# Algae A Credible Frontrunner As Source For Biofuels

**URBANA, ILL.**

Algae are a diverse family of simple plants ranging from common pond scum to ocean seaweed, and some species are now being considered as a promising source of raw material for future biofuels production.

Lance Schideman, a professor in the Department of Agricultural and Biological Engineering at the University of Illinois, said there are a number of reasons he believes algae to be a "credible frontrunner" among the various biomass feedstocks being researched for alternative fuels.

"Key advantages for algae include prolific growth rates and relatively high oil contents in certain species," said Schideman. "In addition, algae can help clean up water resources with excess nutrients and can be grown on lands that aren't useful for agricultural purposes."

Schideman said the 'food versus fuel' debate is one of the key issues in choosing algae as a source of biomass.

"Corn ethanol, soybean biodiesel, and most other dedicated energy crops would generally take prime farmland out of production for food, which is problematic when food demand outstrips supply," said Schideman. "In contrast, algae can be grown just about anywhere – in a polluted pond, in a bio-reactor on top of a power plant, and it can even be harvested out of the ocean. Algae don't have to directly compete for the land. There are other choices."

Algae can be more productive than corn or soy beans, Schideman noted. "Right now we get about 45-75 gallons per acre for soy biodiesel and around 300-500 gallons per acre for corn ethanol. Current research suggests that we could get anywhere from 1,000 to 10,000 gallons per acre for algae biodiesel."

Schideman said there are various options to produce biofuel from algae. "The traditional method is to extract the algae oil from the other biomass components (primarily carbohydrates and proteins) and then convert the oil to biodiesel via transesterification, which is quite similar to soy biodiesel processing," he explained. "Unfortunately, the predominant methods of algae oil extraction are still relatively expensive."

An alternative processing method is called thermo-chemical conversion, or TCC, a chemical process that transforms organic compounds in a heated and pressurized enclosure to produce a biocrude oil.

"TCC gives you the option of processing the algae biomass directly, without drying it or separating out the other fractions," Schideman said. "It simulates the processes that went on in the earth when our petroleum reserves were formed, you're just doing it a lot faster.

"It's my opinion that TCC will be a very important technology in helping biofuels from algae become a reality."

Schideman is currently involved with three projects that address significant environmental issues in conjunction with algae-based biofuel production.

One project, sponsored by the Dudley Smith Foundation, is focused on combining TCC with algae growth on livestock wastewaters to produce biofuels and reduce the environmental impacts of manure disposal.

"We also have some seed funding from the ACES College Office of Research to investigate the feasibility of harvesting natural algae blooms efficiently," he said. "It's a new approach to the hypoxia problem created by algae growth in the Gulf of Mexico, that could yield environmental benefits much faster than other proposed hypoxia remediation measures," Schideman said.

"Even if farmers cut their fertilizer use by 50 percent today, it would likely take ten to twenty years for excess nutrient flows to wash out of the watershed," he said. "Harvesting algae provides an immediate solution – you don't have to wait years to solve the problem."

Schideman is also the advisor on a project that will address carbon sequestration through algae biodiesel production.

"Carbon dioxide emissions from the power industry contribute to growing concerns about global climate change," said Schideman. "Since carbon dioxide is a necessary component for algae growth, this project will sequester carbon dioxide from a local power plant's exhaust gasses into algae biomass that will subsequently be converted into biofuels."

Students from the local chapters of the Water Environment Federation, and Engineers Without Borders will participate in the project to demonstrate algae bioreactors that can reduce carbon dioxide emissions from the coal and natural gas stacks at the Abbott power plant in Champaign, Illinois. The resulting biomass will be converted into biodiesel and used to power University vehicles.

When Schideman looks to the future, he sees the production of algae biodiesel as a decades-long project.

"I think we're within about ten years of being able to make production economically feasible," he said, "but do I think algae or any biofuel will replace petroleum in ten years? No. That will require significant infrastructure and regulatory developments that will play out over thirty to fifty years," he concluded. Δ

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