ChemNet news

RSC ChemNet

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A sustainable future

CAREERS SPOT

You may have heard the term 'sustainable development' on television, in the news, or even in your lessons. The goal of sustainable development is to improve our quality of life without damaging the quality of life for future generations.

Over the past 20 years, there has been a growing realisation that the way in which the world's systems and technologies are developing is unsustainable. The methods we use to generate energy, fuel for transport, the food we eat and consumer products are all having an adverse effect on our climate and our environment. We need to develop new technologies that will enable us to enjoy life as do now and to continue to progress in the future, but that are not harmful to our environment - chemistry will play a crucial part in developing these technologies.

You may have already seen some evidence of the work that chemists are doing in sustainable development for everyday life - on the supermarket shelves. Laundry products which work at lower temperatures to save energy, or that are more concentrated to save on packaging are examples of sustainable consumer products. Research chemists have developed the soap compounds that work more efficiently at lower temperatures, while formulation chemists have devised the technologies behind these more concentrated gels.

Of course, there are lots of other areas where chemistry will be key for developing new, sustainable technologies – such as generating energy. If we are going to continue using fossil fuels as we do now, we need to develop methods such as carbon capture and storage to reduce the harmful effects that they are having on the environment. In generating alternative sources of energy for the future, such as solar and nuclear power, chemists are going to have a very important job.

Welcome to issue 42

This month we're talking about that buzz word – sustainability – following the news that the United Nations' Secretary General, Ban Ki Moon, has named sustainable development as the UN's number one priority for 2010.

Chemistry will be vitally important in the future for developing new technologies in areas such as energy, health, food, water quality and even lifestyle and recreation. More importantly all these technologies will need to be sustainable, which means that they will not compromise the quality of life of future generations, by damaging the climate or the environment.

Sustainability is a global issue, with different problems requiring different solutions in countries across the world. Find out what the RSC is doing to help people live sustainably in Africa, with very little water, on page 2.

I hope you enjoy this issue and it 'sustains' your interest in chemistry!

Victoria Steven

Victoria Steven– Editor

Dates for your diary

ChemNet Events:

▶ Turn On, Tune In (Psychedelics, Narcotics and Euphoriants)
Chemistry Centre, London
4 March 2010
Join writer and scientist John Mann for a trip into the weird world of drug use and abuse.

▶ Look What Chemistry Has Done For Me
University of Manchester
23 March 2010
A broad range of speakers from industry and academia offer insights into careers in chemistry.

▶ Viral Glycobiology: Chemistry of Infection and Therapeutics
13-14 April 2010
University of Oxford
The role of carbohydrates in the transmission of viral disease and their therapeutic potential.

▶ Look What Chemistry Has Done For Me
Queen's University, Belfast
20 April 2010
Gain an insight into careers from chemistry and talk to a number of chemists working in the Belfast area.

▶ Resource Efficiency in a Low Carbon World
Chemistry Centre, London
17 June 2010
Waste reduction - The work of WRAP in encouraging Reduce, Reuse, Recycle.

▶ Meet the Universities 2010
Royal Horticultural Halls, London
Saturday 3 July 2010
Put this date in your diary now – it's a great opportunity to find out more about studying chemistry at university!

To book a place on a ChemNet event:
E: chemnetevents@rsc.org
T: 01223 432340
or book online and find more info about all the events at:
www.rsc.org/chemnet

Splashing out

In developing countries, such as those in Africa, sustainable development is also very important. However, the issues affecting these countries are usually more severe than those affecting developed countries, like the UK. In Africa, supplies of fresh water are becoming more and more scarce in peri-urban communities such as the townships; finding sustainable solutions to this problem is vital.

To tackle this issue, the RSC is working together with Unilever on an initiative called **Project Splash**, to find sustainable technologies to help people in South Africa and Kenya cope with the growing shortages of fresh water supply in their communities. Chemists in these countries are trying to understand how increasing pressure on water supply will affect the type of household products people will need to use and how they will use them.

They are currently working on three projects:

The first project is examining the use of 'domestic grey water' to grow crops in South Africa. Grey water is waste water that has been used previously to wash clothes, dishes and people. Recycling waste water by using it for crop irrigation would be a sustainable solution to this water shortage; however, grey water contains lots of salts from soap products. Greater than average amounts of salt can be bad for plants but there are some plants, such as green peppers and spinach, that have been shown to grow somewhat more effectively if grey water, rather than tap water, is used to irrigate them. However, using this water could have long term adverse effects on soil composition and the levels of important micro organisms in soil. Analytical chemists are studying soil in this region that has been treated with grey water to see if this could be a potential problem in the future.

In Nairobi, Kenya, formulation chemists are investigating new chemical technologies that could be used to design personal washing products that work effectively using much less water, because the cost of water can be a major contributor to the overall cost of a shower or other wash. These new products also have to be appealing to consumers, so the chemists are working together with people living in communities in Nairobi to make sure that they will have water-efficient soap products that they will want to use.

In the third project, materials scientists are studying solar power to provide hot water for people living in peri-urban townships. Solar energy can be produced using photoelectric cells but this technology is far too expensive. Direct solar water heating (SWH) is a viable option, as long as the initial relatively high capital costs to the township dweller are overcome. Scientists are working to develop SWH systems in the townships which will provide much cheaper energy to heat water, thereby improving the quality of life there.

As you can see, chemistry continues to be key to finding sustainable solutions to problems affecting people across the world!

Finding sustainable solutions to water shortage in developing countries will improve quality of life.

Photo: Still Pictures

Careers: The path less followed

Hubert Girault discusses the importance of electrochemistry in the sustainable development of energy solutions.
Interview reported by Marie Cote.

Hubert Girault is a professor of physical chemistry at the Ecole Polytechnique Federale de Lausanne (EPFL), Switzerland. His research interests span analytical and physical electrochemistry, with a special emphasis on developing novel electrochemical methods and working on polarized liquid-liquid interfaces, microfluidics, miniaturization and proteomics, amongst others. He was made a Fellow of the Royal Society of Chemistry in 2009.

'In fact, I am not a chemist by training. With a degree in engineering, I came upon electrochemistry through the 'electro' rather than via the 'chemistry' element'.

What inspired you to become a scientist?
I guess it was chance and curiosity. In school in France I was guided towards a scientific curriculum, so my secondary education focused on mathematics, physics, Latin and Greek. My father had a company dealing with polymers and chemicals, so chemistry was also around me throughout my childhood.

What led you to specialize in electrochemistry?
In fact, I am not a chemist by training. With a degree in engineering, I came upon electrochemistry through the 'electro' rather than via the 'chemistry' element. As far as chemistry is concerned, I am more of an autodidact! *(a self-taught person apparently! – Ed.)*

How do you see the future of electrochemistry?
Electrochemistry is crucial to any modern society aiming at a sustainable development as it is at the heart of energy storage and conversion. It is important to be able to store the energy produced from solar cells and the most efficient way to achieve this is to form chemical bonds. The prime fuel target is H_2 but the electrosynthesis of larger molecules from CO_2, such as methanol, is also an interesting prospect. So I believe electrochemistry will thrive through such applications.

Electrochemistry is also central to sensor technology. An example is the glucose sensor, billions of which are sold each year. This will certainly be followed by other biomedical point-of-care applications and electrochemistry has a lot to offer in their development such as flexibility in manufacturing and cost.

You've been working in several European countries and are currently a professor in China. What do you enjoy most about this?
I guess I was lucky. In 1979, I moved to Southampton just to carry out a master project, but after meeting my future wife I stayed for a PhD and a post-doc. A lectureship took us to Scotland, where I was given the chance to work at the University of Edinburgh. I consider it as one of the greatest advantages of the British university system (compared to continental Europe) to be able to start your own research group at the age of 28. Then, a call from EPFL took us to Switzerland in 1992 to take up a chair in physical chemistry. My research group has always been very cosmopolitan and this started my links with Asia. I was very happy to be a visiting professor at Kyoto University and to be appointed a visiting professor at Beijing University for 3 years. I am also adjunct professor at Fudan University in Shanghai in analytical chemistry. At the moment the Chinese government shows a high respect for science and invests massively in scientific education. In China, the students are very thirsty for knowledge, which is of course very rewarding for a professor.

What would be your advice to the students who will be the next generation of scientists?
Be curious and a free thinker, never accept anything without questioning it and don't follow the fashion. In science, too many people are acting just by fashion and now that I am old enough, I can see that fashion comes and goes. Those who are really successful scientists are those who went their own way from the beginning. So, think by yourself and do not care what the crowd followers may say.

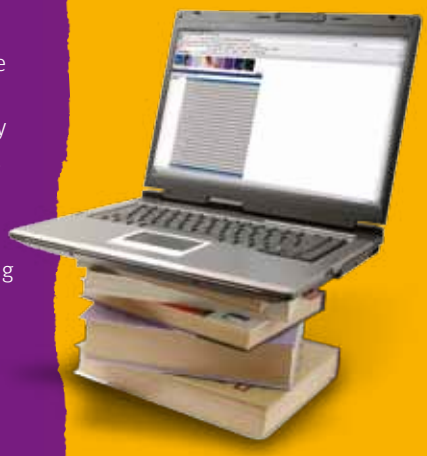
Chemistry on the web

▶ Do you want to learn more about the chemistry behind personal care products and the steps that can be taken to improve their sustainability?

The Green Chemistry Network has developed a website, in conjunction with the University of York and Boots the Chemist, called **Green Consumer Products** which takes you through the life cycles of products like shampoo, toothpaste and lipstick, telling you all about the chemicals that are used to make them and how we can use chemistry to make them less harmful to the environment:
www-users.york.ac.uk/~chem56/index.htm

▶ Carbon neutral beer, recycled polyester fleeces, self cleaning windows and energy from food waste..... Discover more about the practical applications of sustainable chemical technologies in these case studies:
www.chemistryinnovation.co.uk/roadmap/sustainable/casestudies.asp?id=64

▶ Finding sustainable energy sources is a major challenge for the energy industry and has huge potential for offering career opportunities to chemists. Information on careers in the energy industry can be found here:
www.energyzone.net



Win stuff

Solar power could be a sustainable solution to our future energy needs.

The photovoltaic effect, the science behind solar panels, was discovered in 1839 - but do you know who made this discovery?

Send your answer by email to **chemnet@rsc.org**, along with your name and your ChemNet membership number.

Closing date 15th March. The winner will receive a copy of Elegant Solutions, showcasing ten of the best chemical experiments of all time.

Last month's winners were **Jack McKinlay** from Swindon and **Kiran Ali** from Huddersfield – well done!

For a chance to **WIN**, email us at: **chemnet@rsc.org**

What is your favourite chemistry experiment?

Adding sodium to water? Seeing what happens to bananas in liquid nitrogen?

Briefly describe your favourite experiment and tell us why it made an impact on you in 50 words or less and you could be one of five lucky students to win a student edition of the Chemistry LabSkills software. This interactive resource supports your post-16 practical work and comes with its own memory stick.

Entrants should be post-16 chemistry students. Email your entry with your name and date of birth to: **competition@learnsci.co.uk** Winners will be picked at random from suitable entries. Closing date 20th March.

Cutting-edge Chemistry

Printing solar panels

Solar cells could become part of your coat or backpack thanks to flexible silicon technology developed by US scientists.

Silicon is a high performance, reliable material used in solar cell technology, normally in the form of thick, planar rigid structures that restrict its applications.
John Rogers at the University of Illinois at Urbana-Champaign and colleagues have developed a way to make very small (micrometre size) silicon microcells that connect together to form flexible solar panels.

By stamping hundreds of these microcells onto plastic substrates, Rogers' team obtained lightweight, flexible devices that bend without measurable changes in their electrical or mechanical properties, making them ideal for integration on fabrics such as backpacks, clothes and cases. They could also prove invaluable in special operations or expeditionary missions when size, space or weight are an issue says Rogers. High or low voltage devices can be made simply by arranging the microcells in different ways.

'We foresee a much more widespread penetration of silicon-based technologies into areas that are currently served only by devices that use organic semiconductors for the active materials - with comparatively poor performance and reliability,' says Rogers. This would bring many benefits as *'mechanical flexibility also reduces the cost of transport and installation,'* he adds.

'The high voltage silicon solar cell modules are another very interesting application of printable silicon,' comments Heiko Jacobs, an electrical and computer engineering expert from the University of Minnesota, Minneapolis, US.

'The process lends itself to the realisation of modules that produce high voltages enabling a compact and mechanically flexible design,' he adds.

Amaya Camara-Campos

For more stories like this featuring the latest research from RSC journals, visit Chemical Technology on the web: **www.rsc.org/highlightschemtechnol**

Spectroscopy in a Suitcase
part of Chemistry for our future

Fancy getting some cutting-edge equipment into your school's chemistry lab?

The RSC's Spectroscopy in a Suitcase (SIAS) scheme lets you do just that, giving you the chance to get your hands on the latest kit used to perform analytical techniques like infra-red and UV-vis. You'll get to play with them, learn how they work and use them to solve real problems and investigations into structure, synthesis and forensics. The practical experience of these techniques could really come in handy.

You can also check out the SpectraSchool website **www.le.ac.uk/spectraschool** which is packed with information on spectroscopy and has a huge database of compounds for you to use too.

If you like the sound of doing some spectroscopy in your school, then get in touch with the RSC at **hestem@rsc.org** to arrange a visit.

Amazing Chemistry

Scientists in the USA have shown the astonishing ability of a blob of oil to find the fastest way out of a maze.

Researchers created a pH gradient in the maze by flooding it with alkaline potassium hydroxide, then placing hydrochloric acid at the maze exit. The blob of oil, which contains an organic acid, is drawn towards the lower pH at the exit. The scientists observed that, amazingly, the blob found the quickest route out of the maze each time they performed the experiment! They hope that this research will ultimately help them find a way to assist cancer drugs in navigating the maze of blood vessels in the human body to reach their target.

You can watch videos of the red oil blobs whizzing through the maze on the American Chemical Society website: **http://pubs.acs.org/doi/suppl/10.1021/ja9076793**