

## Flow Statistics and the Scaling of Ceramic Water Filters

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### ABSTRACT

According to World Health Organization, there was increase in the number of people that have access to safe drinking water between 2006 and 2010. Such trends can be countered partly by the use of ceramic water filters that can remove microbial pathogens from water. However, the initial flow rates in such filters are often limited to ranges between 1 and 3 L/hr. The flow rates may vary statistically and decrease with increasing filter use. In this paper, the flow through ceramic water filters is characterized using Darcy's equation. An effective permeability is obtained for filters with a range of micro- and nano-scale pore sizes. The statistical variations in the flow rates and effective permeabilities are elucidated along with the potency of multiple filter system for scale-up studies in serving a community.

### 1.0 INTRODUCTION

It is estimated that 1.8 million deaths per year and 61.9 million disability adjusted life-years are attributed to the drinking of unsafe water, and poor sanitation [1]. The World Health Organization (WHO) also suggests that over 99.8% of the deaths are caused by unsafe water, sanitation and hygiene in developing countries [1]. Furthermore, most of the childhood mortality occurs in children that are less than five years old in developing countries [2].

Those that have access to improved waters may also experience contamination between the source of the improved water and the point-of-use. Hence the key is to ensure that people have access to improved water at the point-of-use. This is crucial for the achievement of the Millennium Development Goals (MGD) of halving countries the number of people without access to improved water supply and sanitation by the year 2015 [2]. To achieve this target, it important use point-of-use water purification methods [3] that can improve the health and well-being of people in rural/urban areas in the developing world.

Point-of-use treatment systems (PoUTS) [3,4] can be used to provide microbiological, chemical or physical water treatment. They include: (i) disinfection (chlorination, solar disinfection (SODIS) [5]; solar pasteurization; UV irradiation with lamps, and boiling), (ii) particle filtration (cloth fiber; ceramic filter, bio-sand and other slow sand filter technologies) [6]; (iii) adsorption media (granular activated carbon, and activated alumina, clay) [5,7]; (iv) combined system (combined flocculation and disinfection, filtration) [5,8] and (v) other approaches (plain sedimentation settling, safe storage, flocculation with iron or alum salts, membrane processes) [8,9]. Within the range of possible water treatment methods, water filters are one of the highly rated systems for the removal of turbidity [10-12], fluoride removal [7] and bacteria [10-13]. They are relatively inexpensive [10, 11].