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Researcher examines polymers created with poultry feathers

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BLACKSBURG, VA., April 3, 2007 -- Justin Barone, associate professor of biological systems engineering in the College of Agriculture and Life Sciences, is investigating ways to create biodegradable plastics from agricultural byproducts such as poultry feathers and eggs that would be comparable to petroleum-based plastics. Biodegradable polymers created from such byproducts may add value to the poultry industry and help solve the growing environmental problem of plastic waste, according Barone, who presented his research findings at the 233rd national meeting of the American Chemical Society in Chicago, Ill. on March 29.

Justin Barone

According to the U.S. Environmental Protection Agency, more than 29 million tons of non-biodegradable plastic waste ends up in landfills each year.

“Twelve percent of all plastic packaging ends up in landfills because only a fraction is recycled,” said Barone. “Once in the landfill, it doesn’t biodegrade. The challenge is how can we create a simpler plastic bag or bottle that will biodegrade?”

According to Barone, the technology to create biodegradable plastics from biomass, such as corn and soybeans, has been around for more than 70 years. However the recent push to increase energy production from these feedstocks has increased the value of these agricultural commodities, making products made from them more expensive.

Barone has turned his focus to the agricultural waste stream and is concentrating on developing ways to use under-utilized byproducts or agricultural waste, such as poultry feathers or eggs that don’t pass inspection. These agricultural wastes currently find uses in low-value animal feed or are simply disposed. Both come at a cost to the poultry industry that is passed onto consumers.

The challenge in developing biodegradable plastics is creating a product as good as, if not better than, its petroleum counterpart, explains Barone. “The industry is looking for a versatile product

that can be used for multiple markets."

Plastics made from biomass are made just like petroleum-based plastics. They are cheaper to manufacture and meet or exceed most properties except for water resistance and longevity. Meeting these performance requirements is a challenge, Barone explains.

Barone is taking his lead from nature to find potential solutions to these performance requirements. He is investigating the properties of polymers created from poultry feather keratin. The protein, keratin, is a major component of hair, nails, and feathers and makes them hard and strong.

Barone has found that altering the amino acid structure of keratin can improve the strength and longevity of the polymer. In addition, the viscosity can be improved with reducing agents such as sodium sulfite and lubricants such as poultry fat. The solid-state properties can also be modified using divalent transition metal ions to affect stiffness and smell. These will help the keratin polymer be processed faster, be more aesthetically pleasing, and become water resistant and stronger for increased longevity.

Barone's current research is funded by the U.S. Poultry and Egg Association.

He presented his paper, "Properties of biodegradable feather keratin polymers," as part of the session on Agricultural Biomass, Biobased Products, and Biofuels (http://oasys.acs.org/acs/233nm/techprogram/S24001.HTM) sponsored by the ACS Division of Agrochemicals and Division of Fuel Chemistry, Sustainability of Energy, Food, and Water, Division of Cellulose & Renewable Materials, and Division of Chemical Information.

About the College of Agriculture and Life Sciences

Nationally ranked among the top research institutions of its kind, Virginia Tech's College of Agriculture and Life Sciences (http://www.cals.vt.edu/) focuses on the science and business of living systems through learning, discovery, and engagement. The college's comprehensive curriculum gives more than 2,200 students in a dozen academic departments a balanced education that ranges from food and fiber production to economics to human health. Students learn from the world's leading agricultural scientists, who bring the latest science and technology into the classroom.

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