Finding a better way to make biodiesel

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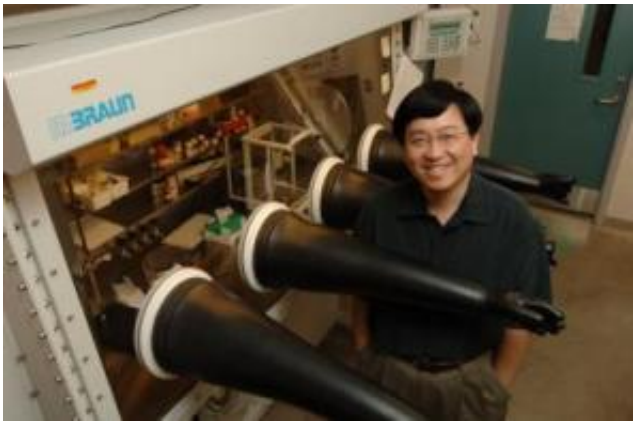

Victor Lin and a team of Iowa State researchers have found a better way to make biodiesel in a chemistry lab. They're now working to test their ideas on a bigger scale. Photo by Bob Elbert

They're only 250 billionths of a meter in diameter. But fill them with the right chemistry and Iowa State scientists say the tiny nanospheres they've developed could revolutionize how biodiesel is produced.

The researchers are after a new, high-tech catalyst that takes some of the energy, labor and toxic chemicals out of biodiesel production. They've come up with a technology that works in the laboratory. And now they're working with the West Central Cooperative in Ralston to test their discoveries on a larger scale. They're also working to establish a company that would move the new technology into biorefineries.

The Iowa State research team is led by Victor Lin, an associate professor

of chemistry. The team also includes George Kraus and John Verkade, both University Professors of chemistry at Iowa State. The researchers are part of Iowa State's Center for Catalysis.

Their project is being supported by a $1.8 million, three-year grant from the U.S. Department of Agriculture, a $120,000, two-year grant from the U.S. Department of Energy and a $140,000 grant from the Grow Iowa Values Fund.

"This is a project that's definitely relevant to the state's economy," Lin said. "I thought as a scientist I could contribute something to the state."

Current biodiesel production technology reacts soy oil with methanol using toxic, corrosive and flammable sodium methoxide as a catalyst. Getting biodiesel out of the chemical mixture requires acid neutralization, water washes and separation steps. It's a tedious process that dissolves the catalysts so they can't be used again, Lin said.

So Lin and his research team started looking for technologies that would create an easier, more efficient and more economical process. They were also hoping to find technologies that would effectively make biodiesel out of raw materials such as used restaurant oils and animal fats – materials that are much cheaper than soy oil, but also contain free fatty acids that can't be converted to biodiesel by current production methods.

Lin has developed a nanotechnology that accurately controls the production of tiny, uniformly shaped silica particles. Running all the way through the particles are honeycombs of relatively large channels that can be filled with a catalyst that reacts with soybean oil to create biodiesel. The particles can also be loaded with chemical gatekeepers that encourage the soybean oil to enter the channels where chemical reactions take place. The results include faster conversion to biodiesel, a catalyst that can be recycled and elimination of the wash step in the

production process.

Lin's particles can also be used as a catalyst to efficiently convert animal fats into biodiesel by creating a mixed oxide catalyst that has both acidic and basic catalytic sites. Acidic catalysts on the particle can convert the free fatty acids to biodiesel while basic catalysts can convert the oils into fuel.

And the particles themselves are environmentally safe because they are made of calcium and sand.

"We're excited about this and so is West Central," Lin said. "This serves as an example of how nanotechnology can be useful for advancing an industry that's not that high-tech. And this allows our students from the Midwest – some of them from farms – to learn a new kind of technology that doesn't take them away from home."

Larry Breeding, the general manager of biodiesel operations for the West Central Cooperative, said the technology shows promise for improving the efficiency of biodiesel production. But he said it still needs to be tested at larger and larger scales to see if the economic benefits are there. Tests also need to prove if the technology works in continuous-flow production rather than batch-by-batch production.

"This research is a real boon to us," Breeding said. "We don't have a research campus. So we have to rely on academia and we've leaned on the people at Iowa State very heavily for a lot of this work."

Source: Iowa State University

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