UNIVERSITY OF RHODE ISLAND
Department of Chemistry
SEMINAR

Room 105 Beaupre
3:00 P.M., Monday, Jan. 31, 2022

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"Closing the Rural Water and Education Gaps with a Simple Advanced Oxidation Process"

HOST

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Closing the Rural Water and Education Gaps with a Simple Advanced Oxidation Process

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Rural communities in the United States face higher risks of drinking water quality violations and have less access to advanced STEM curricula compared to more populated areas. This work directly addresses these issues by focusing on rural water quality and STEM education inequality through the development of a simplified advanced oxidation process based on the activation of ferrate. Although advanced oxidation processes are of growing importance in water treatment they require complex systems for on-site generation making them inappropriate for many settings. The ferrate-sulfite advanced oxidation process (FeSAOP) shows promise as an effective yet simple way to transform recalcitrant organic pollutants. The rationale for this work is that current advanced oxidation processes are not accessible to all water systems and exploiting FeSAOP may close this gap. FeSAOP yields several radical species that rapidly oxidize contaminants while also offering simplicity of production, enabling rural water system use and compelling educational experiences. This presentation will cover several topics: (1) iron radical formation and fate via ultrafast spectroscopy; (2) the mechanism of FeSAOP, including byproduct formation and (3) the integration of research and education via a learning-through-research model.

Ultrafast spectroscopy results show that photoactivation of ferrate is possible, and leads to formation of iron radicals, including Fe(V) and Fe(IV). The formation of these radicals explains improvements in oxidative transformation of 1,4-dioxane and other recalcitrant organics in the FeSAOP system. Tradeoffs exist, however, and radicals formed by activation subsequently produce increased levels of bromate and other brominated oxidative byproducts. Results in the presentation will also include data generated by comparing ozone and FeSAOP in the context of an undergraduate environmental engineering laboratory class.