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PAN AFRICA CHEMISTRY NETWORK
WATER CHALLENGE WORKSHOP
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ABSTRACTS

THE GLOBAL FOOD AND WATER CRISIS: HOW DOES IT APPEAR IN AFRICAN BASINS?

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We are told the world faces a global-scale food and water crisis, in which increasing demand for food exerts ever greater pressures on already strained river basin systems. The argument seems plausible: agriculture consumes most of global freshwater resources; population is projected to grow substantially; agricultural activity is expected to increase to satisfy this greater population. But in more detail, the picture is more complex. Conditions within river basins reflect a combination of several factors: the development status of the region; the condition of water resources; the conversion efficiency with which food systems convert water into food and the institutional factors which govern them. This paper reports analysis from Africa and elsewhere of linked food and water systems. Analysis finds that while water scarcity can be a problem, greater obstacles to development seem to be the eco-efficiency of agricultural systems with respect to water, and their governance. The bad news is that land and water resources need to improve greatly to meet future demands; the good news is that there seems ample biophysical potential to do so. A reasonable goal might be to raise rainfed crop yields in Africa to a moderate 2 t/ha.

THE SODISWATER PROJECT: A MULTI-COUNTRY EVALUATION OF A POINT-OF-USE HOUSEHOLD WATER TREATMENT AND STORAGE TECHNOLOGY FOR USE THROUGHOUT THE DEVELOPING WORLD

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This presentation will examine several point-of-use household water treatment and storage (HWTS) technologies which would be appropriate for most regions within the developing world. Promising candidates for water remediation biotechnologies within the African arena will be discusses. Solar disinfection of drinking water (SODIS) will be highlighted as a HWTS

that was almost unheard of 10 years ago but is now in widespread use across the Globe. SODIS is a point of use household water treatment and storage (HWTS) technology where the available water is stored in ordinary transparent plastic bottles and placed in direct sunlight. After a minimum of 6 hours, the water is safe to drink. Dr McGuigan will report on the SODISWATER Project, which was a 4-year €2.7M multi-country study funded by the EU and Irish government that examined the health impact of SODIS. The project studied several aspects of the technology such as: (i) Health Impact of SODIS for children under age 5 years in S. Africa, Kenya, Zimbabwe and Cambodia; (ii) Enhancement technologies for increasing treated volume and/or speeding up treatment times; (iii) Dissemination strategies for encouraging communities without access to safe water to adopt HWTS technologies; (iv) identifying which microbial pathogens are susceptible or resistant to the treatment; (v) Evaluation of genotoxic risks associated with plastic photodegradation products that might leach into the water after prolonged use. The primary research outputs of the SODISWATER Project are presented and future avenues of research are discussed.

INNOVATION AND THE WATER CHALLENGE

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WATER QUALITY ISSUES IN AFRICAN RIVERS

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The quality of river water is an indication of the state of the environment in any country. Rivers are the major source of water in Africa. At the same time river water pollution is ubiquitous and contains high loads of biological, chemical and sediment deposits. Using the example of African rivers we find high coliform counts during the rainy seasons. This is due to the fact that storm waters are the detergent of the plains and bushes where human and animal waste is deposited. The coliform count during the dry season is low due to the fact that the source of biological deposits is the broken sewers and storm water pipes used for sewer disposal which become the major source of river water. Figure 1 gives the study of Nairobi River which shows that except for the river source spring at Ondiri swamp with coliform count of 200 per 100ml the other sites had counts of 1800 or more. The WHO guidelines for drinking water is zero count per 100ml. The high coliform counts in river water imply health problems for users of untreated water. Indeed diarrhoea diseases have become the major cause of morbidity and mortality for infants in Africa. The chemicals load in river water includes organic and inorganic chemicals, pesticides and agricultural chemicals. The majority of these chemicals may be removed by having green spaces between the rivers and the farms and construction of storm water soak ponds. Some chemicals with developmental consequences are also found in river waters. These include chemicals which have been introduced for commercial and industrial purposes like polychlorinated biphenyls (PCBs) whose presence in river waters are due to either careless disposal of electric transformer fluids or through air transport. Figure 2 shows the concentrations of PCBs in Nairobi river waters. The low levels are found at the sites with low industrial activities like spring source and residential areas. However, industrial sites show high concentrations of this chemical. It is important to note that some of the congeners of this chemical are endocrine disruptors and hence have long term effect to the users of untreated waters.

AFRICA'S WATER QUALITY: A CHEMICAL SCIENCE PERSPECTIVE

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Africa's Water Quality: A Chemical Science Perspective is a unique report summarising the conclusions and recommendations emerging from the Pan Africa Chemistry Network Sustainable Water Conference 2009. It represents the opinions and knowledge from some of Africa's best scientists and practitioners, from 14 countries in Africa, in the field of sustainable water research and development. The recommendations presented in the report specify 'fit for purpose' solutions for water wherever it is used: for drinking, for growing food, and to satisfy domestic and industrial needs. The chemical sciences will be crucial, in particular through centres for analytical chemistry for the evaluation and monitoring of water quality. The vital role that Africa's scientists must play in meeting water quality challenges cannot be overestimated. These challenges present the opportunity for genuine partnership and collaborations between scientific communities and governments, both across the African states and internationally. The ultimate goal of the report is to raise the profile of water quality in policy agenda, so that water quality is always considered alongside water quantity. To access a full version of the report, visit the Royal Society of Chemistry website. www.rsc.org/AfricasWaterQuality

Key messages and recommendations from the report

1. Scientists working within Africa have the knowledge, expertise and potential to help formulate and implement sustainable water strategies.
2. Increasing Africa's capacity in analytical chemistry is imperative in order to support chemical monitoring and water management activities. The creation of 'Centres of Excellence' will be essential to achieve a critical mass of scientifically qualified and technically trained personnel.
3. Improving water quality is a vital requirement for better public health, productivity and economic prosperity
4. Food production accounts for a large proportion of total water use. The conversion rates of water to food in Africa are amongst the lowest in the world. Efficiency of water use as well as land productivity must be improved whilst maintaining a sufficient source of good quality water for other purposes.
5. Governments must be responsible and accountable for providing sustainable water strategies and a framework to provide clean drinking water, sanitation services, and food.

MITIGATION OF GEOGENIC CONTAMINATION OF DRINKING WATER IN ETHIOPIA

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The Government of Ethiopia launched the Universal Access Plan (UAP) to ensure access to safe water and sanitation to all by 2012 in order to achieve the Millennium Development Goals (MDG). The Ministry of Water Resources is working towards this goal in collaboration with other stakeholders. But, contamination of drinking water with naturally occurring chemicals – especially fluoride – poses a public health threat for millions of people. This is

one of the major challenges and constraint towards the achievement of UAP/MDG in Ethiopia. It is reported that several wells failed to supply drinking water due to the presence of fluoride and other contaminants in many rural communities and urban centers in the Rift Valley. This presentation will examine an Integrated Project focuses on developing a framework for mitigation of the effects of the contamination of fluoride. The framework will allow government agencies and NGOs to make planning as well as providing practical mitigation measures. The framework consists of: (i) GIS mapping of fluoride distribution in groundwate, (ii) Assessment, optimization and improvement of fluoride removal technologies appropriate for Ethiopia and other countries as well, (iii) Development of GIS models for the prediction of alternative safe water resources and areas with possible geogenic contamination, (iv) Analyzing how these technologies can be situated within the social and institutional setting of the affected area, (v) Using psychological theories of behavioral change to identify effective strategies for the adoption of water treatment technologies, (vi) Strenghtening institutional capacity for implementation of mitigation measures and monitoring, (vii) Creation of awareness at all levels on fluoride and fluorosis. The project is financed by Swiss National Science Foundation, UNICEF Ethiopia, and Swiss Interchurch Aid (HEKS). Feleke Zewge will talk about both the research and implementation components of the project. The implementing partners are Ministry of Water Resources, Addis Ababa University, Swiss Federal Institute of Aquatic Science and Technology (EAWAG), Oromo Self Help Organization (OSHO), and regional Water Resources Bureaux. Currently, the project has achieved the following: (i) Development of household and community scale defluoridation technology based on Aluminium Oxide hydroxide which is scheduled for field testing on September 2010, (ii) Optimization of household and community scale defluoridation technology based on bone char and contact precipitation and field implementation at pilot scale in rural villages of Ethiopia, (iii) Implementation of defluoridation technology based on Nalgonda Technique in several villages in rural Ethiopia, (iv) Training of 3 PhD students at AAU and EAWAG and several Masters students, (v) Advanced training on integrated fluorosis mitigation approaches to experts working on water quality, public health, and hydrogeology in Government organizations and NGOs in Ethiopia, (vi) Technical and financial assistance to Regional Water Resources Bureaux in Ethiopia, (vii) Various awareness creation activities.

THE ROYAL SOCIETY OF CHEMISTRY

The RSC is an international learned society for advancing the chemical sciences and also the UK's professional body for chemical scientists. Supported by over 46,000 members worldwide and by an internationally acclaimed publishing business, RSC's activities span education and training, contributing to national and international science policy, conference organization and promotion of the chemical sciences to the wider public. RCS's relationships with leading national chemical societies and international companies place the RSC at the heart of a global network of 300,000 chemical scientists.

The RSC's headquarters are in London with a further office based in Cambridge. Other RSC offices are located in China (Beijing and Shanghai), in the USA in Philadelphia and in 2010 an office will be opened in Bangalore, India.

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PAN AFRICA CHEMISTRY NETWORK

The Pan Africa Chemistry Network (PACN) was set up by the Royal Society of Chemistry, with a special focus on the Millennium Development Goals aimed at advancing the chemical sciences across Africa, and represents an innovative approach to working with universities, schools, scientists, teachers, and students. The PACN is engaging with chemical societies throughout Africa, together with the Federation of African Chemical Societies. A coordinated approach is crucial to success. The PACN, with the support of Syngenta has established regional hubs in Ethiopia, Kenya and RSC has increased the existing collaboration with universities and other partners in South Africa. These can respond to the local needs of scientists whilst building extensive relationships across the continent.

The PACN seeks to create a self-sustaining science base in Africa, and it is encouraging the application of best practices to solving local challenges and enabling contributions to global scientific knowledge. It aims to:

- enhance collaboration between governments, universities, industry and communities;
- support the establishment of a sustainable science base across the continent, which attracts students to scientific careers and promotes public appreciation of the role of chemical science in Africa's future;
- disseminate information to researchers and entrepreneurs about available funding opportunities;
- coordinate support for education at all levels, from low-cost practical school teaching to training researchers in the use of modern research instruments;
- encourage the development of 'Centres of Excellence' through the installation of modern analytical technologies and coordinated training.

www.rsc.org/pacn