Industrial Seminar & Exhibition on Expanding Awareness of "Green Chemistry & Green Processes" for Plant & Production Managers

Date: 16th October, 2014
Venue: Hotel Lords Plaza, Ankleshwar, Gujarat

Seminar Report

Supporters:
- Ankleshwar Industries Association
- AARTI INDUSTRIES LIMITED
- JHAGADIA INDUSTRIES ASSOCIATION
- PANOLI INDUSTRIES ASSOCIATION
- United Phosphorus Limited
12 Principles of Green Chemistry

Developed by Paul Anastas and John Warner*, the following list outlines an early conception of what would make a greener chemical, process, or product.

1. **Prevention** - It is better to prevent waste than to treat or clean up waste after it has been created.
2. **Atom Economy** - Synthetic methods should be designed to maximize the incorporation of all materials used in the process into the final product.
3. **Less Hazardous Chemical Syntheses** - Wherever practicable, synthetic methods should be designed to use and generate substances that possess little or no toxicity to human health and the environment.
4. **Designing Safer Chemicals** - Chemical products should be designed to affect their desired function while minimizing their toxicity.
5. **Safer Solvents and Auxiliaries** - The use of auxiliary substances (e.g., solvents, separation agents, etc.) should be made unnecessary wherever possible and innocuous when used.
6. **Design for Energy Efficiency** - Energy requirements of chemical processes should be recognized for their environmental and economic impacts and should be minimized. If possible, synthetic methods should be conducted at ambient temperature and pressure.
7. **Use of Renewable Feedstocks** - A raw material or feedstock should be renewable rather than depleting whenever technically and economically practicable.
8. **Reduce Derivatives** - Unnecessary derivatization (use of blocking groups, protection/ deprotection, temporary modification of physical/chemical processes) should be minimized or avoided if possible, because such steps require additional reagents and can generate waste.
9. **Catalysis** - Catalytic reagents (as selective as possible) are superior to stoichiometric reagents.
10. **Design for Degradation** - Chemical products should be designed so that at the end of their function they break down into innocuous degradation products and do not persist in the environment.
11. **Real-time analysis for Pollution Prevention** - Analytical methodologies need to be further developed to allow for real-time, in-process monitoring and control prior to the formation of hazardous substances.
12. **Inherently Safer Chemistry for Accident Prevention** - Substances and the form of a substance used in a chemical process should be chosen to minimize the potential for chemical accidents, including releases, explosions, and fires.

12 Principles of Green Engineering

Developed by Paul Anastas and Julie Zimmerman*, these engineering principles outline what would make a greener chemical process or product. See also the Sandestin principles of green engineering.

1. **Inherent Rather Than Circumstantial** - Designers need to strive to ensure that all materials and energy inputs and outputs are as inherently nonhazardous as possible.
2. **Prevention Instead of Treatment** - It is better to prevent waste than to treat or clean up waste after it is formed.
3. **Design for Separation** - Separation and purification operations should be designed to minimize energy consumption and materials use.
4. **Maximize Efficiency** - Products, processes, and systems should be designed to maximize mass, energy, space, and time efficiency.
5. **Output-Pulled Versus Input-Pushed** - Products, processes, and systems should be "output pulled" rather than "input pushed" through the use of energy and materials.
6. **Conserve Complexity** - Embedded entropy and complexity must be viewed as an investment when making design choices on recycle, reuse, or beneficial disposition.
7. **Durability Rather Than Immortality** - Targeted durability, not immortality, should be a design goal.
8. **Meet Need, Minimize Excess** - Design for unnecessary capacity or capability (e.g., "one size fits all") solutions should be considered a design flaw.
9. **Minimize Material Diversity** - Material diversity in multicomponent products should be minimized to promote disassembly and value retention.
10. **Integrate Material and Energy Flows** - Design of products, processes, and systems must include integration and interconnectivity with available energy and materials flows.
11. **Design for Commercial "Afterlife"** - Products, processes, and systems should be designed for performance in a commercial "afterlife."
12. **Renewable Rather Than Depleting** - Material and energy inputs should be renewable rather than depleting.
INTRODUCTION

The one-day Industrial Seminar on Expanding Awareness on Green Chemistry & Green Processes for Plant and Production Managers was organised on 16th October 2014, at Hotel Lords’ Plaza, Ankleshwar, Gujarat.

The objectives of the Seminar were as follows:

• To introduce and expand the understanding of 12 Principles of Green Chemistry and Green Engineering particularly amongst the Plant and Production Managers / Personnel

• To bring forth technical know-how of implementing Green Chemistry and Green Engineering practices with a profit-centric approach

• To introduce technical insights on integrating Green Chemistry based practices in their existing manufacturing units

• To connect participants to immediate solution provider companies/ institutes for resolving their environmental and expansion challenges

• To learn from locally implemented successful case-studies and exchange of experiences

ORGANISERS, SUPPORTERS & PARTNERS

The Seminar was jointly organised by Green ChemisTree Foundation (GCF) and Indian Chemical Council with support from Dept. of Chemicals & Petrochemicals (DCPC), Govt. of India; Gujarat Pollution Control Board (GPCB); Jhagadia Industries Association (JIA); Ankleshwar Industries Association (AIA); Panoli Industries Association (PIA) and Industry Partners such as Aarti Industries Ltd. and United Phosphorous Ltd.

PARTICIPATION

The Seminar was well attended by over 100 Plant, Operations and EHS personnel of more than 50 chemical companies from Ankleshwar, Panoli, Jhagadia, Surat, Vapi, Nandesari. The companies participated were a mix of MNC (20%), Large (30%) and SME categories (50%).

SPEAKERS, CONTEXT & CONTENT

Leading academia experts who contributed to the deliberation includes Prof. (Dr.) V V Mahajini, Ex-Professor of Chemical Engineering,. Institute of Chemical Technology. Dr. Parameswaran, VP- Environment, United Phosphorus Ltd.; Shri J. D. Kalyani, Vigilance Officer, South Zone- Gujarat Pollution Control Board; Mr. Nitesh Mehta, Founder Director, Newreka Green Synth Technologies Pvt. Ltd & Green ChemisTree Foundation.

The Welcome addresses by an Industry leader Dr. Parameswaran and another by the Vigilance Officer of GPCB Mr. J D Kalyani, was the right blend as both the Invitees emphasised on the importance of Pollution Prevention at source. By sheer virtue of their industrial experience and expertise the audience could well relate to their sharing and common insistence on looking at ‘greener’ alternatives to implement before End-of-Pipe treatment.

Dr (Prof.) Mahajani’s Keynote presentation was a comprehensive overview on today’s environmental sustainability scenario, vis-à-vis the future and image of chemical industry, definition and scope of Green Chemistry and the opportunities that exist for companies to be ahead in mapping their green chemistry and engineering practices and implementation, along with few case-studies. Prof. Mahajani’s presentation was technically insightful and with several
examples that can serve as instant “tip-offs” for the industry audience in adopting appropriate approach for addressing their immediate environmental and effluent challenges.

Equally inspiring was the extempore talk by one of the senior most Participants- Shri. Babubhai Patel, who shared with the audience on one of his pioneering initiatives on cavitation technology. The talk was followed by Mr. Nitesh Mehta’s presentation on Opportunities and barriers of Green Chemistry implementation. Mr. Mehta, a young Enviropreneur with his pioneering experience in the field of commercializing Green Chemistry technologies in Indian Chemical Companies, particularly those from the SME sectors, brought-forth the Business case of implementing Green Chemistry & Green Engineering as a long-term strategy to sustain our businesses not only in India but in the Global market. Mr. Mehta shared with the audience on the global trends, opportunities and challenges of Industrial Green Chemistry.

The Seminar aptly incorporated an informative presentation by the Senior Project Engineer, Mr. Mr. Hiren Bhendwal from Gujarat Cleaner Production Centre (GCPC), on the wide-ranging Govt. Policies and incentives on Green Chemistry, Clean Technology and similar environmental initiatives as available till date. Mr. Bhendwal’s comprehensive presentation on all the relevant schemes available in this direction was found to be of immediate interest to many of the Industry Participants.

The second part of the Seminar, brought-forth successful case-studies from locally situated companies such as United Phosphorous Ltd., Lupin Ltd, Heubach Colour Pvt. Ltd., presented by their respective Site-Heads and Plant Managers.

One of the key presentations was made by Senior Principal Scientist, Dr. R S Somani, CSIR-CSMCRI, highlighting case-studies of successful Industry-Academia Partnership models. This presentation showcased the technical strength and scope of Partnering with Research Institutes such as CSIR-CSMSCRI. These case-studies were further backed-up by following case-studies from the Industry.

**SOLUTION PROVIDERS SHOWCASE / EXHIBITION**

The key highlight of the Seminar was the Exhibition- an exclusive platform to tangibly connect environmental based solution providers to its industry seekers participating in the Seminar to seek short-term and immediate solutions for addressing their immediate environmental challenges at their respective Units.

Following companies participated as exhibitors in the Seminar:

**Green Processes:**

1. Newreka Green Synth Technologies' Pvt. Ltd., Mumbai
2. Geist Technologies Pvt. Ltd., Goa

**Green Engineering:**

3. Corning India Ltd., Gurgaon

**ZERO Liquid Discharge systems:**

4. PRAJ Industries Ltd., Pune

**Research Institute:**

5. CSIR- Central Salt and Marine Chemicals Research Institute (CSMCRI), Bhavnagar

**Environmental Analytical Equipment:**

6. PRIMA Equipments, Vadodara
PARTICIPANTS’ POST-EVENT FEEDBACK, OVERVIEW:

Rating Scale of 5 to 1 (5 - Excellent, 4 - Very Good, 3 - Good, 2 - Satisfactory, 1 – Poor)

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<thead>
<tr>
<th>Topic</th>
<th>Rating</th>
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<tbody>
<tr>
<td>Keynote Presentation by Prof. (Dr.) V. V. Mahajani</td>
<td>4.5</td>
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<tr>
<td>Challenges &amp; Opportunities by Nitesh Mehta, Green ChemisTree Foundation</td>
<td>4.0</td>
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<td>Govt. Policies &amp; Schemes, Gujarat Cleaner Production Centre (GPCP)</td>
<td>3.4</td>
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<tr>
<td>Industrial Case-studies : CSMCRI, Lupin, Heubach &amp; UPL</td>
<td>4.2</td>
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<td>Relevance of Solution Providers’ Exhibition</td>
<td>3.8</td>
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<td>Registration Process</td>
<td>4.1</td>
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<td>Assistance / Hospitality at the venue</td>
<td>4.3</td>
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<td>Audio visual equipment</td>
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<td>Onsite Management</td>
<td>4.0</td>
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<tr>
<td>Pre-event Communication</td>
<td>4.0</td>
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The above feedback as shared by 25% of the participants after the event serves as an effective sample feedback indicating the overall deliverables of the Seminar. The above Average Ratings indicate that the event largely met the expectations of the Participants with regards to the content of the Presentations shared, relevance of solutions at the Exhibition booths, local case-studies and the overall execution of the Seminar.

OVERALL FEEDBACK & OUTCOME

To briefly summarise the overall outcome of the Seminar:

The Seminar & Exhibition effectively introduced the Industry Participants to various success-stories, local case-studies and relevant solutions with which they could identify their existing environmental and expansion challenges, and thereby impact their knowledge, willingness and commitment to incorporate new and emerging technologies.

- The above Seminar served as a platform to expand the existing awareness on the subject of Green Chemistry amongst the participating Chemical companies, and thus expanding their understanding on green chemistry and engineering based practices and technologies available for its industrial implementation.

- The Seminar facilitated a bridge between the Gujarat Pollution Control Board (GPCB) and the Industry, and thereby transforming GPCB’s perception of approach from Policing to Partnering.

- The Industrial Seminar also served as an opportunity for the local companies to share experiences and case-studies, exchange initiatives and ideas and collectively evaluate feasible and implementable alternatives for impacting their immediate environmental challenges.

- The technical presentations introduced various potential solutions that can help in resolving some of the pressing environmental challenges currently faced by the chemical industry.

- The Seminar participants also utilized this opportunity to interact with speakers and experts for their guidance on their process relevant effluent issues, while exchanging their respective environmental issues and initiatives with other co-participants.

The Seminar, in addition also facilitated a valuably interactive platform for solution providers and solution seekers. A panel discussion chaired by Mr. Nitesh Mehta was incorporated with the Solution Provider companies as the Panellists, where they shared in a nut-shell about their core competency and the audiences asked relevant questions regarding the proposed solutions.
Seminar Inauguration & Welcome by Dignitaries

- Responsible Care Introduction by ICC Gujarat, Secretary, Mr. Y P Saxena
- Dr. Parmeswaran, VP - Environment, United Phosphorus Ltd.
- Mr. J D Kalyani, Vigilance Officer, South Zone, Gujarat Pollution Control Board

Over 100 Industry representatives participation

Keynote Presentation by Prof. (Dr.) V V Mahajani

Special recognition of Shri Babubhai Patel and his team from Nandesari Industries Association

Green Chemistry - Challenges & Opportunities overview by Mr. Nitesh Mehta, Green ChemisTree Foundation

Govt. Policies & advantages by Mr. Hiren Bhendwal, Gujarat Cleaner Production Centre
Networking with co-participants & experts

Successful case-study Presentation and participants’ engagement

Dr. R S Somani, Sr. Principal Scientist, CSIR-Centre for Salt and Marine Chemicals Research Institute, Bhavnagar

Dr. Hariom Sharma, Manager Green Cell, United Phosphorus Ltd.

Mr. D K Rana, Head of Operations, Heubach Colour Pvt. Ltd.

Sharing about CAP Initiative & Lupin Case-study by Mr. D M Gandhi, Sr. General Manager- Works, Lupin ltd.
Visiting Solution providers’ booths

PRAJ Industries Ltd, Pune

Geist Research Pvt. Ltd., Goa

Newreka Green Synth Technologies’ Pvt. Ltd., Mumbai

CSIR-CSMRCRI, Bhavnagar

Corning India, Gurgaon

PRIMA Equipments, Baroda

Panel Discussion and Q&A with the Solution Providers