Realising the shifting needs of the industry and its emerging technical requirements, the organisers of the Chemspec events hosted a ‘Green Chemistry Workshop’ at Chemspec Europe in Munich on 5-6 June 2013.

The workshop was organised in partnership with Newreka Green Synth Technologies’ P. Ltd. and the Green ChemisTree Foundation, with the objective to bring forth industrial case studies by leading companies who have implemented Green Chemistry & Engineering practices.

Designed over two half days, the workshop had presentations from academia and industry. While the former shared insights into some promising technologies in sustainable manufacturing, industry presentations shared the economical aspects and the environmental impacts.

Bio-based economy
Dr. Roger Sheldon, CEO, CLEA Technologies B.V. (the Netherlands) spoke on the potential of a ‘bio-based’ economy that encompasses the replacement of fossil-based feedstocks with renewable biomass as a raw material. He also dwelt on the industrial application of biocatalysis in the fine & specialty chemicals sector.

Eco-efficiency analysis
Dr. Peter Saling, Head Eco-efficiency Analysis, BASF (Germany), highlighted analytical methodologies developed by BASF’s eco-efficiency team, with the objective of standardising quality and aspire for best efficiency benchmarks. The presentation also shared insights into how a large organization such as the BASF evaluates its sustainability measures, and integrates the analysis into key strategic decision-making.

Cellulosic ethanol
Dr. Paolo Corvo, Business Development Manager Biofuels Europe, Clariant (Germany), shared technical developments in manufacture of cellulosic ethanol – a second-generation biofuel. He presented Clariant’s sun-liquid technology that overcomes the many challenges limiting competitive conversion of lignocellulosic feedstock into cellulosic sugars for fermentation to ethanol. The process itself is energy-neutral, yielding ethanol with about 95% CO₂ emission reduction. Besides, the process is flexible for use of different feedstock and different production plant concepts.

Solvent recovery strategies for APIs
Prof. Mariano Savelski, Professor & Chair of Chemical Engineering, Rowan University (USA), shared his eight-year experience of partnering with several pharmaceutical companies and the US-EPA to explore sustainable pathways for manufacture of active pharmaceutical ingredients (APIs).

Bio-renewables: a sustainable source of chemicals and materials
Prof. James Clark, Director, Green Chemistry Centre of Excellence and Bio-renewable Development Centre, University of York (UK), dwelt on the growing interest in the use of biomass to
make chemicals, alongside the now established manufacture of bio-fuels. “However, bio-fuels have shown us that a bio-source does not guarantee sustainability, nor is it automatically compatible with societies wider needs,” he pointed out.

Prof. Clark’s talk presented sources of biomass and the critical issues in assessing suitability; methods of extracting chemicals from different types of bio-renewables; and examples of bio-based chemicals and materials.

The drivers for change from traditional chemical supply chains were also examined.

Green Custom Manufacturing
Dr. Boris Bosch, Head of Project Management, Manufacturing Strategy, Saltigo GmbH, highlighted his company’s approach to continuous improvement of chemical processes to improve process efficiency. He pointed out that minimising process waste streams, optimising recycling rates for solvents and throughput intensification measures are prerequisites for modern and sustainable chemical processes.

Six case studies were presented where Saltigo succeeded in optimisation of custom manufacturing processes in a multi-hundred tonne scale:

1. REACH is right: Substitution of a carcinogenic solvent improved overall process economics.
2. Why not try without a solvent? Omitting a solvent is the “best recycling strategy”. In a highly exothermic reaction this challenge was targeted by means of extensive process automation.
3. Save energy by increasing productivity: Continuous improvement work within an interdisciplinary project team resulted in over 100 process modifications and pushed productivity of a long-time established large-scale production process by 250% within twelve month from the first brainstorming.
4. Where has the catalyst gone? Thorough investigation of a process led to a straightforward catalyst recycling process.
5. Create value from waste: DOE allowed to simplify product work-up, isolate a valuable by-product from a product waste stream and stabilize product quality within a given asset structure.
6. Not always believe in stoichiometry: Using process analytical technologies in the lab only one lab experiment was necessary to increase throughput of a production process by 25% and to reduce process waste streams significantly.

Design of environmentally benign processes at DSM
Dr. Peter Poechlauer, Principal Scientist, ChemTech Center, DSM (The Netherlands), shared the early development of continuous flow equivalents of lab scale processes that allowed improving on the PMI (process mass intensity) and thus the environmental footprint of the final process with very limited investment of time and resources.

He presented the key success factor of this development process and shared examples of tactical considerations concerning choice of reactors, scale, which unit operations to operate in flow, and how to integrate them into existing equipment.

Recycle@Source – a platform technology
Mr. Nitesh Mehta, Founder Director, Newreka Green Synth Technologies P. Ltd. (India) emphasized the need of “new tools” in the Green Chemistry toolbox, which would offer both economical & environmental competitiveness.

The presentation introduced the concept of Recycle@Source as a profit-centric approach to deal with environmental challenges associated with aqueous effluent streams; shared some case studies where this solution has been successfully commercialized; and the benefits it offers.

Contribution of CPME to Green Chemistry
Mr. Shunji Sakamoto, Manager, Specialty Chemicals Division, Zeon Corporation (Japan) focused on the innovative ‘green’ solvent, cyclopentyl methyl ether (CPME), which has many characteristics that traditional ether solvents do not have: higher hydrophobicity, lower formation of peroxides, as well as a better stability under acidic & basic conditions.

CPME meets eight out of the twelve Principles of Green Chemistry, as set out by Paul Anastas and John Warner. It contributes to Green Chemistry because of the reduction of total amount of solvent used and in lower amounts of wastewater, waste solvents and CO₂ emissions. It can save process time and facilities by shortening work-up time and simplifying the total process, which can reduce fixed costs.