Researcher converts biodiesel-waste glycerol into omega-3 fatty acids

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The typical American diet often lacks omega-3 fatty acids despite clinical research that shows their potential human health benefits. Zhiyou Wen, assistant professor of biological systems engineering in Virginia Tech's College of Agriculture and Life Sciences, found a way to grow these compounds using a byproduct of the emerging biodiesel industry.

"High energy prices have led to an increase in biodiesel production, which in turn has led to an increase in the amount of crude glycerol in the market," said Wen, who explained that biodiesel plants leave behind approximately 10 percent crude glycerol during the production process.

This has led the price of glycerol, a chemical compound widely used in the pharmaceutical and cosmetic industries, to drop in recent years. The rise in biodiesel production over the last decade means that the market can no longer absorb all the extra glycerol. Biodiesel producers must find alternative means for disposing of crude glycerol, which is prohibitively expensive to purify for industry use. Wen and his colleagues have developed a novel fermentation process using microalgae to produce omega-3 fatty acids from crude glycerol.

"We have shown that it is possible to use the crude glycerol byproduct from the biodiesel industry as a carbon source for microalgae that produce omega-3 fatty acids," said Wen, who added that the impurities in crude glycerol may actually be beneficial to algal growth. "After thorough chemical analysis, we have also shown that the algae biomass

composition has the same quality as the commercial algae product."

After growing the algae in the crude glycerol, researchers can use it as an animal feed. This mimics a process in nature in which fish, the most common source of omega-3 fatty acid for humans, eat the algae and then retain the healthful compounds in their bodies. Humans who consume the fish in turn consume the omega 3s. Fish-derived products such as fish oil are an inexpensive alternative, but the taste has deterred widespread use.

Wen has partnered with Steven Craig, senior research scientist at Virginia Cobia Farms, to use crude glycerol-derived algae as a fish feed. "The results so far have been promising," Wen said. "The fish fed the algae had significant amounts of omega-3 fatty acids."

He and Audrey McElroy, associate professor of animal and poultry sciences, are now trying to determine whether the algae would work as a chicken feed. Kumar Mallikarjunan, associate professor of biological systems engineering, is also working with Wen to determine the fate of omega 3s after they enter the food supply. Researchers do not yet know whether oxidation would have a major impact on omega-3 fatty acids stored in cheese, for example.

Source: Virginia Tech

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