RESEARCH BRIEF
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NAWI
National Alliance for Water Innovation

Electrocoagulation/Electrooxidation to Accelerate Cost-Effective Potable Water Reuse

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Challenge

Potable reuse of municipal wastewater to generate drinking water requires an intensive treatment train including disinfection, filtration, and advanced oxidation. Microbiological contaminant concentrations are tightly regulated to protect public health. States require stringent log reduction values for viruses demonstrating the need for technologies for their effective attenuation. Although chemical coagulation of wastewater has been shown to attenuate viruses,[1] it requires the transport, storage, and handling of corrosive chemicals that alter the water pH, necessitating additional chemical dosing of acids/bases to readjust the pH. Electrocoagulation (EC) is an alternative to conventional coagulation that can overcome these challenges. In EC, a sacrificial anode is oxidized to release coagulant precursors directly into the feedwater.[1,2] Many advantages of EC have not been practically realized because it has often been prematurely implemented without a thorough understanding of redox, electrochemistry, and performance mechanisms. We further hypothesize that combining EC with an electrooxidation (EO) step will enhance virus log reduction values and improve water quality.

Research Approach

The overarching goal of this project is to increase utilization of a non-traditional source water (municipal wastewater) for potable reuse by improving our understanding of how iron EC/EO processes can effectively mitigate viruses and improve membrane pretreatment. To this end, this research project will systematically evaluate how to optimize the iron EC/EO system to simultaneously generate coagulant and reactive oxidative species, to facilitate two independent mechanisms of virus attenuation: removal by coagulation and inactivation by oxidation, all while improving the quality of the wastewater effluent (e.g., removing organic matter). We will also focus on the process / energy efficiency of EC/EO. This effort will be facilitated by advanced spectroscopic, microscopic, and scattering techniques along with detailed technoeconomic analysis.

Impact

Research will be conducted synchronous with two other NAWI-funded EC projects. All three projects will share the same testing devices and characterization methods to ensure a synergistic approach to improving our understanding of EC. If successful, this project will facilitate a broader adoption of modular, scalable, and electrified treatment technologies by demonstrating that EC/EO can lower pretreatment costs, improve resiliency, and reduce the risks associated with production, transportation, storage, handling, and use of hazardous chemicals required for conventional coagulation and disinfection.

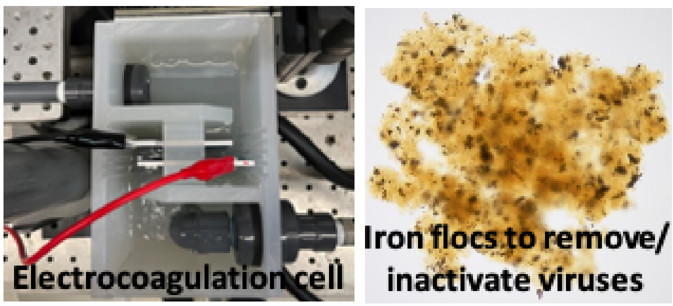

Figure 1. Conceptual representation of iron electrocoagulation for virus attenuation.

RESEARCH PARTNERS

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