Report from the International Workshop on Green Initiatives in Energy, Environment and Health, 2-3 December 2013, Delhi, India

By Heather Buckley

Stepping off the airplane in Delhi, India at 3 am, it is impossible not to notice that the fog on the tarmac is distinctly yellow in colour, or that the air in the main terminal is thick enough that you cannot see the far end. As the sun rises and the world awakes, the constant din of traffic rises, reminding you through a groggy, jet-lagged cup of tea that you are in a city of 22 million people.

While this may seem an inauspicious locale to host an international workshop in green chemistry (the only green to be found is in the brilliant fabrics of saris and kurtas worn by women in all walks of life), Delhi serves as a poignant reminder of what it means to live in a world of limited resources. The trash piles are a shock to the senses. The greater shock is to learn that communities will be furious if you try to take them away. The trash is a resource to the poor; children of the slums sift through it and sell what they can for the last traces of value at the end of its life. When there is no material value left, the chemical energy is extracted. Burning trash keeps families warm in the night.

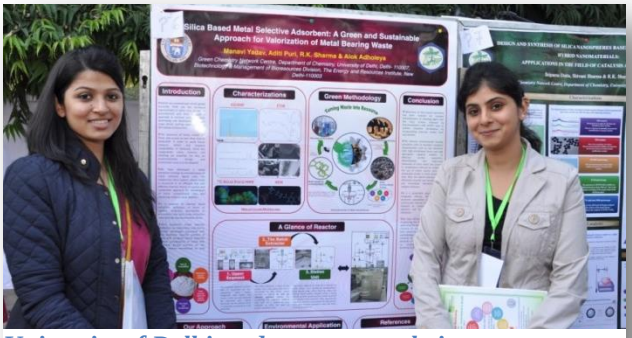
Delegates continue their discussion of the future of green chemistry with Hon. Minister of State Shri Rajiv Shukla on the grounds of the Maidens Hotel

The beautiful colonial architecture of the Oberoi Maidens Hotel stands in stark contrast to the scene on the streets of Delhi. However, the conversations hosted there on December 2nd and 3rd, 2013 carry an implicit recognition of the challenges faced by India; more importantly the faces in the room reflect that these challenges are truly global. The first International Workshop on Green Initiatives in Energy, the Environment, & Health brought together chemists from India, Brazil, Mexico, South Korea, Canada, the United States, and the United Kingdom with support also voiced by delegations from South Africa and Greece.

These scientists gathered not only to discuss challenges, but to propose solutions. This is a group of people intent on working together to revolutionize chemistry. With a range of expertise from catalysis to pharmaceuticals to energy to bio-based waste valorisation, and a range of backgrounds from academia to industry to public policy, the promise of change is real.

In many cases, green chemistry is already very much a part of the research programmes at the institutions represented in Delhi. Brazilian researchers are developing simple biomass solutions for transportation fuels, while Korean scientists are working to use petrochemicals sensibly for value-added products. Government agencies like India's TERI are recognizing that capture of solar energy is a huge opportunity in the desert of Rajasthan, and are asking tough questions about the life cycle of the materials in their photovoltaic cells.

What quickly arises in dialogue with any of these green chemistry leaders is the need for greater access to shared resources – the need for collaboration. While each of the research and education programs has connections within their home countries, the level of local support for green chemistry varies greatly. Many groups find they have limited access to



University of Delhi students present their poster on green adsorbents for metal-bearing waste

industry contacts, either because chemicals are not a dominant industry in their host country or because of historical communication rifts between industrially- and academically-focused research.

By building an international network, the opportunity exists to overcome the limitations of each individual green chemistry centre, and to encourage individual chemists to bolster their research and education programs and broaden their impact. Schools like the University of Delhi and University of York, which have green chemistry programs offered in their departments, can share the materials they have developed and the lessons learned from being early adopters in their regions. Schools like UANL (Mexico) and University of California Berkeley, where green chemistry has been largely student-initiated, can contribute an understanding of the factors that encourage students to take ownership of their education and their world. Schools like Federal University Rio de Janeiro (Brazil) which have a strong tie to bio-based materials and Korea Research Institute of Chemical Technology and Korean Institute of Chemical Technology which have a strong connection with petrochemical industry, can contribute practical knowledge of building bridges to primary resource industries and an expertise in mapping resource extraction to the provision of ecosystem services.

Industrial and bridging partners are also excited to take part in this network. Dr Reddy's is eager to see a new generation of scientists trained in green chemistry, and Green Centre Canada is uniquely equipped to facilitate technology transfer from academic laboratories into practical implementation. Both see the existing gap between industry and academia as a high priority challenge, a view that is echoed by major institutional partners such as the American Chemical Society's Green Chemistry Institute.

All of the university programs represented at this workshop will benefit from connections with each other and with partner institutions. The student body present at the workshop clearly demonstrated through their energy and enthusiasm that they are ready to take on the challenges of bringing green chemistry into practice. Students from Delhi, Faridabad, Jaipur, Banswara, Kanpur, Gurgaon, Tezpur, Kota, Noida and elsewhere throughout India listened to the seminars given by experts and revelled in the chance to talk one-on-one with world-renowned scientists. For their part, the students presented high quality posters demonstrating that green chemistry is already alive and growing in the graduate research programs of their universities. The next step for them is to find international opportunities to expand their research enabled by this new network, and to bring the expertise home and build a better future for India.

Back in the snowy winter of Canada, the hot, crowded streets of Delhi seem a world away, but change is coming here too. In a city of just over one million, 300,000 people ride Calgary's Light Rail Transit every day, and friendly strangers on the bus ask "what is green chemistry?" Oil executives who have doubled their daily commute in the name of a sustainable future are ready to have conversations about life cycle and water conservation. Although the mountains and national parks are pristine, and the half-frozen rivers run pure, they too are seeing the shadows of Delhi, Beijing, and Rio on the world of tomorrow. The global challenge of sustainable living is real, and collaboration through an International Green Chemistry Network is an important piece of designing a better future.