Turning waste into inexpensive, green fuel

September 14 2011

Researchers at the University of California, Riverside's Center for Environmental Research and Technology (CERT) at the Bourns College of Engineering have received two grants to further explore a process they developed that turns waste into inexpensive, green fuels.

"These grants allow for the continued happy marriage of clean technologies," said Chan Park, an associate research engineer at CERT. "This research has the potential to produce a number of clean fuels that are carbon neutral and turn landfill waste into renewable energy."

A $650,000 grant from the California Energy Commission extends its commitment to $2 million to CERT for its patented steam hydrogasification reaction, which can turn any carbonaceous material – including waste from food, yards, sewage treatment facilities – into transportation fuels or natural gas.

It will allow for the completion of a process demonstration unit at CERT that will provide data needed before a proposed pilot plant is built at the city of Riverside's waste water treatment facility.

Riverside Mayor Ron Loveridge, who wrote a letter in support of the grant application, said he was delighted to hear CERT had received the grant.

"The city supported the initial research on the gasification of biosolids from our water treatment facility, and we certainly look forward to partnering as this technology is developed," Loveridge said. "This

process has the potential to be used throughout California and globally to provide a cost effective sustainable component to our natural gas supply."

The second grant, for $100,000 from the UC Discovery Program, which pairs industry and university research to boost the California economy, will connect CERT researchers with Irvine-based Food Recycle Science Corporation, which has developed a process to turn food waste into a concentrated biomass. The biomass will be evaluated as a feedstock for CERT's steam hydrogasification reactors.

Initial testing has found the concentrated biomass is 10 percent more efficient than other biomass feedstocks evaluated, said Sean Lee, the CEO of Food Recycle Science.

"We saw that and said, 'Wow, this is a great discovery,'" Lee said.

The steam hydrogasification reaction, which CERT engineers began developing in 2005, has been found to be 12 percent more efficient, with 18 percent lower capital costs, compared to other mainstream gasification technologies when evaluated by the National Energy Technology Laboratory of the U.S. Department of Energy.

The reaction also has other advantages. It can be used with mixed fuel stocks, including agricultural byproducts, waste wood, municipal wastes and sewage sludge. The optimal plant size can be smaller because of the lower capital investment needed. This means smaller fuel plants can be located near sources of feedstocks, reducing the cost and carbon emissions released by transportation of fuel stocks.

The grant from the California Energy Commission will allow for the evaluation of new feedstock sources, including algae, which can be readily grown at waste water treatment plants, and the concentrated

biomass produced by the Food Recycle Science process.

Another goal is to produce synthetic natural gas from a mix of biomass, food waste, and biosolids as a renewable replacement for natural gas found in the earth and sea.

CERT engineers project that substantial synthetic natural gas could be gasified out of the carbonaceous wastes produced annually in California. They estimate that more than 132 trillion cubic feet of synthetic natural gas could be produced in the state. That could replace 5.5 percent of natural gas found in the earth and sea with a clean, renewable resource.

If successful, the process could also cut greenhouse gases released by the burning of natural gas by an estimated 10.5 million tons each year. Just as importantly, estimates show that synthetic natural gas can be produced for nearly half the current price of natural gas, reducing the annual price tag by $606 million.

Food Recycle Science has developed a proprietary process, eCorect, for the hydrothermolytic decomposition of food wastes. The process and steam hydrogasification reaction are environmentally "closed," meaning they produce no methane or carbon emissions and therefore no global-warming-producing greenhouse gases.

Initially, Food Recycle Science focused on implementing the system at restaurants and hotels, said Lee, the CEO. Now, they are focused on large-scale plants that could process 200 tons of waste per day, he said.

Food Recycle Science and CERT researchers will work to integrate the two technologies during the next year. Their first goal is to evaluate the optimum moisture content and particle size of the feedstock. They will then measure the carbon conversion efficiency of the process in CERT laboratories.

Using lab experiments and computer simulations, the final step will be to calculate the economic return of the production of different energy types – including synthetic diesel, natural gas, or electricity – that can be produced by the process.

Provided by University of California - Riverside