
**Issue 14 July 1, 2011 | Focus on Household Water Treatment and Safe Storage**

This *WASHplus Weekly* contains 11 recent articles and reports on household water treatment. A June 2011 study in Zambia found that safe-storage practices that minimize recontamination may be more effective in managing the risk of disease from drinking water at a fraction of the cost of boiling. A PATH Safe Water project matrix provides a useful landscape of HWTS both presently existing and under development by numerous researchers and manufacturers. Videos from Bolivia and India show consumers' opinions and use of HWTS products. Please contact WASHplus if you have suggestions for future Weekly topics or items to feature.

**JOURNAL ARTICLES**

- **Assessing the Microbiological Performance and Potential Cost of Boiling Drinking Water in Urban Zambia**, IN: *Environ Sci Technol. 2011 Jun 23*. R. Psutka, London School of Hygiene and Tropical Medicine. (Link to abstract)
  A six-week study in peri-urban Zambia assessed the microbiological effectiveness and potential cost of boiling among 49 households without a water connection who reported "always" or "almost always" boiling their water before drinking it. Evidence suggests that water quality deteriorated after boiling due to lack of residual protection and unsafe storage and handling. The potential cost of fuel or electricity for boiling was estimated at 5% and 7% of income, respectively. In this setting where microbiological water quality was relatively good at the source, safe-storage practices that minimize recontamination may be more effective in managing the risk of disease from drinking water at a fraction of the cost of boiling.

- **The Efficacy of Simulated Solar Disinfection (SODIS) against Ascaris, Giardia, Acanthamoeba, Naegleria, Entamoeba and Cryptosporidium**, IN: *Acta Trop. 2011 May 27*. W. Heaselgrave, University of Leicester. (Link to abstract)
  The antimicrobial activity of simulated solar disinfection (SODIS) in the presence and absence of riboflavin against various protozoa and helminth organisms was investigated in this study. With Acanthamoeba, Naegleria, Entamoeba and Giardia exposure to SODIS at an optical irradiance of 550Wm(-2) for up to 6 hours resulted in significant inactivation of these organisms. The addition of riboflavin to this system

significantly increased the level of inactivation observed with cysts of A. castellanii. With Cryptosporidium oocysts and Ascaris ova exposure to SODIS in the presence and absence of riboflavin for 6-8 hours resulted in a negligible reduction in viability of both organisms. In this present study we have been able to show that SODIS is effective against a variety of previously untested waterborne organisms and with A. castellanii cysts the addition of micro-molar concentrations of riboflavin can enhance cyst inactivation.

- **Impact of a Natural Coagulant Pretreatment for Colour Removal on Solar Water Disinfection (SODIS)**, IN: *Jnl Water, Sanitation Hygiene Dev. (1)1 2011*. S. Wilson, University of Toronto. (Link to abstract)
  This work investigates the impact of source water color on SODIS efficiency and evaluates a natural coagulant for color removal. The ability of Moringa oleifera seed emulsion to both clarify and decolorize source waters was investigated as a coagulation pretreatment for SODIS. This coagulant reduced the color by more than two-thirds and achieved up to 90% (1-log10) bacterial removal. The combined Moringa oleifera coagulation-SODIS treatment sequence was tested in highly colored natural source water and was found to reduce the sunlight exposure time required by up to 2 hours.

- **Purification of Household Water Using a Novel Mixture Reduces Diarrhoeal Disease in Matlab, Bangladesh**, IN: *Trans R Soc Trop Med Hyg. June 2011*. M. Islam, International Centre for Diarrhoeal Disease Research, Bangladesh (ICDDR,B). (Link to abstract)
  This pilot study was conducted to determine the acceptability and effectiveness of a recently developed surface water purifying mixture to prevent diarrhoeal diseases in a rural community in Bangladesh. The mixture, using a combination of alum potash, bleaching powder and lime, is added to 15 liters of surface water and mixed; the water becomes suitable for drinking after 30 minutes. A total of 420 households from 15 villages were provided with the mixture and were taught how to use it. A total of 83 diarrheal patients were treated at Matlab Hospital from 1613 control families, but only one patient was treated for diarrhea from among the intervention families. Among the intervention families, 73 families decided to shift from using tube well water to surface water using the mixture. The mixture could be used as a cheaper, easier and simpler point-of-use water treatment strategy in Bangladesh.

- **A Qualitative Assessment of Beliefs, Attitudes, and Behaviors Related to Diarrhea and Water Filtration in Rural Kenya**, IN: *American Journal of Public Health, June 2011*. T. De Ver Dye, Syracuse University. (Link to abstract)
  This study assessed beliefs, attitudes, and behaviors related to diarrhea and water filtration in rural Kenya. A public health campaign was conducted in rural western Kenya to give community members a comprehensive prevention package of goods and services, including a personal water filter or a household water filter (or both). Participants provided positive reports of their experiences with using filters and of their

success with obtaining clean water, reducing disease, and reducing consumption of resources otherwise needed to produce clean water. Novel water filtration devices distributed as part of a comprehensive public health campaign rapidly proved acceptable to community members and were consistent with community practices and beliefs.

- **Small-scale and Household Methods to Remove Arsenic from Water for Drinking Purposes in Latin America**, IN: *Sci Total Environ. June 2011*. M. Litter Comisión Nacional de Energía Atómica. (Link to abstract)
  Small-scale and household low-cost technologies to provide water free of arsenic for drinking purposes, suitable for isolated rural and periurban areas not connected to water networks in Latin America, are described. Some of them are merely adaptations of conventional technologies already used at large and medium scale, but others are environmentally friendly emerging procedures that use local materials and resources of the affected zone. The technologies require simple and low-cost equipment that can be easily handled and maintained by the local population. The methods are based on the following processes: combination of coagulation/flocculation with adsorption, adsorption with geological and other low-cost natural materials, electrochemical technologies, biological methods including phytoremediation, use of zerovalent iron and photochemical processes.

- **Virus Attenuation by Microbial Mechanisms During the Idle Time of a Household Slow Sand Filter**, IN: *Water Res. May 2011*. M. Elliott, The Water Institute at UNC, Department of Environmental Sciences and Engineering, University of North Carolina at Chapel Hill. (Link to abstract)
  When observed over a 7-10 week period, suppression of microbial activity by sodium azide eliminated virus reduction during the idle time, indicating that the operative media aging process was microbially mediated. The mechanism of virus reduction was not modification of media surfaces by physical/chemical or microbial processes. Instead, it appears that the activity of the microbial community within the filter is responsible. Implications of these findings for filter design and operation and their relevance to other biological filtration technologies are discussed.

- **Virus Removal Efficiency of Cambodian Ceramic Pot Water Purifiers**, IN: *Journal of Water and Health (9)22011*. H. Salsali**,** University of Guelph. (Link to abstract)
  Virus removal efficiency is described for three types of silver-impregnated, ceramic water filters (CWFs) produced in Cambodia. The tests were completed using freshly scrubbed filters and de-ionized (DI) water as an evaluation of the removal efficiency of the virus in isolation with no other interacting water quality variables. Removal efficiencies between 0.21 and 0.45 log are evidenced, which is significantly lower than results obtained in testing of similar filters by other investigators utilizing surface or rain water and a less frequent cleaning regime. Other experiments generally found

virus removal efficiencies greater than 1.0 log. This difference may be because of the association of viruses with suspended solids, and subsequent removal of these solids during filtration. Variability in virus removal efficiencies between pots of the same manufacturer, and observed flow rates outside the manufacturer's specifications, suggest tighter quality control and consistency may be needed during production.

**REPORTS**

- **Addressing Water Quality Issues in Rural Cameroon with Household Biosand Filters**, 2011. L. Klopfenstein. Engineers Without Borders. (Link to full-text)
  This paper describes an ongoing collaboration between the Hope College student chapter of Engineers Without Borders – USA and the rural community of Nkuv in the Northwest Province of Cameroon related to improving drinking water quality using Manz Biosand filters. Results from microbiology testing of the constructed filters indicate that this water treatment method is effective for improving water quality in rural areas. The critical finding from this study is that transferring this technology in rural settings in developing countries may require years of iterative intervention and site specific adjustments to the construction and distribution model.

- **Global Landscape of Household Water Treatment and Safe Storage Products**, 2010. PATH. (Link to full-text)
  This matrix portrays a global landscape of technologies both presently existing and under development by numerous researchers and manufacturers.It reflects the complexity of making choices regarding the use of HWTS in various geographies with variable source waters and user needs.

- **Impact and Determinants of Community Level SODIS Interventions: Experience from a Community Randomised Trial on Solar Water Disinfection**. 2011. A. Christen, University of Basel. (Link to full-text)
  The main goal of this research was to assess the effectiveness of a Latin American community level SODIS dissemination program in reducing child diarrhea and the determination of factors related to the adoption of SODIS among the population. The analysis revealed that households that were more likely to use SODIS were those that participated more frequently in SODIS promotional events, included women, owned latrines, and had severely wasted children living in the home. Those household-level factors are easily assessable indicators that SODIS program managers could use to identify early adopters in SODIS promotion campaigns. In summary, this study demonstrates that the SODIS-method promoted in a typical rural Bolivian setting was not effective in reducing diarrheal disease in children under 5 years, despite a comprehensive SODIS-dissemination of a local non-governmental organization. This research suggests that additional work is needed to better understand how the well-established laboratory efficacy of this household water treatment method translates into field effectiveness under various cultural settings.

**VIDEOS**

- **Bolivia - Biosand Filter Interview**, 2010. (Link to video)**-** An interview of a resident of Tacachia, Bolivia about their Biosand filter. Previously, EWB-Missouri University of Science and Technology had constructed filters to clean the community's drinking water.

- **HydraVita - High-Speed Water Filtration System for Developing Countries,** 2011. (Link to video) HydraVita is a third prize winner in a university design competition.

- **PATH Safe Water Project: User Testing**, 2010. (Link to video) A woman posing as a traveling salesperson displays the AquaSure household water treatment product to a family in Attapur.

- **PATH Safe Water Testing**, 2011. (Link to video) A study participant and a researcher discuss the AquaSure water treatment product three days after its installation.

- **Potters for Peace Ceramic Water Filter Part 2**, 2011. (Link to video) This slideshow introduces the Potter for Peace Ceramic Silver Water Filter.

- **A Remarkable and Inexpensive Way to Produce Clean Water**, 2011. (Link to video) An ACF International staff member gives a brief presentation on how something as simple as a Biosand filter can transform dirty and unhealthy water into clear and healthy water.

- **SODIS/WATSAN Project News on Vietnamese Television**, 2011. (Link to video) The news show is about a Helvetas project that purifies water with solar energy and creates awareness of hygiene and sanitation in the Mekong Delta.

*WASHplus Weeklies* will highlight topics such as Urban WASH, Indoor Air Quality, Innovation, Household Water Treatment and Storage, Handwashing, 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@aed.org.

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**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 quality (IAQ). 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 contact: **washplus@aed.org**.