

## analysis

# Green chemistry

Researchers in chemical technology are ready to come out of the shadows to make hazardous chemicals a thing of the past, reports **Alexander Hellemans**.

Sustainable chemistry was first introduced in the US in the late 1980s by Paul Anastas of Yale University. The discipline not only searches for ways to reduce the carbon footprint of the chemical industry and its products, but to introduce production processes which eliminate the use and production of hazardous substances.

With the introduction of the Presidential Green Chemistry awards by the US Environmental Protection Agency in 1995, the idea quickly spread. Other countries followed suit, remarkably India and Italy, which at Bhopal and Seveso had both experienced catastrophic releases of toxins. China too is now embracing sustainable chemistry.

In the US, one of the main factors supporting the sustainable, or green, chemistry movement was the realisation that people are surrounded by chemicals that are health hazards. "The adverse effects of everyday chemicals, in environmentally relevant concentrations we never dreamed would be problematic a couple of decades ago, should be a topic of public discussion," says Terry Collins, who directs the Institute for Green Science at the Carnegie Mellon University in Pittsburgh, Pennsylvania.

The nomination in February of Anastas as the EPA's science adviser is viewed by many as encouraging. "Europe is lagging behind; we are not quick at inventing things," says Gernot Klotz, the executive director for research and innovation for the lobby group the European Chemical Industry Council and a strong advocate of the sustainable chemistry movement. Innovation

in sustainable chemistry is a component as important as research, he argues, and you have start-up innovation simultaneously at various places in the development chain.

Klotz and Collins were speaking at the Hybrid Materials Workshop in Luxembourg at the beginning of March. The workshop was organised by SusChem, the European Technology Platform for Sustainable Chemistry in cooperation with the Dutch Polymer Institute and supported by DG Research of the European Commission.

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Hybrid materials are quickly finding their way into almost every technology imaginable. For Klotz, it is important to reach industries that will make use of hybrid materials at an early stage in the industrial development of these materials. "It was

the first time that we have invited researchers from solar energy, the automotive and aerospace industry, lighting, and energy efficient building," says Klotz.

One of the major driving forces in industry is the ecological footprint of a product. But public awareness is still lacking. Public acceptance of the principles of sustainable chemistry is important for creating new markets.

Sustainable chemistry is part of Framework 7, but for Framework 8 Klotz would like to see more support for 'proof of concept', which seems to fall between the cracks: "We had a concept of a smart-energy home, using existing techniques, with self-cleaning surfaces, less pollution, less noise. But we could not find a place to present it because it was not viewed as research," he says.

**ANOTHER OBSTACLE** to innovation, especially in Europe, is aversion to risk taking, Klotz says: "From a hundred projects, 99 fail; so failure is part of innovation."

Chemistry, because of its apparent invisibility in society, remains somewhat the stepchild in innovation policy. "In my view, chemistry should be a distinct sector: we are the roots of all sustainability, there is no development in sustainability without these materials. We are everywhere and we are nowhere," he adds.

The multiplicity of approaches to innovation in the 27 member countries is still a "nightmare" Klotz says and Collins agrees: "You have very different sensitivities to green chemistry; unfortunately the problem is not technical, it has to do with cultural factors." They hope the nomination of a Commissioner for Research and Innovation will smooth these problems out.

One change Collins would like to see in Europe is not to limit efforts to solvents, but to study toxicity more broadly. "Anything [European researchers] might achieve is dwarfed by the impact of 'endocrine disrupters'; it is a top-level problem." Endocrine disrupters diminish sperm counts, and there are strong statistical differences between sperm counts in countries that rely little on pesticides, like Finland, and countries that use intensive farming, such as Denmark.

Collins mentions that now in the US there are companies producing 'green' pesticides. And he stresses that they've made a sustainable business out of it, in every sense.

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