Alethia Environmental

water quality analysis in the
developing and developed worlds

Executive Summary

Investigation of the Potters for Peace Colloidal Silver Impregnated Ceramic Filter
Report 1: Intrinsic Effectiveness

In September 2001, Jubilee House Community contracted with USAID to provide intrinsic and field investigations of the Potters for Peace (PFP) colloidal silver impregnated ceramic filter. Daniele Lantagne, MIT Lecturer in Civil and Environmental Engineering and Principal of Alethia Environmental, was hired to complete the work. Ms. Lantagne spent three weeks in Nicaragua in October 2001 conducting experiments on the filter and sampling water quality in homes using the filter. Further research was conducted in November and December 2001 with filters that were transported back to the United States. Report 2: Field Investigations, was completed in November 2001, and detailed the effectiveness of the filter in the homes. Report 1: Intrinsic Effectiveness researched variables related to filtration rate and colloidal silver effectiveness, as well as challenge testing of the filter with known contaminant concentrations. The following results were determined:

1. Filtration Rate Investigations

- The pore size within the PFP filter is 0.6-3.0 microns.
- Scrubbing of the filter rejuvenates the filtration rate, and should be undertaken periodically to increase the filter lifetime.
- *E. coli* is removed in a number of filters without colloidal silver application because the pore size is small enough to capture the *E. coli.* In addition, a significant fraction of total coliform and fecal coliform are removed without the colloidal silver, although it is not 100 percent removal. Thus, the colloidal silver is necessary for compete removal/inactivation of bacteria.

2. Colloidal Silver Investigations

- Application of colloidal silver to the filter does not affect the filtration rate or the pH and conductivity of the filtered water.
- Colloidal silver needs to be applied to both the inside and outside of the filter to achieve 100% bacterial inactivation.
- No sample from the first three runs of a number of filters, with filtration rates up to 2 Liters/hour and concentrations of Microdyn colloidal silver as high as 5 mL, exceeded USEPA or WHO standards for silver in drinking water.
- Colloidal silver manufactured for the naturopathic industry in the United States did not inactivate bacteria in the PFP filter, and it is recommended that PFP continue to use 2 mL of the industrial concentration (3.2 percent) of Microdyn.
- Filters as old as 7 years were tested and found to still remove 100% of total and fecal coliform, indicating that the lifespan of the colloidal silver is indefinite. However, the policy of reapplication every year that is recommended by PFP should not be abandoned without further testing, because it provides a important margin of safety.

3. Challenge Testing

- Microbiological challenges consistently show that many different variations of the filter all have effectively reduced bacterial indicators by 98-100 percent in the laboratory.
- Data from the arsenic challenge conducted by PFP showed a steep decrease in removal rate of arsenic with increasing amount of challenge water. Data from the pesticide and VOC challenge conducted for this study was inconclusive, but the general trend was the same as with the arsenic: a decreasing removal rate with increasing amount of challenge water.
- The one PFP filter tested achieved greater than a 4-log reduction of both *Cryptosporidium* and *Giardia.*
- The one PFP filter tested did not achieve a 1-log reduction of MS2 bacteriophage virus.

Based on these results, it is concluded that the PFP filter effectively removes and inactivates bacteria and bacterial indicators of disease-causing organisms. With the modifications recommended in Report 2, it is expected that the PFP filter could also reliably remove these organisms in the field. Preliminary results indicate that the PFP filter also removes protozoa, but not viruses. Further research is necessary to detail exact removal rates of protozoa, viruses, and contaminants. In addition, research is needed to determine the thickness of the colloidal silver layer within the ceramic. This will allow application of the mathematical model developed by Eriksen (2001), and a determination of the filter life based on removal of ceramic during the scrubbing process. Results to date indicate the filter life is indefinite, and currently decreasing flow rate and breakage are the limiting factors on filter life. Based on the results of Report 1 and Report 2, it is concluded that, with an education component for the users, the PFP filter is an effective and appropriate technology that improves both water quality and human health.

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