Environmental Engineering & Sciences

Department of Civil and Environmental Engineering
CEE 595AG Seminar

Friday, March 10, 2023 | 10:00 – 10:50 a.m. CST | 3310 Newmark Lab

From Wastewater Recovery to Refining: Electrochemical Approaches to Circular Chemical Manufacturing

Over the past century, humans have altered the global nitrogen cycle so drastically that managing nitrogen has emerged as a grand engineering challenge and urgent need. The Haber-Bosch process for industrial fertilizer production, which converts nitrogen gas into ammonia, outpaces wastewater nitrogen removal due to fertilizer runoff and 80% of wastewater being discharged without treatment. This net discharge of reactive nitrogen (e.g., ammonia, nitrate) threatens aquatic ecosystems and human health by inducing harmful algal blooms that affect 70% of U.S. surface waters and cost over $2.2 billion annually to remediate. Refining nitrate and ammonia into valuable products through reactive separations, which integrate catalysis and separations, is a useful approach for addressing both water pollution and chemical manufacturing. This seminar will focus on recent work designing nitrogen-selective processes, materials, and molecular mechanisms to valorize wastewaters.

Guest Speaker

Prof. Will Tarpeh | Stanford University

Academic Appointments

- Assistant Professor, Chemical Engineering
- Center Fellow, Precourt Institute for Energy
- Assistant Professor (By courtesy), Civil and Environmental Engineering
- Center Fellow (By courtesy), Stanford Woods Institute for the Environment
- Member, Bio-X

Reimagining liquid waste streams as resources can lead to recovery of valuable products and more efficient, less costly approaches to reducing harmful discharges to the environment. Pollutants in effluent streams can be captured and used as valuable inputs to other processes. For example, municipal wastewater contains resources like energy, water, nutrients, and metals. The Tarpeh Lab develops and evaluates novel approaches to resource recovery from "waste" waters at several synergistic scales: molecular mechanisms of chemical transport and transformation; novel unit processes that increase resource efficiency; and systems-level assessments that identify optimization opportunities. We employ understanding of electrochemistry, separations, thermodynamics, kinetics, and reactor design to preferentially recover resources from waste. We leverage these molecular-scale insights to increase the sustainability of engineered processes in terms of energy, environmental impact, and cost.