Waste Not

Eight years ago, engineering associate professor Mingming Lu, PhD, and a team of students began turning waste cooking oil at UC dining facilities into biodiesel. Four short years later, Lu partnered with UC's power plant to turn that biodiesel into power generation on the university's campus.

Now, with support from the first round of funding from UC's Technology Commercialization Accelerator, Lu will turn her team's patent-pending oil extraction technology into a pilot scale reactor system with hopes of transforming the fat-to-biodiesel concept into a commercially viable green-energy technology.

By Desiré Bennett
Photo by Dottie Stover

Lu's jump into the world of commercialization kicked off on Earth Day 2012 on the National Mall in Washington, D.C., during the U.S. Environmental Protection Agency's National Sustainable Design Expo and P3 "People, Prosperity and the Planet" student sustainable design competition.

There with partners from the Metropolitan Sewer District (MSD) of Greater Cincinnati and Falmouth, Ky.-based Bluegrass Biodiesel, Lu and team were making the case for a project expansion: to collect trap grease (greases intercepted by 'traps' before entering drains) from Cincinnati's sewer system and convert it into biodiesel.

"As we went to the EPA P3 project demonstration in D.C., I realized that this research may have commercial value," said Lu.

The EPA agreed and awarded Lu nearly $90,000. That investment, along with up to $40,000 and entrepreneurial support from UC's Technology Commercialization Accelerator, is expected to take Lu's work to another level.

WHY BIODIESEL?

Lu says that making biodiesel from trap grease solves real-world problems like sewer clogging and associated damage. Compared to petroleum diesel, the combustion of biodiesel also reduces significantly the emissions of most air pollutants.

Biodiesel fuel, Lu says, also provides a potential solution for the United State's dependency on foreign oil.

"Our technology could ultimately help to reduce this reliance by converting waste trap grease into biodiesel as a petroleum diesel alternative," said Lu.

Trap grease is considered a non-traditional biodiesel feedstock because of its low quality: It has more impurities, higher moisture content and the oil content is comprised mainly of free fatty acids (FFAs) instead of the soybean oil traditionally used in biodiesel generation. Whatever process to extract the oil content they developed, Lu says, it had to be adaptable for biodiesel producers.

The team's successful innovation uses waste cooking oil to extract the FFAs. The process is free of chemical solvents and doesn't require removal of water prior to extraction, which can be an expensive step.

Now, with this technology and success on UC's campus comes the next stage: the creation of a pilot reactor and tests to determine optimal operating conditions for large scale extraction and production.

The results Lu and team are achieving are not only good for UC but for the community at large.

"With the pilot scale reactor system, I hope to move more into commercial applications," she says. "And I have great students in the biodiesel group and look forward to finding them jobs."

But her ultimate objective reaches far beyond the university.

"My goal is to reduce waste to landfills, and to make use of the waste."

Green for Less Green

The majority (70-90 percent) of the total cost for producing biodiesel comes from the expense of the feedstock used, so reducing feedstock costs could make biodiesel production more competitive. UC's trap grease-to-biodiesel technology could offer a cost-lowering solution to biodiesel production.

SECOND OPINION

From UC Technology Commercialization Accelerator Entrepreneur-in-Residence David Blum:

"Mingming Lu and her team came up with a novel way to deal with trap grease in the Metropolitan Sewer District (MSD) of Greater Cincinnati system. This is a tremendous start to commercialization. For MSD and other sewage facilities this is a solution to a chronic problem. For Bluegrass and other biodiesel producers, this will create a new source of feedstock that won't require high-energy consumption or huge capital outlay to produce."

"We will further test this patented process by running more temperature and time series tests to determine the optimum operating conditions. We will then set up a small/pilot scale trap grease-to-biodiesel production system and test the results obtained from bench analysis. We will examine a few different types of trap grease and the resultant operating conditions to make the system more robust."

The biodiesel project has been a great teaching opportunity for Lu, and has been part of UC's National Science Foundation (NSF)-funded **Research Experience for Teachers** program. About 19 STEM (Science, Technology, Engineering and Mathematics) teachers from grades 6 through 12 have made biodiesel fuels and seven NSF **Research Experiences for Undergraduates** students have also worked on the project.