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EMERGING CONTAMINANT REMOVAL BY POINT-OF-USE WATER TREATMENT TECHNOLOGIES

Under the Safe Drinking Water Act (SDWA), the United States Environmental Protection Agency (USEPA) sets legally enforceable levels which a contaminant known to cause negative human health effects cannot exceed in drinking water to protect public health.[1] Currently there are around 90 regulated contaminants, but USEPA monitors drinking water every five years to gather data on emerging contaminants that are not yet regulated but are suspected to pose a risk to public health. [2]

As one of the most widely detected emerging contaminants, per- and poly-fluoroalkyl substances (PFAS) have gained attention due to their persistence in the environment and associated health risks.[3] Other contaminants of emerging concern due to their wide detection and health concerns in drinking water are manganese, uranium, and Legionella pneumophila. Despite their frequent occurrence in drinking water, limited studies have been done to evaluate removal of these emerging contaminants by point-of-use (POU) technologies.

Results:

RO membranes removed between 97.8% to 99.9% of all PFAS tested, 95% to 97.8% of manganese, 96.6% to 99.8% of uranium, and 100% of *Legionella pneumophila*.[4]

Activated carbon filters effectively removed between 98.1% to 99.9% of all PFAS tested. Removal efficiencies of manganese, uranium, and *Legionella pneumophila* were, on average, below 30%. While the AC filters were not designed to remove them, it was observed that the tested filters partially reduced dissolved iron and effectively reduced trace level copper.[4]

Novel Finding Warrants Future Research:

Dr. Zhou found three statistically significant correlations and four observed positive correlations between PFAS removal efficiency and solubility out of 18 samples. These correlations indicated that PFAS solubility was a more accurate indicator than chain length to describe

Methods:

To address the knowledge gap, the Water Quality Research Foundation funded research conducted by Dr. Zhi (George) Zhou at Purdue University.[4]

Dr. Zhou systematically evaluated the removal of 3 PFAS chemicals (PFOS, PFBS, PFHxS), manganese, uranium, and *Legionella pneumophila* by POU devices.

Three unique POU reverse osmosis (RO) membranes and three unique activated carbon (AC) filters were tested in this study. A diagram of the POU device testing station is shown in Figure 1.

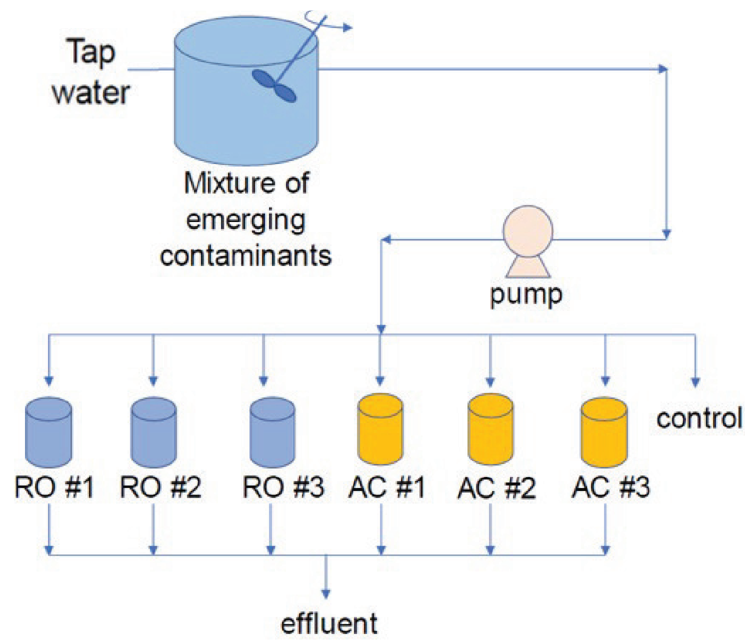

Figure 1: Schematic diagram of POU device testing.

removal efficiencies by RO membranes in the WQRF-funded study. Further POU mechanistic studies should be conducted to evaluate whether solubility is a better predictor of reduction as compared to carbon chain length for PFAS removal.[4]

Impact:

The knowledge generated from this research will help guide the water quality industry in developing cost-effective treatment devices and new ways of mitigating risks of emerging contaminants in drinking water.

References:

The full research report and executive summary can be accessed at WQRF.org/completed-studies.

1. EPA. (2017, March 8). *Secondary Drinking Water Standards: Guidance for Nuisance Chemicals*. Retrieved November 5, 2019, from: https://www.epa.gov/dwstandardsregulations/secondary-drinking-water-standards-guidance-nuisance-chemicals
2. EPA. (2018, January 24). *Learn About the Unregulated Contaminant Monitoring Rule*. Retrieved November 5, 2019, from: https://www.epa.gov/dwucmr/learn-about-unregulated-contaminant-monitoring-rule.
3. EPA. (2021, October 18). *PFAS Explained. PFOA, PFOS and Other PFAS*. Retrieved March 14, 2022, from: https://www.epa.gov/pfas/pfas-explained
4. Zhou, Z. (2022, January 4). *Emerging Contaminant Removal and Microbial Growth in Membrane Filtration and Activated Carbon POU Technologies*. Retrieved March 14, 2022, from: https://www.wqrf.org/completed-studies.html

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