Biodiesel is a cleaner alternative to regular diesel fuel. Diesel is produced from nonrenewable petroleum. Biodiesel comes from renewable sources such as vegetable oils or animal fats. Biodiesel also burns cleaner than diesel, and it is biodegradable.

Scientists around the world are working to produce alternative fuels from a wide variety of plant materials. Ethanol derived from corn is already widely used. Unlike corn, however, algae aren't food crops. And algae doesn't have to be grown on arable soil—soil that could be used for growing food.

THERE CERTAINLY WILL BE NO SHORTAGE OF PRODUCT TO SELL. ACCORDING TO HU, THE $CO_2$ FROM A SINGLE POWER PLANT COULD HELP GENERATE ABOUT 10 MILLION TONS OF ALGAL BIOMASS PER YEAR.— **DIANE BOUDREAU**

## Principles of Green Chemistry

**Use renewable feedstocks**: Using raw materials that are renewable rather than depleting.

**Analyze in real time to prevent pollution:** Include in-process real-time monitoring and control during syntheses to minimize or eliminate the formation of byproducts.


*by*

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# ALTERNATIVE FUEL OF THE 21ST CENTURY GOES GREEN

You know algae. It's the gunk that collects on the sides of a fish tank when you forget to clean it. It's the slime that makes you slip on rocks while crossing a stream. You probably think of algae as a nuisance, if you even bother to think of it at all.

# FUELS OF GREEN

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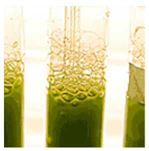

"Every cell is photosynthetic. Algae are more productive than corn or soybeans because every cell is a factory."

MILTON SOMMERFELD

Where other people see slime, the ASU professors of Applied Biological Sciences see solutions. They see environmentally friendly fuel. They see pollution control. In short, they see it as an answer to many problems that currently stare humanity in the face.

The benefits of oil produced from algae are endless, according to the ASU researchers. "Algae are non-food/feed sources, so there is no inherent conflict of using food crop plants for fuel rather than for food," said Drs. Hu and Sommerfeld of ASU Polytechnic Campus. "Also, algae can be grown on land that is unsuitable for agriculture and can use saline or brackish water, making the algae feedstock production system complementary rather than competitive to existing agriculture.

"Moreover, since algae can use carbon dioxide from waste or flue gases as a nutrient for growth, an added value of algae feedstock production is environmental carbon sequestration."

The yield of algae's oil, which is converted into fuel, is projected to be at least 100 times that of soybean per acre of land on an annual basis.

## WHAT MAKES ALGAE SO APPEALING FOR SO MANY APPLICATIONS?

"They reproduce quickly, and unlike the cells found in a leaf, they don't have unnecessary baggage. In other words, no roots and stems and they do not go dormant," says Sommerfeld. "Algae have natural properties that allow them to grow quickly, with some species able to double 2 to 3 times in a day. That's a good thing when you want to produce large quantities of algae."

"We know we can make diesel from algae. The next question is—is it economical?"

QIANG HU

Hu says that the process is environmentally friendly and sustainable over the long term.

"The process is driven by solar energy, not electricity…our by-product is renewable," he adds.

## IT GENERATES ENERGY WITHOUT RELEASING $CO_2$ INTO THE ATMOSPHERE.