

Tuesday, July 1, 2008

Volume 03, Issue 31

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## Glycerol may benefit the autohydrolysis process of biomass

What happens to red oak when glycerol is added to the autohydrolysis process used to separate the sugars, lignin and other components from the biomass?

That question was the focus of a six-month study directed by **Dr. Jan Pekarovic**, a research associate in the Department of Paper Engineering, Chemical Engineering, and Imaging. He worked with **Maria Jose Feria Plaza**, an exchange student from Lleida University in Spain, to compile the results.



**Dr. Jan Pekarovic** and **Maria Jose Feria Plaza** with red oak chips used to in research involving the autohydrolysis of red oak in the presence of glycerol

According to Pekarovic, who has been involved with biomass research for almost 30 years, the autohydrolysis process transforms carbohydrates into fermentable sugar syrup by exposure to high temperatures.

Glycerol, a “green” sugar alcohol containing three alcoholic hydroxyl groups, was selected because of its potential to replace either ethanol or methanol in organosolv pulping. “Glycerol is a by-product in biodiesel production, so we used it in the hydrolysis to see what it would do,” he said. “It makes sense to look for ways to use glycerol in new processes.”

The liquor obtained after the autohydrolysis of the red oak in the presence of glycerol is called a hydrolyzate, which has use as raw material that can be fermented for liquid fuels such as methanol or ethanol, made into artificial sweeteners, or used for biopolymer production. “It’s a value added process called bio-refinery,” he said.

Plaza studied the autohydrolysis process of producing the hydrolyzate by varying reaction times, temperatures, and glycerol concentrations.

At her final project presentation, Plaza described her methodology and results, which suggested that the presence of glycerol may enhance the separation process.



Some of those involved in the research include (from left): **Dr. Sasha Pekarovicova**, **Maria Jose Feria Plaza**, **Dr. Jan Pekarovic**, **Dr. John Patten**, and **Dr. Bade Shrestha**.

Pekarovic said that the research suggests that the glycerol has limited the lignin solubilization. “The glycerol seems to re-polymerize with the lignin and its fragments thus protect lignin,” he said. “That was what we hypothesized, and I am very impressed.”

Autohydrolysis’ studies involving glycerol will continue this fall even though Plaza has returned to Spain. **Matej Pekarovic**, a master’s student in chemical engineering who is also Jan Pekarovic’s son, will continue the research using corn stalks instead of red oak.

Pekarovic said the findings encourage studies to explore applications of the biomass residues. “It would make a nice master’s thesis,” he said.



**Maria Jose Feria Plaza** and **Dr. Jan Pekarovic** examine the physical properties of hydrolyzates, ready to be analyzed for the quantitative and qualitative chemical analysis of the sugars presented.

Other faculty members involved in the project were **Dr. John Patten**, the manufacturing engineering chair who supervised Plaza’s exchange program assignment, and **Dr. Bade Shrestha**, an associate professor in the Department of Mechanical and Aeronautical Engineering who is involved in hydrogen fuel research.