Ja Kyong was originally from South Korea and attended Korea University in Seoul, Korea, where she graduated with a Bachelor and Master degree of food science and technology in 2007 and 2009, respectively. At Purdue, she has studied on the effect of liquid hot water pretreatment on lignocellulosic biomass for its bioconversion into biofuel as part of the Laboratory of Renewable Resources Engineering (LORRE).

Agricultural & Biological ENGINEERING

Dissertation Defense

Speaker: Ja Kyong Ko

Title: Characterization of lignin isolated from liquid hot water pretreated hardwood

Major Professor(s): Dr. Michael Ladisch

Date: Thursday, March 27, 2014

Time: 9:30 am

Location: Fu Room, Potter building

Abstract:

Lignin, one of the major component of lignocellulosic biomass, plays an inhibitory role on the enzymatic hydrolysis of cellulose. When hardwood was pretreated with liquid hot water at severities ranging from log R_o = 8.25 to 12.51, 80–90% lignin was recovered in the solid. The ratio of acid insoluble lignin (AIL) to acid soluble lignin (ASL) increased and the formation of spherical lignin droplets on the cell wall surface was observed as previously reported in the literature. When lignins were isolated from hardwoods pretreated at increasing severities and characterized based on glass transition temperature (T_g), the T_g of isolated lignins was found to increase from 171 to 180°C as the severity increased from log R_o = 10.44 to 12.51. The increase in T_g suggested that the condensation reactions of lignin molecules occurred during pretreatment and altered the lignin structure. The more condensed lignin structure has a higher glass transition temperature and coincides with more extensive enzyme adsorption as severity increases. Since the enzyme components which are required to synergistically hydrolyze cellulose have different profiles (molecular weight, hydrophobicity, pI), they exhibit different adsorption behaviors with lignin, and thereby change the ratio of enzyme activities needed for synergism during cellulose hydrolysis. Among the enzyme components of Trichoderma reesei cellulase cocktail, β-glucosidase showed the strongest adsorption onto lignin. The adsorption of cellulase enzymes onto lignin is shown to be non-productive and in effect causes inhibition of enzymatic hydrolysis of cellulose in liquid hot water pretreated lignocellulose.