Industrial Green Chemistry World (IGCW) 2013: Context & Relevance

The transition to a sustainable chemical industry requires radical technological innovation for new processes and products. This new paradigm implies added value from the use of chemicals without adding new risks to our society or transferring risk to future generations.

Environmentally benign chemical synthesis – better known as 'Green Chemistry' – is the most basic among a list of promising concepts to transform sustainable chemicals into action. But 'Green Chemistry' is not yet established in the chemical industry, despite the fact that its implementation can increase corporate value, mitigate a company's risk and strengthen long-term competitiveness.

To bring new innovation from lab to real world faces many barriers. The chemical industry is a well-established, mostly capital-intensive industry. There is a high investment barrier of economic and financial resources for new technology to arise. While current regulations focus on reducing risk through reductions in exposure, 'Green Chemistry' promotes the reduction of inherent risk by reduction of hazard. Changes to more benign processes are inhibited by cost-intensive, control-oriented regulation.

The number of disciplines involved in 'Green Chemistry' is high and, accordingly, so is the number of "scientific" languages. The lack of appropriate training of chemists, including the ability to think on a more global or system level, has emerged as an important barrier. The "promoters by know-how" – e.g., the chemist in research and development – are mostly not in a position of power. The "promoters by power" – e.g., the management executives – need the right attitude to support it strongly enough.

Industrial Green Chemistry World (IGCW) is the manifestation of this need, designed to bring forth opportunities (disguised as challenges) to chemical manufacturing companies. It aims to facilitate the industry jump from its current state of pollution and pollution control, to one avoiding the creation of chemical waste – with a double gain: avoiding creating waste while adding to profits. Yet, the *preventive* process moves slowly due to misconceptions, misunderstandings, fear of the unknown, and fear of loss of privacy.

IGCW aims to highlight emerging solutions by bringing together technology leaders, start-up companies, technocrats, academia, research institutes and Government bodies working toward this goal. Participants include speakers of international standing and reputation; industry experts at global level who have taken bold steps in adopting 'Green Chemistry'; academics who have been relentlessly working toward solutions not at lab- but industry-scale; and government officials and

IGCW in a nutshell

- A context that goes beyond the theoretical understanding of 'Green Chemistry'.
- An attempt to bring forth technical knowhow of 'Green Chemistry' applications from the corridors of laboratories to the cauldrons of industry.
- A platform to familiarize 'Green Chemistry' not as a different genre of chemistry, but as an integral way of doing chemical processes.
- Focus to recognize emerging global trends in the direction of prioritizing sustainability and environmental safety.
- Commitment towards triple bottom-line benefits for meeting profit, social responsibility and sustainable planet.
- An ecosystem for creating on-the-court value for chemical companies by providing and seeking relevant services, technologies, expertise and solutions.

regulatory bodies with their planned proactive steps to support industries.

All these open up new vistas for companies seeking solutions, and for even those industries still uncertain of their future actions.

Looking back

The IGCW Conventions in 2009 and 2011 were successful in their objectives of bringing together individuals and organizations committed and focused towards expanding implementation and commercialization of 'Green Chemistry' based technologies and products on a common platform.

IGCW-2009 saw over 1,000 stakeholders from the chemical industry participating to explore the possibilities of industrializing 'Green Chemistry' and 'Green Engineering' technologies.

IGCW-2011 saw a momentous growth in interest and participation

globally. The new features incorporated in the second edition was the 'IGCW EXPO' subject-specific seminars on relevant topics.

The expo brought forth innovative technologies and solutions such as switchable solvents, intelligent fluids, micro-reactors, recyclable enzyme catalysts, etc. The companies showcasing at the expo came in all sizes – small medium and large – and included Tata Chemicals' Innovation Center, Excel Industries, Godavari Biorefineries, Lonza etc. Eight laboratories under the Council for Scientific and Industrial Research (CSIR), along with professors from the Institute of Chemical Technology (ICT) and Indian Institute of Tech-

Feedback shared by past IGCW participants

"It is been tremendously valuable and worthwhile to be attending this event over the past three days. The discussions that have taken place, the presentations that have been made, the questions that have been answered and addressed have revealed the insight, have revealed a passion, have revealed a sense of urgency that things which are essential now move forward".

- Prof. Paul Anastas, Head – R&D, Environmental Protection Agency (USEPA), USA

I think that passion is what is abundance here; you can see it in the young students, you can see it in all the industrialists. It was a great conference, and I look forward to growing collaborations as we move forward.

- Dr. John Warner, President & CPO, Warner Babcock Institute for Green Chemistry, USA

Thank you for your hospitality – the event seemed to be a great success, largely due your organisations excellent planning and organisation.

- Prof. James Clark, Director, Green Chemistry Centre of Excellence for Industry, University of York, UK

"IGCW-2011 Expo provided a very good opportunity for us to meet, a large number of chemical industry professionals and green technology service providers who were keen about our range of services, and in particular our Green Chemistry & Technology services. These engagements led to new business engagements. We are sure that furture IGCW events will continue to provide new growth avenues for all the stakeholders".

- Dr. R. Rajagopal, COO, KnowGenix, India

"We thank you again for all the effort and organisation that you've put into the IGCW and in making this event such as success for our company! We've had many good talks and conversation and are looking forward to establishing good relationships with several Indian companies. It really was a great pleasure for us to participate in the IGCW convention!".

- Katrin Kiesel, Bubbles & Beyong GmbH, Germany

"IGCW was a very good opportunity for us to introduce new products to potential customers from pharmaceutical and fine chemical industry in India".

- Shunji Sokamoto, Speciality Chemicals Division, ZEON Corporation, Japan

nology, Bombay (IIT-B) also demonstrated their technologies.

The seminars brought forth technical insights on green chemical processes, solvents, catalysts, matrices & measurements, and engineering. Strategic and technical insights were shared by industry stalwarts and thought leaders through case-studies.

Looking ahead: What is awaits participants in 2013

IGCW-2013 – to be held from **6-8 December 2013,** in the Renaissance Hotel & Convention Center, Mumbai – will connect 'Green Chemistry' based solution seekers (i.e the industry) with solution providers (technology companies, start-ups, academia and research institutes). It will also serve as a collective resource for impacting non-industry sectors such as the teachers & educators, students of chemistry & chemical engineering, government & regulatory bodies, industry associations, non-governmental organisations and media.

The dimensions of the event include:

1. Symposium
2. Expo
3. Awards
4. Seminars on green processes, measurements & matrices, green catalysts, green solvents and green engineering
5. Workshops for teachers and students
6. Conferences for pharmaceutical companies, State Pollution Control Board officers and on academia-industry partnerships

The overall convention will incorporate participation from over 300 chemical companies (1200 + senior representatives across three days) and over 50 relevant academic and research institutes. Apart from these, around 50 + organisations (Govt. bodies, Industrial Associations, NGOs & Media) that directly or indirectly drive sustainability of chemical industry, will also participate. Overall, over 2000 chemical community representatives in various capacities are expected to participate.

- Day 1 is for senior management (CEOs, Directors, Chairmen and Presidents) who are the custodians of an organisation's core vision and values and for whom the theme of 'Ignition, Inspiration and Initiation' is most relevant for integrating industrial green chemistry as a culture of their organisations.
- Day 2 is for the Technical Directors, R&D directors, President & Vice-Presidents, Principal Scientists and Consultants for whom the theme of 'Identification, Invention and Innovation' will serve most resourceful.
- Day 3 is for the Plant Managers, Operations' Director, Heads of Manufacturing Units, EHS Managers, etc. who are responsible for ensuring the quality and sustainability of their processes and operations, and mainly deal with the challenges and concerns of 'Implementation, Industrialization and Impact.'

Award program

IGCW has instituted 'Green Innovation Award Program' to recognize advances that either incorporate the principles of 'Green Chemistry' into chemical design, manufacturing, or use; or that promote activities which support or implement those technologies.

In the context of the award program, 'Green Chemistry' is defined as the use of chemical or engineering practices for the purpose of source reduction. Source reduction prevents the formation/accumulation of any hazardous substance in any chemical product or process, and is the highest tier of the risk management hierarchy. Whenever possible, source reduction is preferable to recycling, treatment, control, or disposal.

Industrial 'Green Chemistry' technologies encompass all aspects of chemical processes including syntheses, catalyses, reaction conditions, separations, purification, distribution and monitoring. A 'Green Chemistry' technology can be an entirely new chemical product/process or an influential incremental improvement on an existing process/protocol. For example, one approach may be to substitute a 'greener' feedstock, reagent, catalyst or solvent in an existing synthetic pathway. A 'Green Chemistry' technology also can involve substituting an improved product or an entire synthetic pathway. Ideally, a 'Green Chemistry' technology incorporates the principles of 'Green Chemistry' at the earliest design stages of a new product or process.

Benefits to human health and the environment may occur at any point in the technology's lifecycle: feedstock, synthesis, use and ultimate fate.

A nominated green chemistry achievement should be an example of one or more of the following four focus areas, but must be India-specific and illustrate how the innovation supports India's growth and benefits India's economy, environment and health.

1. Greener Synthetic Pathways: This focus area involves implementing a novel, green pathway for a new chemical product or material. It can also involve using a novel, green pathway to redesign the synthesis of an existing product. Examples include synthetic pathways that: Use greener feedstocks that are innocuous or renewable (e.g., biomass, natural oils); Use novel abundant, reagents or catalysts,

including biocatalysts; are natural processes, such as fermentation or biomimetic synthesis; and are atom-economical.

2. Greener Reaction Conditions: This focus area involves improving conditions other than the overall design or redesign of a synthesis. Examples include reaction conditions that: Replace hazardous solvents with reaction media that have a reduced impact on human health and the environment; Use solventless reaction conditions and solid-state reactions; Use novel processing methods; eliminate energy- or material-intensive processing (e.g., separation and purification); Improve energy efficiency, including reactions running closer to ambient conditions; and Develop novel catalysts which are more efficient and robust.
3. Design or Implementation of Greener Chemicals and Materials: This focus area involves designing or deploying chemical products or materials that are less hazardous than the products or technologies they replace. Examples include chemical products or materials that are: Less toxic to humans than current products; Inherently safer with regard to accident potential; Recyclable or biodegradable after use; Safer for the environment (e.g., do not deplete ozone or form smog).
4. Design, Implementation, or Advocacy of Greener Processes: This focus area involves advocating for, designing, or deploying a process where chemicals (particularly hazardous and/or toxic chemicals) were used in such a way that the resulting process will be environmentally benign and economically sound and readily operated, while still ensuring product quality. Examples include designing, implementing or advocating for: Greener processes or technologies in the market and/or community; Cleaner chemical manufacturing processes; Elimination, reduction or recycling of chemicals containing waste, such as water waste.

Many green chemistry technologies fit into more than one focus area.

IGCW will present one award in each of the following categories:

1. Industry: Individual efforts, team efforts, and/or corporation efforts for a 'Green Chemistry' technology in any of the four focus areas. The awards will be given in two categories based on size and revenue of the company – one each for large and MNC enterprises and for Small and Medium sized enterprises.
2. Academic: Academic research and development efforts in any of the four focus areas. The awards will be given in two categories: Knowledge Community (academicians, researchers, and start-ups) and Students.

IGCW-2011 award winners included Orchid Pharma, Steps, Gharda Institute of Technology, Dept. of Chemistry, Guwahati University, and Praj Matrix Innovation Centre. Dr. G.D. Yadav, Dr. Bob Peoples and Dr. Pete Myers were felicitated for their outstanding contributions to this field.

IGCW-2009 award winners included PI Industries Ltd., Biosynth Group IITB, IICT-Hyderabad and Catapharma.

Industries, researchers and scientists committed to implement 'Green Chemistry' based solutions are welcome to present an abstract for the award. Self-nominations are allowed and expected.

All abstracts will be reviewed by the Scientific Committee and relevant notifications about acceptance or rejection will be sent out to the presenting author by 30th October 2013. The award will be presented during an evening ceremony to be held at IGCW on 6th December 2013.

Key highlights of IGCW-2013

- Asia's largest conglomeration on the subject of green chemistry & engineering.
- Participation from over 300 chemical companies.
- Over 30 global experts, thought leaders and industry pioneers as speakers.
- 50 companies showcasing their ready-to-commercialize green chemistry or engineering based technologies, solutions, products or services.
- Over 1500 industry representatives participating in various capacities across three days.
- Participation of Government bodies including Ministry of Environment & Forests, Central Pollution Control Board, Dept. of Chemicals & Petrochemicals, Dept of Pharmaceuticals; and Dept. of Science & Technology.
- Leading publications and Associations on-board to create awareness about the convention.
- Workshops for teachers, students, academia-industry partnerships, state pollution control boards.

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