Identifying Natural Flocculating Proteins for Affordable Anti-Microbial Sand Filters

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An estimated 2.5 billion people lack access to improved sanitation and 780 million people to improved water sources worldwide. This is due to the high expense and difficulty of traditional filtration methods. In these areas, slow sand filters are a possible alternate system, removing dissolved waste, protozoa, and microbes. Previous studies have shown that functionalizing the sand with extracts of Moringa oleifera seeds can improve microbial filtration. However, the presence of accessible, fruiting Moringa oleifera is limited to southeast Asia. This project attempted to increase the particulate removal capability of slow sand filters through functionalization with flocculating proteins found in naturally occurring sources, from other parts of the developing world. Opuntia ficus-indica, Ocimum basilicum, Ziziphus jujuba, and Salvia hispanica were used as alternatives to the Moringa oleifera chitin-binding protein. Seeds from these plants were crushed in water and the filtrate was used to functionalize silica glass beads, a sand analog. These beads were loaded into a filtration column and wastewater from a natural standing water source was allowed to filter through. Photographs of the water samples were taken under a microscope. A computational ImageJ analysis was done on the images to count and size detectable particulates. Compared to traditional sand filters, Moringa oleifera, Ziziphus Jujuba, and Opuntia ficus-indica functionalized filters demonstrated increased particulate removal and produced potable water exceeding the EPA's potable water standard. The use of these natural particulate-removing seeds may allow for the use of affordable household sand filters yearlong in impoverished regions worldwide without the need for pretreatment.

Awards Won:
First Award of $5,000