Algae Converted to Crude Oil in Less Than an Hour

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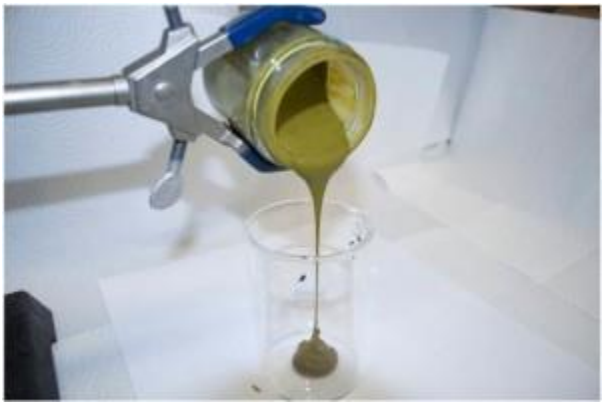

This concentrated goo of algae can be converted into a bio-crude in less than an hour, according to the U.S. Department of Energy. Pacific Northwest National Laboratory

The day when planes, trucks and cars are commonly revved up on pond scum may be on the near horizon thanks to a technological advance that continuously turns a stream of concentrated algae into bio-crude oil. From green goo to crude takes less than an hour.

The goo contains about 10 percent to 20 percent algae by weight. The rest is water. This mixture is piped into a high-tech pressure cooker where temperatures hover around 660 degrees Fahrenheit and pressures of 3,000 pounds per square inch in order to keep the mixture in a liquid phase.

Inside the cooker are "some technology tricks that other people don't have" that help separate the plant oils and other minerals such as phosphorous from the water, Douglas Elliott, a fellow at the Department of Energy's Pacific Northwest National Laboratory in Richland, Wash., explained to NBC News.

An hour after being poured into the cooker, gravity separates the crude oil from the water as it flows out the other end. "We can clean up that bio-crude and make it into liquid hydrocarbons that could well serve to displace the gas, diesel, and jet (fuel) that we make from petroleum now," he added.

What's more, a further water-processing step recovers methane — essentially natural gas — from the leftover plant material. The remaining nitrogen-rich water and recovered phosphorous can be recycled to grow more algae.

Elliott and colleagues describe the process in a paper accepted for publication in the journal Algal Research. Utah-based biofuels company Genifuel Corp. has licensed the technology and is working with an industrial partner to build a pilot plant.

The process takes raw algae slurry and converts it into a bio-crude that can be further refined into gasoline, Department of Energy

Revisited technology

The so-called hydrothermal liquefaction technology that Elliott and his colleagues used to create the bio-crude was pioneered in the 1970s, but fell out of favor as researchers focused on developing algae strains that yield high amounts of oil in the form of lipids.

To recover the oil from these high-yielding plants, the algae is dried and the oils extracted in a process that is energy intensive and thus expensive.

Hydrothermal liquefaction "has the advantage that it makes use of the whole algae, therefore it has the significant advantage that there is no need to promote lipid accumulation or indeed to extract lipids," Aris Karcanias, a managing director at FTI Consulting in London, explained to NBC News in an email.

"Furthermore," the expert in renewable energy added, "there is no need to expend energy for the algae drying process."

Despite the advantages, until now, Elliott explained, most demonstrations of the technology have been at the lab scale and done in so-called batch reactors. That is, the teams can only produce one batch of crude at a time. In addition, they use chemical solvents to separate the water from the oil.

Using the continuous process described in Algal Research, "we find that, if we do it the right way, we don't need those chemical steps," Elliott said.

Challenges ahead

Among the remaining challenges to make algae-derived biofuels a contender in the global energy marketplace is the ability to efficiently grow a sufficient amount of the plant for conversion into biofuels, according to Elliott.

There are also regulatory hurdles such as rewriting standards and specifications to allow the plant-derived oils to be blended into, or used in lieu of, petroleum-based fuels. "The fact is, they do look a little bit different and they have slightly different properties," he explained.

In addition to Genifuel, who is collaborating with the Department of Energy on this process, other companies pursuing algae-based biofuel technology worth watching include Sapphire Energy, Cellana, and Synthetic Genomics, according to energy consultant Karcanias.

Throughout the industry, he said, "further research is required to enhance algal oil productivity on a continuous basis, ability to demonstrate wastewater treatment and optimize nutrient cycle." If that's achievable on a commercial scale, he added, "It will be an important and indeed useful step forward."

John Roach is a contributing writer to NBC News. To learn more about him, visit his website