PROJECT TITLE: Sustainable Clay-Based Sorbent Materials for Selective Removal and Recycling of Nutrients from Agricultural and Municipal Wastewater

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

Dionysios (Dion) D. Dionysiou, Ph.D.
F. EurASc, F. AEESP, F. ACS, F. IWA, F. RSC, F. CSP, BCEEM
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
Email: dionysios.d.dionysiou@uc.edu

Project Description

Treatment and reuse of agricultural drainage and municipal wastewater can reduce freshwater demand and recover valuable nutrients (phosphate and nitrate). While there are many ways to separate phosphate and nitrate from water, they are costly, energy intensive, and require large treatment processes. Out of the many available water treatment processes, adsorption processes are attractive due to the low-cost and low-energy requirements. To further lower the cost of treatment and integrate the potential for recovery of the target nutrients, clay-based sorbent materials were chosen for this research. The goal of this project is to develop an environmentally friendly sorbent material that can adsorb phosphate and nitrate and desorb the
nutrients under environmentally relevant conditions for reuse applications. The project will be focused on the following objectives: 1) Synthesize novel, low-cost, clay-based sorbents for the selective removal of phosphate and nitrate; 2) Preform adsorption tests using synthetic water containing competing ions and environmental water samples; 3) Preform desorption tests under a variety of conditions; 4) Conduct advanced material characterization on the developed sorbents; 5) Explore the feasibility of multiple applications of the sorbent.

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