Clarkson University
Department of Chemical and Biomolecular Engineering
SEMINAR (Graduate Student Presentation)

"THE ROLE OF SURFACTANT IN THE DEGRADATION OF PERFLUOROBUTANE SULFONATE (PFBS) BY ELECTRICAL DISCHARGE PLASMA "

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20% of wastewater samples from public and private sources in Michigan were reported to contain perfluorobutane sulfonate (PFBS), a toxic compound that can potentially cause severe health defects in humans on exposure. PFBS has also been found at varying concentrations in groundwater and drinking water samples near fire-fighting training sites, industrial sites, and manufacturing sites. Electrical discharge plasma- an oxidative and reductive treatment technology- has proven to be highly effective for compounds that reside at the plasma-liquid interface due to the proximity of the compounds to the reactive species. However, due to PFBS's non-reactivity with oxidative species and its poor surface activity, it has been challenging to treat by conventional treatment methods. For non-surface-active compounds, applying plasma technology requires adding a surfactant, which binds to and aids the transport of the PFBS to the interface via argon bubbling, where it gets degraded. Preliminary results showed that the presence of a cationic surfactant improves the removal rate constant of PFBS from 0.002 min^{-1} to 0.06 min^{-1}. In this study, we investigate the role of the surfactant in the degradation of PFBS in the plasma reactor by testing different commercial and synthesized cationic surfactants. Depending on the molecular structures of the surfactants added, the removal rate constant of PFBS ranged between 0.01 min^{-1} and 0.28 min^{-1}, which ultimately affected its degradation at the plasma-liquid interface. Further analysis of PFBS liquid byproducts showed that the choice of surfactant could also influence its (PFBS) degradation mechanism. This study hopes to improve our understanding of maximizing PFBS interfacial concentration and its degradation at the plasma-liquid interface.

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Osakpolo Faith Isowamwen is a Ph.D. candidate working with Professor Selma Mededovic Thagard at Clarkson University. Her research is focused on treating long and short-chain poly-and perfluoroalkyl substances (PFAS) in FAB wastewater using electrical discharge plasma. Before graduate school, Faith earned her bachelor's degree in Chemical Engineering from Obafemi Awolowo University, Nigeria.