

# Researchers improving plastics made from corn and soy proteins

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David Grewell displays plastics developed by a team of Iowa State University researchers. The researchers are working to improve biorenewable and biodegradable plastics made from corn and soy proteins. Credit: Photo by Bob Elbert/Iowa State University

David Grewell picked up the little plastic model of a molecule he keeps in his office. He scrunched the model's folding pieces into a ball. That's about the shape of a soy or corn protein, said Grewell, an Iowa State University assistant professor of agricultural and biosystems engineering. Then he unfolded the model into a long, straight loop. That's what happens when researchers add some glycerin – a byproduct of biodiesel production – and some water to the molecule. And that's how biorenewable, biodegradable plastics can be made from the proteins in Iowa crops.

But those aren't the strongest plastics. So Grewell is working with a team of Iowa State researchers to reinforce the plastics with nanoclays, pieces of clay that are just 10 to 20 billionths of a meter thick.

It's not easy to work with those tiny pieces of clay. They tend to stick together in clumps because of electrostatic forces, said Michael Kessler, an Iowa State assistant professor of materials science and engineering who's also working on the project. Those clay platelets need to be separated and mixed evenly throughout the plastic to be much good as a reinforcing agent.

The researchers are turning to high-powered ultrasonics – high-frequency sound waves too high for human hearing – to separate and disperse the platelets. It's a technology Grewell knows a lot about: he worked 12 years in research and development for the Branson Ultrasonics Corp. of Danbury, Conn. He has used ultrasonics to freeze strawberries, process rice and handle many other applications.

The researchers are also using microcellular foaming technologies from Trexel Inc. of Woburn, Mass., to mold and extrude the plastics. The processing technology is expected to enhance the biodegradable plastics while allowing the researchers to use less base material to make the plastics.

Grewell said the potential applications for plastics from crop proteins include disposable wraps for hay bales, pots for plants and packaging for the food industry.

Grewell, Kessler, Howard Van Auken, a professor of management, and Gowrishankar Srinivasan, a graduate student in industrial and agricultural technology, are working on the plastics project with two Iowa companies, the Vermeer Manufacturing Co. of Pella and Vibroacoustics Solutions Inc. of Ames. The project is partially supported

by a \$68,758 grant from the Grow Iowa Values Fund, a state economic development program.

Jay Van Roekel, the segment manager for Vermeer's ag product group, said the company will test hay wraps made from the plastics developed by the Iowa State researchers. Van Roekel said the company is very interested in helping the research project.

"It's exciting to be involved in the development of biorenewable technologies and the harvesting of biomass," he said. "We see biorenewables taking hold and expanding every day."

Sam Senti, an application specialist for Vibroacoustics Solutions Inc., said the company would like to use biorenewable and biodegradable plastics in a stick lubricant it has developed. The bio-based lubricant rubs off on metals – it, for example, can be used to help locomotive wheels roll more easily around curves in a track. Senti said biodegradable plastics that add rigidity to the company's product would be very useful in outdoor applications. And so the company wants to help the researchers with some field tests.

The researchers' plastics aren't quite ready to leave the laboratory. Grewell said he's working on production recipes, processing techniques and ultrasonics applications. Kessler will also work to characterize the plastics' strength plus its thermal and mechanical properties.

Working with the two companies should help move all that work ahead, Kessler said.

"Collaborating with these companies will be useful," he said. "And we hope it will help us come up with other ideas."

Source: Iowa State University

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