The Newsletter of the Royal Society of Chemistry Water Science Forum

Water Science

Autumn / Winter 2015

Volume 16 Issue 2

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"Promoting the professional and scientific interests of members to safeguard the public interest in the application of chemical sciences in water-related industries."

In this issue:

Can We Afford Not To Monitor Priority Pollutants

Edinburgh, 24 - 25 November 2015

Richard Allan

The aim of the conference was to bring together leading experts in the field of priority substances listed in Annex X of the Water Framework Directive (WFD) to discuss the potential issues associated with the implementation of the Directive 2013/39/EC relating to priority substances in the field of water policy. There were about 50 attendees from a variety of organisations ranging from water utilities, regulators, government departments, academics and SMEs. The conference was held over two days with day one focusing on policy and day two focusing on monitoring of priority substances in the aquatic environment. The presentations were both interesting and engaging posing such challenges as what are the economic and social benefits of complying with the water framework directive. The experts suggested that identification and prioritisation of substances that pose a widespread threat to European waterways remains a challenging issue. There is concern that resources will be focussed on chasing trivial issues whilst real problems are overlooked. Monitoring requirements demanded from regulators are becoming very onerous: LOD and LOQ values for some new substances are 3-6 orders of magnitude below what can be achieved in research laboratories and the amount of monitoring required to meet the standards currently set for existing and proposed substances require extremely high financial and laboratory resources at a time when resources are being severely constrained by the economic climate.

This was a conference organised jointly by WSF, EHSC and supported by the SCI. The event was sponsored by Highlands and Islands Enterprise. The poster prize was sponsored by Environmental Science, Water Research and technology journal. The support and assistance of the sponsors is greatly appreciated, without which this event would not have taken place.

The poster prize was won by Karin Helwig from Glasgow Caledonian University for her work on "Spatially differentiated environmental risk assessment for selected pharmaceuticals".

Continued Support for Environmental Standardisation – ISO Water Quality Meeting in Philadelphia, USA

Ian Barnabas

The latest International Standards Organisation (ISO) Technical Committee meeting on Water Quality standardisation (ISO TC 147) took place at the ASTM headquarters in Conshohoken, Pennsylvania on the outskirts of Philadelphia.

Several members of the Water Science Forum (WSF) committee attended to represent the British Standards Institute (BSI) across a variety of technical committee streams in the field of water quality including sampling and analysis. The week long meeting saw 18 different meetings in the chemical analysis field as well as many others covering terminology, radiochemical measurements, microbiology, biology and sampling.

Many of the chemical standards will go on to become European standards in support of the Water Framework Directive. Over 100 delegates attended from across the world to develop a wide range of standards, these included Tim White (former WSF chair), Gavin Mills (Treasurer), Richard Allan, Dr Ian Barnabas (WSF vice-secretary), Simon Gillespie and Prof Clive Thompson from the WSF committee. Pictured are many of the UK delegation taking some time out to travel to Philadelphia city centre.

This edition's water factoid:

Water has the second highest specific enthalpy of fusion of all substances (only ammonia has higher). The specific enthalpy of fusion of water is 333.55 $kJ.kg^{-1}$ at 0 °C. Water also has the second highest specific heat capacity of all known substances (again ammonia has the highest specific heat), and a high heat of vaporization (40.65 $kJ.mol^{-1}$).

The high specific heat and heat of vaporization results from the high degree of hydrogen bonding between water molecules. One consequence of this is that water is not subject to rapid temperature fluctuations. On Earth, this is key to preventing dramatic changes in climate.

Water Science Forum bursaries

Please consider applying for the Alan Tetlow and WSF bursaries. They are open to all WSF members from any country and the money available can be used for a wide range of activities from conference and research lab visits for example to research projects in a range of topics including the water quality area. Up to £2000 is available per applicant. If you are unsure of eligibility please still apply and your application will be given full consideration.

WSF Members Advise Nappy Science Project

Adrian Clark

WSF are assisting a citizen-science project which is being sponsored by RSC and the Wellcome Trust. Nappy Science Gang are a group of nappy users who want to find scientific answers to a range of questions about cloth nappy use. This project is novel in that it is user-led, where volunteers submit the questions and work out how to answer them, before going on to design and execute their own experiments. The project leader first contacted members of RSC via the WSF website, seeking to solve the mystery of a pink stain, before asking if volunteers could provide scientific expertise to the group on a range of questions relating to detergent chemistry, water hardness, microbiology and disinfection.

The WSF website was initially used for the exchange. This was subsequently followed by Facebook, evening online Chat Sessions (after the little ones had been put to bed), and emails to provide detailed response to specific questions. Concerns have included optimum wash temperature, choice of detergent (bio, non-bio, liquid, powder etc), use of wash additives (softeners, sanitisers), water hardness characteristics, detergent build-up, washing machine settings etc. Also whether disposal of nappy liners labelled as 'flushable' is consistent with water utility policy. Modern reusable nappies are much more sophisticated in construction than the terry towelling many of us will remember. Numerous different designs are on the market and they can be made from hemp or bamboo fabrics, microfibre, cotton, or a combination. Advice as how best to wash them, as provided by the various manufacturers and online consumer groups, is often conflicting and confusing. This is compounded by the different washing machine designs, wash programmes, choice of detergent (its formulation and instructions for use), and the types of water ("hardness") encountered.

The prime objective is to achieve efficient and hygienic washing, with optimum use of resources, but without leaving residues which affect absorbency or cause skin irritation, while at the same time resulting in minimal damage to the reusable fabrics. There is an incentive for environmentally-conscious parents to opt for reusable nappies, especially if clear, evidence-based advice can be provided, since use of reusable nappies can work out cheaper than buying disposable nappies, while also significantly reducing waste going to landfill. A baby will use over 4,000 nappies before it is potty trained, and an average of 5,000 in total. A study by DEFRA published in 2007 gives a figure of 2.5 billion disposable nappies sold in the UK each year which forms some 2-3% of our household waste at approximately 400,000 tonnes, with disposable nappies accounting for approximately 95% of the nappy market. Optimising the method of washing and drying can also save energy, thereby cutting carbon emissions as well as reducing water consumption. Support for this project conforms to RSC's commitment to supporting the goal of helping the chemical science community to create a more sustainable future.

Project progress can be followed on the Nappy Science Gang website:

https://nappysciencegang.wordpress.com/

Alan Tetlow Bursaries

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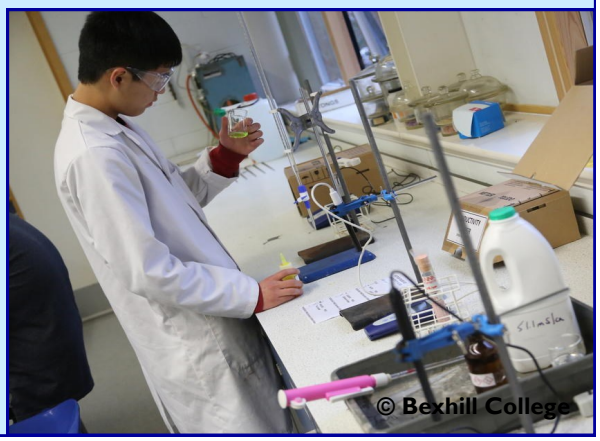
Bexhill college

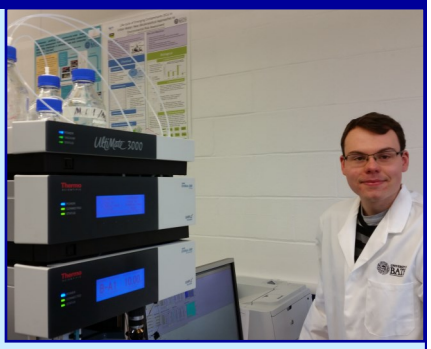
We at Bexhill College's extracurricular Science Academy are extremely grateful for the generous bursary awarded to us by WSF. In the first instance, this has made the Gold Crest Award Project by one of our students possible; Jeonghoon Kim has chosen to investigate the various methods to desalinate sea water and has used equipment bought using the bursary to analyse the conductivity and chloride content of the water pre- and post-distillation, as a measure of change in salt concentration. He has done this through calibrated conductivity readings and through titrations against silver nitrate. He has also monitored how the dissolved oxygen content of water varies through distillation to ensure that desalinated water is suitable for freshwater marine life.

He is currently researching osmotic techniques and molecular sieves, and hopes to continue with this project beyond his Crest Award and into his Year 13 studies. Because of this exposure to experimental Chemistry, Jeonghoon's enthusiasm for the subject has blossomed. He then went on to represent the college at our local heat of the RSC Schools Analyst competition and to enter the Cambridge Lower 6th Chemistry Challenge. He will be applying for a Chemistry degree at Oxford.



Jack Rice, University of Bath

I applied for the Alan Tetlow bursary in the summer of 2015, with hopes of using it to attend and present at the interdisciplinary conference *Testing the Waters II*, which was being hosted at the conference centre Monte Verità in Switzerland. Applying for the bursary was very straight forward and I was kept informed throughout the decision making process. Receiving the award helped to cover the costs of attending the conference and allowed me the chance to present my work at a large gathering, of a niche field of water analysts. *Testing the Waters II* was the second, in what is hoped to be, a series of conferences focussing on advances in the use of wastewater analysis for epidemiology.



Wastewater based epidemiology aims to quantify analytes present in wastewater, with the aim of understanding trends within and characteristics of a population. Most of the research presented at the conference was focused on quantifying the consumption of traditional drugs of abuse, such as ecstasy or amphetamine, in various communities across Europe, North America, Australia and New Zealand. Other presentations covered topics as diverse as the ethics of sewage monitoring, trends in UK drug use and statistical modelling, necessary for accurate application of wastewater analysis for epidemiology.

The bursary allowed me to present the initial results of my PhD, which focusses on the novel application of wastewater epidemiology, to the analysis of proteins in wastewater, for human health monitoring. The Alan Tetlow bursary was instrumental in allowing me the chance to introduce and help establish both myself and my work within the wastewater epidemiology community. Having had the opportunity to present at an early stage in my PhD, I am hopeful that such exposure will greatly benefit my research and my working relationships with other researchers.

Forthcoming WSF events in 2016

WSF are organizing a number of events for 2016. Please check out the website for further details:

http://www.rsc.org/Membership/Networking/InterestGroups/WaterScience/ForthcomingEvents.asp

Famous water quotes!

"*When the well is dry we will know the worth of water.*"
Benjamin Franklin

"*Water is the driving force of all nature.*"
Leonardo da Vinci

"*It's a strange world of language in which skating on thin ice can get you into hot water.*"
Franklin P. Jones

"*The rain water enlivens all living beings of the earth both movable (insects, animals, humans, etc.) and immovable (plants, trees, etc.), and then returns to the ocean, its value multiplied a million fold.*"
Chanakya

The Newsletter of the Royal Society of Chemistry Water Science Forum

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Alan Tetlow Bursary

In memory of Alan Tetlow the Water Science Forum bursary will help post graduate students, young (under 35) or professional water scientists during the first 10 years of their career.

Contact: Hon Sec, RSC Water Science Forum, Thomas Graham House, Science Park, Milton Road, Cambridge, CB4 0WF, UK

Join the Committee

We are always keen to recruit new personnel to the Committee. All Water Science Forum members are eligible. Vacancies usually arise at the end of each year and elections are held if necessary. The Water Science Forum fully support the Royal Society of Chemistry's policies regarding equality and diversity.

If you wish to be considered for election to membership of the WSF Committee please contact the Hon. Secretary who will advise you accordingly.

Emerging Frontiers for Sustainable Water, Johannesburg, 2015

Richard Allan and Graham Mills

The Department of Applied Chemistry /Institute of Nanotechnology and Water at University of Johannesburg, in Collaboration with Indian Institute of Technology, Madras India worked with a number of institutes (The Royal Society of Chemistry, The Indian Institute of Science, and others) to deliver the "Third Conference and Exhibition on Emerging Frontiers For Sustainable Water: A Trilateral Partnership Africa-India-UK". The event was held at Protea Hotel Wanderers, Johannesburg on 3-5 August 2015. This event brought together internationally renowned scientist operating within the water sector.

The conference covered a wide range of topics which included:

- Issues in water quality (both groundwater and surface water)
- Drinking water testing and purification: the science and emerging technologies from laboratories
- New products/services/technologies from Industries
- Wastewater Management- monitoring and treatment technologies
- Water and Sanitation challenges
- Water and health issues
- Water and the rural communities
- Needs of Industry, Municipalities and Policymakers
- Policy development in water including catchment areas
- Supply demand balance

The scientific programme included a formal exhibition and posters evening, on the 4 August 2015, where companies and service providers within the water sector showcased their innovations. The international nature of the conference enhanced the impact of the event and extended the reach of the knowledge exchange activity. A number of opportunities for collaborative working were identified through networking, discussion and active participation in the conference which will be taken forward. The RSC was well represented, with Prof Graham Mills giving an informative presentation on passive sampling of water bodies and Richard Allan giving a detailed overview of catchment modelling. The output of the conference will deliver collaborative research projects between the UK, Africa and India.

A question of taste?

Adrian Clark

While analytical measurements are essential in determining the quality of drinking water, we still rely on our own human senses in assessing its potability as well as palatability. Thus we make a subjective judgement of water quality according to how it tastes and smells. These two senses, which are intimately related, together with sight and mouth feel, give us our appreciation of food and drink, and provide what are known as the organoleptic properties.

Taste and smell have their own receptor organs, and it is the combined signals from both which our brain uses to recognise a flavour, but with the olfactory input generally predominating [1]. Thus food tastes different when the sense of smell is impaired, as anyone with a head cold can attest. Even the colour and type of cup can trick your taste buds according to some sensory researchers [2]. But could you be fooled through sight and smell alone into thinking you are drinking a sugary fruit juice instead of just plain water?

An inventor is now claiming to be able to do just that by infusing the polymer lining of a drinking cup with one of four scents to make plain water taste like fruit juice or soda. The cups have also been given colours to match the 'flavour': orange, lemon-lime, apple (green), and mixed berry (red). The Right Cup has opened a crowdfunding campaign with plans to launch the product in the U.S. early next year [3]. It remains to be seen whether consumers' tastebuds can be sufficiently convinced to fall for this ruse and whether use of autosuggestion might be sufficient to encourage us to turn to plain and healthy tap water instead of sugary drinks. Needless to say, this idea should not be considered as a means to mask any water supply which possesses an unacceptable taint or smell. This leads us rather neatly to mention a forthcoming workshop devoted to problems of taste and odour in tap water (causes and treatment) which the WSF Committee is proposing to hold in 2016.

Further details will be appearing on our website.

[1] http://www.brainfacts.org/sensing-thinking-behaving/senses-and-perception/articles/2012/taste-and-smell/
[2] http://www.scientificamerican.com/podcast/episode/cup-color-tricks-taste-buds-13-01-07/
[3] http://www.nstperfume.com/2015/11/16/scented-drinking-cups/