MODELING AND APPLICATION OF REDUCED HEIGHT BIOSAND FILTERS FOR HOUSEHOLD SCALE WATER TREATMENT

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Despite its widespread popularity as a useful point-of-use water treatment solution, the biosand filter (BSF) made from concrete, sand, and gravel has two inherent gaps in its design: (1) it is oversized relative to its performance, and (2) its heavy design (350-lbs. per filter) makes it difficult to reach remote audiences in need of clean water. The main objective of this study was to characterize the fluid flow and bacterial removal capabilities of two alternative designs of the v.10 CAWST biosand filter using a finite element approximation of Darcy's law with discrete time steps and a slow sand filtration model. A 40% and 70% reduced height filter from the traditional BSF were characterized while conserving the total filter area, reservoir volume, and vertical dimensions of the biolayer. Results suggested near 100% removal for the 70% reduced height design using medium-coarse, medium, and fine sand at full depth regardless of the biolayer maturation age, while the traditional filter design displayed the lowest efficiency of the three filters with 100% removal only using fine sand. These results can be used to improve the overall efficiency, ease of use, and accessibility of the biosand filter for communities living with inadequate water quality as a 70% reduced height design can lead to new construction methods; preliminary results of using wood ash as a cement alternative are further explored here.

PRESENTER BIO: James Phillips is a University of Florida senior Chemical Engineering major in the Land and Water Lab focusing on water quality in developing regions. He is the program lead of the UF Engineers Without Borders Nepal Program and wishes to continue pursuing water development in a Masters program.