DEPARTMENT OF CHEMICAL AND ENVIRONMENTAL ENGINEERING
COLLEGE OF ENGINEERING AND APPLIED SCIENCE

RESEARCH OPPORTUNITIES FOR UNDERGRADUATE students

APPLICATION DEADLINE: 03/01/2022

PROJECT TITLE: A Novel Redox Material (FeSO3) for Efficient and Rapid Treatment of Concentrated PFAS Matrices

Physical Requirement: Be able to follow all safety all wet chemistry safety procedures

Project's Technical Skills Requirement: Experience/familiarity with water treatment processes; Experience working in a lab and using basic lab equipment (pipetting, dilutions, etc.); Basic chemistry knowledge

Project's Available Positions: Co-Op position for Spring 2023

Dionysios (Dion) D. Dionysiou, Ph.D.
Professor of Environmental Engineering and Distinguished Research Professor (STEMM)
Sustainable Solutions Laboratories (SSLs)
Center of Sustainable Urban Engineering Drinking Water, Water Supply, Quality, and Treatment, and Environmental Nanotechnology Laboratories Environmental Engineering and Science Program Department of Chemical and Environmental Engineering (ChEE) 705 Engineering Research Center University of Cincinnati Cincinnati, OH 45221-0012 Phone (513) 556-0724 Fax (513) 556-4162 Office Number: ERC 780 Email: dionysios.d.dionysiou@uc.edu

Project Description

The decades-long and extensive global use of per- and poly-fluorinated alkyl substances (PFAS) has led to their widespread contamination of aquatic systems. PFAS, often referred to as forever chemicals due to their incredible stability and persistence, have serious adverse effects on human and environmental health. We recently developed a unique iron(II) sulfite (FeSO3) material and demonstrated its incredibly powerful reductive and oxidative properties in the degradation of per- and poly-fluorinated alkyl substances (PFAS). Our primary investigations demonstrated rapid degradation of highly concentrated PFAS by this unique FeSO3 material in less than 10 mins without the need for any additional post-treatment, including incineration. The three
specific objectives for the project are as follows: (1) Perform fundamental mechanistic studies on FeSO$_3$ initiated redox degradation of PFAS, identify transformation/degradation products, and elucidate reaction pathways; (2) Investigate the effects of different water quality constituents present in the tested matrices on the performance of FeSO$_3$ redox materials for degradation of selected PFAS; and (3) Assess FeSO$_3$ redox materials for degradation of PFAS in real groundwater, retentate water from membranes, water from ion exchange resin regeneration, and AFFF–impacted waters. This research will be conducted in the Sustainable Solution Labs in the Department of Chemical and Environmental Engineering. You will work as part of a team that consists of members of Dr. Dionysiou’s lab and other collaborators from different universities, national research labs, and industry partners.

Preferred skills include:
- Experience/familiarity with water treatment processes
- Experience working in a lab and using basic lab equipment (pipetting, dilutions, etc.)
- Basic chemistry knowledge

Training provided:
- Lab on-boarding and safety training
- Water quality analysis instrumentation and procedures
- Material synthesis and characterization techniques
- Collaboration with academic and industry partners
- Potential for research publications and presentations