Investigation into Fabric-Enhanced Ceramic Candle Filters

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Background

Treatment of water at the point of source has been instrumental in reducing waterborne diseases in developing countries. However, water is often transported or stored by the user in a container that is contaminated (Clasen and Bastable 2003); this renders the efforts of treating the water less effective. The importance of safe storage and treatment at the point of use is now widely recognised with a number of systems in use around the world. Furthermore, studies have shown that household based treatment is more effective than earlier intervention at the point of source (Clasen, Roberts, et al 2007). One such household based system uses a simple ceramic candle filtration which is the subject of this investigation.

With large charities such as Oxfam distributing the ceramic candle filter systems this simple apparatus has the potential to assist in meeting the challenging Millennium Development Goal Target 10 – which aims to halve, by 2015, the proportion of people without sustainable access to safe drinking water and basic sanitation (United Nations 2006). However, a major hurdle to overcome when employing household based systems is that they rely largely on the users to undertake proper use and maintenance (Oxfam 2008). Ceramic candle filters require frequent cleaning as the pores become obstructed by particulates in suspension thereby decreasing the flow rate. The frequency of cleaning depends on the quality of the source water and the specific manufacturing of the filter; sometimes requiring cleaning as often as once a week. Due to their brittle nature, ceramic candles are prone to being damaged during handling; particularly during the routine cleaning process. If a ceramic candle becomes cracked the ability to reject harmful bacteria during filtration reduces and the user is put at risk. Users require training on this maintenance routine when the equipment is distributed.

Anything that can be done to increase the length of time that the filters can be used before cleaning is required will be beneficial. Decreasing the frequency of cleaning will reduce the risk of damage caused by handling. Simplifying the cleaning process by reducing the required handling of the ceramic candles will also enhance the effectiveness of this system. It is proposed that the scope for such enhancements be investigated.

Initial Concept

The initial concept for enhancing ceramic candle filters comes from previous successful studies of fabric enhanced slow sand filters. Research carried out on slow sand filters sought to use layers of fabric on top of slow sand filters to benefit in two ways:

- The simplification of filter cleaning by the removal and washing of the fabric alone
- The extension of filter run times by a lower rate of pressure head loss development within the fabric

(Graham and Mbwette 1987)

Through various trials it has been shown that sand filter run times can be increased by a factor of 8 compared with unenhanced slow sand filters (Graham and Mbwette 1991) and cleaning processes were simplified. Observing this success it is supposed that the same benefits can be expected when applying a similar approach to ceramic candle filters.

The theory of using a high porosity fabric to increase run times through a lower head loss rate combined with a large specific surface area to increase filterability is well established but can this be applied to ceramic candle filters in a practical manner?
Aims and Objective

With the initial concept conceived, the idea requires development into a workable project. To this end, the following aims and objective were set:

The overall objective of this investigation is to enhance ceramic candle filter systems by reducing the frequency of cleaning required and simplifying the cleaning process.

To achieve this objective the following aims have been set:

- Collect samples of various synthetic fabrics and investigate the porosity, filterability and other relevant properties of the fabrics for this application.
- Make fabric filters that fit over the ceramic candles and are practical to use;
- Develop an experiment for comparing the performance of the fabric-enhanced filters with conventional ceramic filters;
- Based on the experimental results and research determine optimal fabric properties based on performance, practicality and cost.

Results

Results of research to be presented at the conference.

Acknowledgements:

Many thanks to Dr. Caetano Dorea for the initial concept of fabric-enhanced ceramic candle filters.

References:


Oxfam (2008) Household Water Treatment and Storage. Technical Brief 4