Minnesota scientists create new biodiesel manufacturing process

By Jerry W. Kram | March 17, 2008

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An undergraduate research project may lead to a revolution in biodiesel manufacturing. Brian Krohn, a senior at Augsburg College in Minneapolis, Minn., worked with his advisor, Arlin Gyberg, to select a research project for Krohn's chemistry major. Because they both had an interest in biofuels, Krohn decided to investigate the chemistry of manufacturing biodiesel. "Without Brian being interested in this project we never would have started," Gyberg said. "We decided to do a very thorough literature search on this. So he spent the first two or three weeks doing a very extensive literature search looking at more than 1,000 articles, which he narrowed down to 100. Out of that we ran across two papers that caught our eye."

The papers discussed esterification catalyzed by solid strong acids to manufacture biodiesel. Gyberg, who has a background in chromatography, which uses columns of chemically active solids to separate mixtures of chemicals, wondered if a similar column could be used to make biodiesel. He contacted Augsburg alumni, Clayton McNeff, who invented a chromatography method using zirconia and formed a company to sell it. "One of the papers had mentioned zirconia based catalysts," Gyberg said. "Nobody out there had ever thought of zirconia being a catalyst because they're chromatographers."

Along with fellow scientist Ben Yan, Gyberg and McNeff built and tested a column that mixed oil and alcohol with the catalyst under high heat and pressure until the mix became supercritical, a state where the mixture contains properties of both a gas and a liquid. Under the right conditions in the column, the oil and alcohol were converted into biodiesel in six seconds. Gyberg said the column allows for continuous production of biodiesel – as opposed to the current batch method of production. A column about 4 inches in diameter and two feet long will be able to produce 3 million gallons of biodiesel per year. The process can also convert glycerin into dimethyl ether, which is more valuable in the current market.

McNeff, Gyberg and Yan named the method, the Mcgyan process, and have applied for a patent.

For the past six months a pilot plant using the Mcgyan process has been using a wide range of feedstocks with no problems, Gyberg said.

McNeff has formed the company, Ever Cat Fuels LLC, to build a commercial-sized 3 MMgy facility in Isanti, Minn. The company broke ground in November, and if permitting is on schedule, the plant should be operating by October. The plant will use hydrous ethanol, rather than methanol, and corn oil extracted from distillers grains as the feedstock. Gyberg said the feedstock will have up to 20 percent free fatty acids, which renders it almost useless for traditional biodiesel production, however, the Mcgyan process converts free fatty acids to biodiesel as easily as virgin vegetable oil. "The process converts it 100 percent to biodiesel with essentially no waste," Gyberg said. At the end of the process, the finished biodiesel doesn't need to be washed. And he added, the use of feedstocks from a nearby ethanol plant, will make Ever Cat Fuels' cost of production nearly $2 per gallon lower than other biodiesel plants.

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