CHEMICAL AND ENVIRONMENTAL ENGINEERING
ENG. APP. SCI.

RESEARCH OPPORTUNITIES FOR UNDERGRADUATE students

APPLICATION DEADLINE: 11/28/2022

PROJECT TITLE: Upcycling fats, oils and grease for biodiesel production

Physical Requirement: lift about 20 lbs;
Project's Technical Skills Requirement: interested in learning basic lab skills, such as titration, working with acids, base and oil
Project's Available Positions: 1

Dr. Mingming Lu, professor, Dept. of
Chemical and Environmental Engineering
email: mingming.lu@uc.edu

Project Description

Since 2006, Dr. Lu’s lab has been making biodiesel using waste materials: waste cooking oil (WCO), spent coffee grounds (SCGs) and fats, oil grease (FOGs). We also actively develop processes to reuse other byproducts. The zero-waste approach of waste reuse is environmentally friendly and can reduce the cost of product upcycle. It can effectively divert waste from landfill and lower community carbon footprint.

We are currently at the most exciting stage of the FOG-reuse project funded from the National Science Foundation, the field test of the pilot solvent-free lipid extraction system for the fats, oils and grease at a wastewater treatment plant. A pilot scale reactor system with a 150-gallon FOG processing capacity has been built and installed at the Metropolitan Sewer District of Greater Cincinnati, our industrial partner. After onsite assembly, custom fitting, material acquisition and safety inspections, the pilot system is ready to operate. A few test runs will be conducted during the summer, make adjustments as needed and develop a step by step operation procedure, before data collection in the fall for material and energy balance estimates.

By the time the undergraduate student joins, the pilot system has been tested and a documentation has been developed. He/she will be involved in the pilot system runs built upon the graduate students’ work. The student will help with economic analysis of the system. He/she will receive training of different lab skills needed for this project. He/she will be very hands on in different professional settings, a small business, and MSD. He/she will also do waste grease characterization in laboratory.

The undergraduate student will be trained to obtain the following critical technical skills, e.g. fatty acid titration, grease drying, lipid extraction, etc., by learning from SOPs (Standard Operation Procedures), publications, from the graduate student and the PI, etc. The student will learn to log data
and analyze data. The student will also receive lab safety training and follow COVID-19 safety guidelines at various professional organizations. Student will be trained on commercial aspects of this project, too. The student is also expected to help-out with other projects as needed, with very specific instructions and mentoring from the adviser.

This research experience will be very valuable to the undergraduate student, since the opportunities to do research, especially in large scale on site, is rare. For example, the logistics of moving 300 gallons of waste cooking oil (with a forklift) is very different from getting a 5-gallon bucket from the cafeteria, and needs a lot of coordination. The student will have the opportunity to work with many different people from various organizations, and learn to work as a team, coordinate with others as well as enhancing commercialization skills.