, Continuous Flow Chemistry Lab, Chemistry Department, IIT-Bombay, India
Continuous Flow Process: A New Paradigm in Green Chemistry

Dr. Deepak Palekar, Head - Strategy & Technology, STEP Pvt. Ltd., India
New Developments in Process Intensification - Reactors & Chromatographic Separations

Workshop on Biomimicry - A Natural Green Chemistry Tool, 16th Oct. 2019

Dr. John Warner, Co-Founder & CTO, Warner Babcock Institute of Green Chemistry, USA
Nature's Molecular Mechanisms of the Circular Economy

Mr. Mark Dorfman, Sr. Principal & Lead Chemist, Biomimicry 3.8, USA
Roles and Key Features of Chemistry in the Living Natural World



Mr. R.N. Mohanty, President, Pidilite Industries Limited
Biomimetic Adhesives and an Indian Perspective on Biomimicry

Workshop on Green Chemistry for Environment, Health & Safety (EHS), 17th Oct. 2019

Dr. Johannes Benkhoff,
Sr. Vice President - Group Chemical Research, Clariant Produkte (Deutschland) GmbH, Germany
Going green in chemistry – the Clariant innovation journey

Prof. Sandip Roy, Professor, Dept. of Chemical Engineering, IIT-B, India
Process Safety Management: The Question of Culture

Mr. Vijaya Sarathy, Manager EHS, West Pharmaceutical Services, India
Zero Accident Vision - A pathway to Positive Safety Culture

Mr. Philip Krook, Communications Officer, Chemsec, Sweden
Finding safer alternatives to hazardous chemicals on ChemSec's Marketplace

Mr. Sushil Kharkwal, Sr. Vice President - EHS, PI Industries Ltd., India
Best EHS practices for sustainable operations in a chemical industry

Workshop on "Bio-Catalysis for accelerating Green Chemistry Processes", 17th Oct. 2019

Dr. Pravin Kumar, Chief Scientific Officer, KCat Enymatic Pvt. Ltd., India
From Laboratory to Industrial Scale: A Scaleup Frame Work for Biocatalysis

Dr. Alessandra Basso, Life Tech Manager, Purolite Lifesciences, UK
Use of immobilized enzymes in industry: overview of pharmaceutical, chemical and food applications

Dr. Swapnil Mohile, Business Development Manager - Biocatalysis & Chemicals, Novozymes South East Asia Pvt. Ltd., India
Biocatalysis – Sustainable Solution Across Industries

Prof. John Woodley, Dept. of Chemical & Biochemical Engg., Denmark Technical University, Denmark
Methods for Evaluation and Improvement of Biocatalytic Processes to Enable Industrial Implementation

Dr. Young Sung Yun, Head of Biotech Lab, Amicogen Inc., South Korea
Engineering of penicillin G acylases for the production of β-lactam antibiotics on an industrial scale

Dr. Rajesh Kumar, Chair Pfizer WRD Green Chemistry Team & Associate Research Fellow, Biocatalysis Group, Pfizer Inc., USA
Biocatalysis Application to Pfizer Portfolio

Conference on "Green Chemistry for Pharma/API Industry Sector", 17th Oct. 2019

Dr. Rakeshwar Bandichhor, Head, Chemistry-API-PR&D, Dr. Reddys Laboratories Ltd. and Vice Chair, ACS-India Chapter (South), India
Topic:- Chemistry Connect between Flow and Green: An Industrial Perspective

Dr. Rajesh Kumar, Chair Pfizer WRD Green Chemistry Team & Associate Research Fellow, Biocatalysis Group, Pfizer Inc., USA
Topic:- Pfizer's Green Journey – Working for a Sustainable Future

Mr. Harish Verma, Vice President & Global Head - EHS, Cipla Ltd., India
Topic:- Role of EHS in Scaling-up API Manufacturing from Lab to Plant

Dr. Sudhir Nambiar, President - Research & Technology, Hikal Ltd., India
Topic:-Closing Remarks & Acknowledgements

Dr. Guy Humphrey, Distinguished Scientist, Merck, Sharp & Dohme (MSD), USA
Keynote: Business Case for Green and Sustainable Chemistry Development at MSD

Conference on "Green Chemistry for Agro Chemicals Industry, 17th Oct. 2019

Dr. Sudhir Nambiar, President - Research & Technology, Hikal Ltd., India
Topic:-The Kaleidoscopic Green shades of Crop Chemistry

Mr. Mahesh Chandak, Head of HSE – South Asia & HSE Business Partner for Crop Science Division-APAC, Bayer Cropscience, India
Topic:- India environmental regulations – From compliance to excellence

Dr. Mritunjan Chaubey, Global Vice President - Environment & Sustainability, UPL Ltd., India
Topic:- Case study on ensuring environmental sustainability in Agro Chemical Industries

Dr. Bhanu Manjunath, Director - Research & Technology Centre, Syngenta Biosciences Pvt. Ltd., India
Topic:- Sustainability trends in Agrochemical Chemical Research and Development

Mr. Vijay Kirpalani, CEO, Pi-Process Intensification Experts LLP, India
Topic:- Flow Chemistry in Agro Chemicals Industry

Prof Yogendra Shastri, Assistant Professor, Dept. of Chemical Engineering, IIT-Bombay, India
Topic:- Closing Remarks & Acknowledgements

Conference on "Green Chemistry for Speciality & Fine Chemicals Industry Sector"

Dr. Achala Danait, Vice President, Regional Innovation Centre, Clariant Chemicals (India) Ltd., India
Keynote: Innovating for a Sustainable Future

Dr. Steve Thomas Pannakal, Principal Scientist & Head (Bio-technology), Center of Excellence for Natural Extracts - Asia, Research & Innovation, L'Oreal India Pvt. Ltd., India
Topic:- Green Sustainable processes to generate Bio-based Ingredients

Dr. Dhananjay Deulgaonkar, EHS Manager-Innovation Campus Mumbai and Sub Regional Environment Safety Manager- South Asia, BASF India Ltd., India
Topic:-Sustainability and Responsible Care Excellence at BASF

Dr. Laxmikant Patil, Chief Manager - R&D; Dr. Krishnendu Sil, Chief Manager - QA, Excel Industries Ltd., India
Topic:- Green Chemistry initiatives in Process developments at Excel Industries Limited

Dr. Rahul Nabar, Dept. of Chem. Engg., IIT-Bombay, India
Topic:- Green Chemistry through effective Industry-Academia Collaborations: Challenges and Opportunities

Mr. Shirish Paranjpe, Marketing Manager, Godavari Biorefineries Ltd., India
Topic:-Bio-based Chemicals: Future of the Chemical Industry

Conference on "Green Chemistry for Dyes & Pigment Industry Sector“ 17th OCT.

Mr. John Frazier, Senior Technical Director, Hohenstein Institute America, USA
Keynote : Green Chemistry Drivers - from regulations to innovations

Dr. Rajiv Banavali, Global Vice President - Research & Technology, Huntsman Corporation, Singapore
Keynote :-Sustainability and Innovation in Textile Dyes & Chemicals

Dr. Rajiv Banavali, Global Vice President - Research & Technology, Huntsman Corporation, Singapore
Keynote :-Sustainability and Innovation in Textile Dyes & Chemicals

Mr. D. K. Rana, Director, Heubach Colours Pvt. Ltd., India
Environment Management & Sustainability - Heubach Case Study

Mrs. Ashwini Gunnal, R&D Incharge, Newreka Green-Synth Technologies Pvt. Ltd., India
Concept of recycle@source & case studies of recycle of acidic &

Prof. Sanjay Mahajani, Professor, Dept. of Chemical Engg., IIT-Bombay, India
Closing Remarks & Acknowledgements