Supportive Environments for Healthy Communities

Issue 49 March 30, 2012 | Focus on Nanotechnology

Nanotechnology has introduced a new generation of water filters and purification systems. Though much of the research is still at the laboratory stage, some simple, cost effective technologies incorporating nano-materials have reached the market. This issue of the WASHplus Weekly contains some of the most recent studies, reports and videos on this topic. Included are a DFID report on the market potential of nanotechnologies, reviews by IFPRI and OECD on water nanotechnologies and a SCIDEV website feature on the progress, potential and possible risks of water nanotechnologies.

Please let WASHplus know at any time if you have resources to share for future issues of WASHplus Weekly or if you have suggestions for future topics. An archive of past Weekly issues is available on the WASHplus website.

REPORTS

- **Agriculture, Food, and Water Nanotechnologies for the Poor: Opportunities and Constraints**, 2011. G Gruère, International Food Policy Research Institute (IFPRI). (Policy Brief) | (Full-text report)
  Despite their promise, agricultural and food nanotechnologies, especially those that could reduce poverty or increase food and nutrition security, will likely face many challenges in each step of development. This brief presents a review of the potential opportunities and challenges of using nanotech applications for agriculture, food, and water in developing countries.

- **Access to Safe Water: Approaches for Nanotechnology Benefits to Reach the Bottom of the Pyramid**, 2011. K Lakshmi, DFID. (Full-text)
  The study found that nanotechnology has made huge strides in providing solutions for safe drinking water. However, the widespread roll out of these solutions, especially to the bottom of the pyramid (BoP), is impeded by a few barriers. The study found that nanotechnology research benefits can reach the BoP, through innovative and appropriate delivery models.

- **Fostering Nanotechnology to Address Global Challenges: Water**, 2011. OECD. (Full-text)
  This document reports on the key issues of water access; some important technologies for water purification and resource management; nanotechnology, water and industry; and key challenges. It is intended to address policy issues faced by both developed and developing countries. The document also identifies policy recommendations for consideration and adoption.

- **Market Potential Analysis for Water Purifier Using Nanotechnology for the Bottom of the Pyramid Market**, 2011. Development Alternatives. (Full-text)
  The study assessed the market potential of water purifier for the bottom of pyramid markets. Apart from interviewing the consumers and the dealers, the study analyzed the purifier market and also analyzed the scope of nanotechnology for water purification. Two-thirds of the purifier market is UV based, indicating that the low-cost, non-electric nanotechnology based purifier is not reaching the BoP population.

- **Nanotechnology Applications to Desalination: A Report for the Joint Water Reuse & Desalination Task Force**, 2011. T Mayer, Sandia National Laboratories. (Full-text)
  Because many traditional water treatment technologies depend on nanoscale processes, it is reasonable to expect one outcome of nanotechnology research to be better, nano-engineered water treatment approaches. The most immediate and possibly greatest impact of nanotechnology on desalination methods will likely be the development of membranes engineered at the near-molecular level.

JOURNAL ARTICLES/BLOG POSTS

- **Aluminum Nanoclusters in Coagulants and Granulates: Application in Arsenic Removal from Water**, *Rev Environ Sci Biotechnol, May 2011*. J Mertens EAWAG. (Full-text)
  In recent years, the unique properties of nanomaterials have received much attention in water treatment research, and their properties may make them suitable for arsenic removal. This contribution evaluates chemical properties of aluminum nanoclusters and their efficiency for water treatment, particularly for arsenic removal. It assesses the advantages and constraints when applied in an industrially produced aluminum coagulant or in aluminum granulate during water treatment.

- **Biological Approaches for Addressing the Grand Challenge of Providing Access to Clean Drinking Water**, *Jnl Biol Eng 5(2) 2011*. M Riley. (Full-text)
  This article discusses how biological engineers can address the challenge of providing access to clean drinking water. This issue must be addressed in part by removing or inactivating microbial and chemical contaminants in order to properly deliver water safe for human consumption. Despite many advances in technologies this challenge is expanding due to increased pressure on fresh water supplies and to new opportunities

for growth of potentially pathogenic organisms.

- **Cost-Effective Filter Materials Coated with Silver Nanoparticles for the Removal of Pathogenic Bacteria in Groundwater**, *Intl Jnl Env Health Res, Jan 2012*. L Mpenyana-Monyatsi, Tshwane University of Technology. (Full-text)
  In this study potentially low-cost filter materials coated with silver nanoparticles were developed for the disinfection of groundwater. Silver nanoparticles were deposited on zeolite, sand, fibreglass, anion and cation resin substrates in various concentrations. The results suggest that the filter system can be used as a potential alternative cost-effective filter for the disinfection of groundwater and production of safe drinking water.

- **Device for Harvesting Energy and Water from Human Wastes Gets Green Light**, a post to the WASHplus Innovation Exchange Blog, Mar 26, 2010. (Blog post)
  A project from a team of researchers from Imperial College London, the University of Manchester and Durham University will receive funding from the Bill and Melinda Gates Foundation to develop a prototype system for recovering drinkable water and harvesting hydrogen energy from human faecal waste. The researchers say that the device will be portable, allowing installation in homes and remote locations. The technology is based on a porous scaffold that holds bacteria and metal nano-particles.

- **Electrochemical Multiwalled Carbon Nanotube Filter for Viral and Bacterial Removal and Inactivation**, *Env Sci & Tech, May 2011*. C Vecitis, Yale University. (Full-text)
  This study demonstrates the efficacy of an anodic multiwalled carbon nanotube (MWNT) microfilter toward the removal and inactivation of viruses (MS2) and bacteria (E. coli). In the absence of electrolysis, the MWNT filter is effective for complete removal of bacteria by sieving and multilog removal of viruses by depth-filtration. Advantages of the electrochemical MWNT filter for pathogen removal and inactivation and potential for point-of-use drinking water treatment are discussed.

- **Evaluation of a Low-Cost Ceramic Micro-Porous Filter for Elimination of Common Disease Microorganisms**, *Physics & Chemistry of the Earth, 36(14-15) 2011*.J Simonis, University of Zululand. (Abstract)
  In this research project, the microbiological quality of the water processed by a low cost, newly developed micro-porous ceramic filter is evaluated. A low cost, micro-porous ceramic water filter with micron-sized pores was developed using the slip casting process. Naturally occurring water from two streams and a lake containing different species of bacteria was used in testing the ceramic filter's effectiveness in eliminating bacteria. The filter proved to be effective in providing protection from bacteria and suspended solids found in natural water.

- **Identifying Nanotechnology-Based Entrepreneurial Opportunities in Line**

with Water-related Problems, *Middle East Jnl Sci Res 8(2) 2011*. S Hejazi. (Full-text)
This paper categorized some entrepreneurial opportunities in line with nanotechnology and water-related problems. Some of these opportunities arise from demand pull for detecting and removing pollutants from water and the others come from technology push. In each category there are several sub-categories of nanomaterials for solving water problems.

- **Nanotechnology for Clean Water: Facts and Figures**, SCIDEV feature, May 2009. (Link)
This website feature provides a useful overview of nanotechnology for water treatment up to 2009 and also discusses the potential, progress and some of the risks.

- **Nanotechnology-Enabled Water Treatment and Reuse: Emerging Opportunities and Challenges for Developing Countries***, Trends in Food Sci & Tech, Nov 2011*. J Brame, Rice University. (Abstract)
Nanotechnology shows great promise as a feasible means of treating both long-standing and emerging water contaminants, as well as enabling technologies such as desalination of seawater to increase water supply. However, some engineered nanomaterials could also become water pollutants that threaten public and ecosystem health. Accordingly, this paper considers both the applications and implications of nanotechnology within the context of water quality and water security for developing countries.

- **Photocatalytic Enhancement for Solar Disinfection of Water: A Review,** *International Journal of Photoenergy, 2011*. J. Byrne, Nanotechnology and Integrated BioEngineering Centre. (Full-text)
Solar disinfection (SODIS) is a simple and low cost technique used to disinfect drinking water, where water is placed in transparent containers and exposed to sunlight for 6 hours. There are a number of parameters that affect the efficacy of SODIS, including the solar irradiance, the quality of the water, and the nature of the contamination. One approach to SODIS enhancement is the use of semiconductor photocatalysis to produce highly reactive species that can destroy organic pollutants and inactivate water pathogens. This paper presents a critical review concerning semiconductor photocatalysis as a potential enhancement technology for solar disinfection of water.

VIDEOS

- **IBM Makes Water Clean With Smarter, Energy-Efficient Purification** – (Video) 2 min
Scientists at IBM Research, together with collaborators from Central Glass, the King Abdul Aziz City for Science and Technology, and the University of Texas, Austin have created a new membrane that filters out salts as well as potentially harmful toxins in water such as arsenic while using less energy than other forms of water purification.

- **Making a Nano-Water Filter for the Developing World**, Stanford University – (Video) 3 min
  Researchers at Stanford University in Palo Alto, California, are developing a filter that rapidly kills bacteria in water. The researchers hope their filter will be used in the developing world, where at least one billion people lack access to clean water.

Each WASHplus Weekly highlights topics such as Urban WASH, Indoor Air Pollution, Innovation, Household Water Treatment and Storage, Hand Washing, Integration, and more. If you would like to feature your organization's materials in upcoming issues, please send them to Dan Campbell, WASHplus knowledge resources specialist, at dacampbell@fhi360.org.

About WASHplus - WASHplus, a five-year project funded through USAID's Bureau for Global Health, creates supportive environments for healthy households and communities by delivering high-impact interventions in water, sanitation, hygiene (WASH) and indoor air pollution (IAP). WASHplus uses proven, at-scale interventions to reduce diarrheal diseases and acute respiratory infections, the two top killers of children under five years of age globally. For information, visit **www.washplus.org** or email: **contact@washplus.org**.