Household Water Treatment Options in Developing Countries: Flocculant/Disinfectant Powder

CDC
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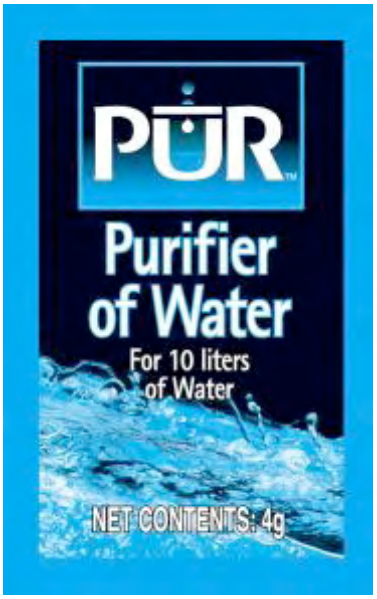
Household water treatment and safe storage (HWTS) interventions are proven to improve water quality and reduce diarrheal disease incidence in developing countries. Four of these proven HWTS options – chlorination, solar disinfection, ceramic filtration, and flocculation/disinfection – are widely implemented in developing countries. Organizations wanting to develop HWTS programs are often faced with the difficult decision of selecting which option or options are appropriate for their particular circumstances. The most appropriate HWTS option for a location depends on existing water and sanitation conditions, water quality, cultural acceptability, implementation feasibility, availability of HWTS technologies, and other local conditions. This series of fact sheets is designed to assist organizations in comparing, and ultimately selecting, the appropriate proven HWTS option or options. For more information on household water treatment, please visit www.who.int/household_water. For more information on the flocculant/disinfectant powder PUR Purifier of Water™, please visit www.csdw.org/index.shtml or www.pghsi.com/safewater.

Flocculant/Disinfectant Powder

The Procter & Gamble Company (P&G) developed PUR Purifier of Water™ in conjunction with the Centers for Disease Control and Prevention. PUR sachets are now centrally produced in Pakistan, and sold to NGOs worldwide at a cost of 3.5 cents per sachet. The PUR product is a small sachet containing powdered ferric sulfate (a flocculant) and calcium hypochlorite (a disinfectant). PUR was designed to reverse-engineer a water treatment plant, incorporating the multiple barrier processes of removal of particles and disinfection.

To use PUR, users open the sachet, add the contents to an open bucket containing 10 liters of water, stir for 5 minutes, let the solids settle to the bottom of the bucket, strain the water through a cotton cloth into a second container, and wait 20 minutes for the hypochlorite to inactivate the microorganisms.



Lab Effectiveness, Field Effectiveness, and Health Impact

The flocculant/disinfectant powder PUR has been proven to remove the vast majority of bacteria, viruses, and protozoa, even in highly turbid waters. PUR has also been documented to reduce diarrheal disease from 16 to greater than 90% incidence in five randomized controlled health intervention studies. In addition, PUR removes heavy metals, such as arsenic, and chemical contaminants, such as some pesticides, from water. Studies showing the efficacy of PUR have been conducted in the laboratory and in developing countries, in rural and urban areas and refugee camps, and include adults and children that are poor and/or using highly turbid water.

Benefits, Drawbacks, and Appropriateness

The benefits of flocculant/disinfectant powders are:

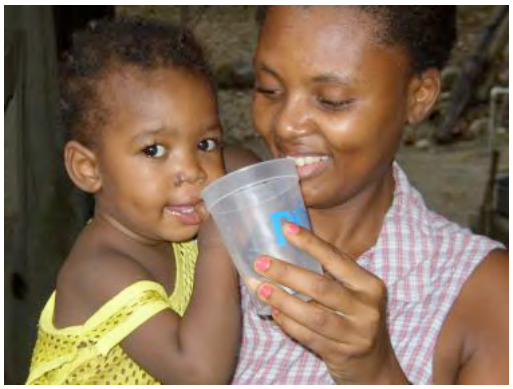
- Proven reduction of bacteria, viruses, and protozoa in water;
- Removal of heavy metals and pesticides;
- Residual protection against contamination;
- Proven health impact;
- Acceptable to users because of visual improvement in the water; and
- Sachets are easily transported due to their small size, long shelf life, and classification as non-hazardous material for air shipment.

The drawbacks of flocculant/disinfectant powders are:

- Multiple steps are necessary to use the product, which requires demonstration to teach new users;
- The need for users to have, employ, and maintain two buckets, a cloth, and a stirring device; and,
- The higher relative cost per liter of water treated compared to other household water treatment options.

PUR is most appropriate in areas with a consistent supply chain for sachet resupply, and in urban, rural, and emergency situations where educational messages can reach users to encourage correct and consistent use.

Selling PUR sachets in Haiti
(CDC, D. Lantagne)



Drinking water treated with PUR
(P&G, G. Allgood)

Implementation Examples

85 million sachets of PUR, treating 850 million liters of water, have been distributed in emergency response or sold through social marketing projects in 2003-2007. PUR has been made available in 23 countries with numerous partners using a variety of strategies, including:

- Social marketing organizations, such as the NGO Population Services International (PSI), sell PUR sachets in 9 countries.
- Local organizations use the social marketed PUR sachets in their own programming to provide safe drinking water. For example, in Western Kenya students in schools are taught how and why to use PUR, and safe water clubs treat drinking water for all the students. Also in Kenya, HIV self-help groups sell PUR sachets and storage containers as an income generating activity.
- PUR sachets have been widely used to respond to emergencies – from the 2004 tsunami in Indonesia to flooding in Haiti to cholera epidemics in Africa.
- The Procter & Gamble Children's Safe Drinking Water program has been given numerous awards, including the Ron Brown Presidential Award for Corporate Leadership in 2007, the EPA Children's Health Excellence Award in 2007, the Grainger Challenge Bronze Award in 2007, and the Stockholm Industry Water Award in 2005.

For more information on PUR programs, please visit www.csdw.org/index.shtml or www.pghsi.com/safewater.

Economics and Scalability

Each sachet of PUR is provided to global emergency relief organizations or non-governmental organizations at a cost of $0.035 (3.5 US cents), not inclusive of shipping from Pakistan by ocean container. Transport, distribution, education, and community motivation can add significantly to program costs. Sachets are generally sold at product cost recovery for 10 US cents each, for a cost of 1 US cent per liter treated. Currently, PUR projects operate either operate on partial cost recovery (charging the user only for the product, and subsidizing program costs with donor funds), or fully subsidized free distribution such as in emergency situations. Procter & Gamble sells the PUR sachets at cost, makes no profits on PUR sales, and donates programmatic funding to some projects.

Turbid water in Kenya treated with PUR
(P&G, G. Allgood)