Sustainable Colloidal-Silver-Impregnated Ceramic Filter for Point-of-Use Water Treatment

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Cylindrical colloidal-silver-impregnated ceramic filters for household (point-of-use) water treatment were manufactured and tested for performance in the laboratory with respect to flow rate and bacteria transport. Filters were manufactured by combining clay-rich soil with water, grog (previously fired clay), and flour, pressing them into cylinders, and firing them at 900 °C for 8 h. The pore-size distribution of the resulting ceramic filters was quantified by mercury porosimetry. Colloidal silver was applied to filters in different quantities and ways (dipping and painting). Filters were also tested without any colloidal-silver application. Hydraulic conductivity of the filters was quantified using changing-head permeability tests. $[^3H]H_2O$ water was used as a conservative tracer to quantify advection velocities and the coefficient of hydrodynamic dispersion. *Escherichia coli* (*E. coli*) was used to quantify bacterial transport through the filters. Hydraulic conductivity and pore-size distribution varied with filter composition; hydraulic conductivities were on the order of 10^{-5} cm/s and more than 50% of the pores for each filter had diameters ranging from 0.02 to 15 µm. The filters removed between 97.8% and 100% of the applied bacteria; colloidal-silver treatments improved filter performance, presumably by deactivation of bacteria. The quantity of colloidal silver applied per filter was more important to bacteria removal than the method of application. Silver concentrations in effluent filter water were initially greater than 0.1 mg/L, but dropped below this value after 200 min of continuous operation. These results indicate that colloidal-silver-impregnated ceramic filters, which can be made using primarily local materials and labor, show promise as an effective and sustainable point-of-use water treatment technology for the world's poorest communities.