Enhancing Water Access and Health in Drought-Affected Regions: A Study on Point-of-Use Water Treatment Intervention

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Abstract

This study examined the effectiveness of point-of-use (POU) filtration systems in enhancing water quality, focusing on microbial removal, growth, and metal removal. The results demonstrated that reverse osmosis (RO) membranes effectively eliminated *Legionella* at all tested concentrations (10-1,000/mL), whereas activated carbon (AC) filters exhibited negligible removal efficiency. Biofilm growth significantly reduced flow rate in AC filters. These findings highlight the importance of considering both contaminant removal efficiency and susceptibility to biofilm formation when selecting POU filters. A separate investigation assessed AC filters in removing heavy metals from high-salinity water, simulating conditions found in locations like Paraguay and Ecuador. Lead removal was excellent (>95%), while zinc removal was moderate and decreased in high-salinity environments. AC filters surprisingly excelled at chromium removal (>99%) regardless of salinity. Boron and manganese removal were minimal. Salinity significantly impacted zinc concentration after filtration. This study highlights the effectiveness of AC filters in removing heavy metals from high-salinity drinking waters, but their performance can vary depending on the specific metal. This study also explored the feasibility of using POU systems to enhance safe water access in drought-affected regions, such as the El Chaco region in Paraguay. The results indicated that high salinity and metal contamination were prevalent across water sources and existing water treatment infrastructure suffers from inadequate maintenance. However, locally available POU filters present a promising solution due to affordability and ease of use. Overall, the study suggests that POU filters hold significant potential for improving water access in drought-affected regions but require further evaluation and tailored implementation strategies.

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