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SESSION 1A
Enzyme Catalysis and Engineering

Introduction to Session 1A

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Understanding and overcoming the natural resistance of plant cell walls to enzymatic hydrolysis remains one of the most active research areas in biofuels production (as indicated by the number of abstracts and papers submitted to this session). A number of the oral presentations given during the Enzyme Catalysis and Engineering session highlighted the use of new and innovative tools for advancing our understanding of plant cell wall deconstruction. The oral presentations and posters given for this session included applications of imaging tools and computational models to advance our understanding of biomass recalcitrance relative to enzymatic deconstruction. This session was opened with a presentation by Dr. Danny Akin, who outlined the structural and chemical barriers for the bioconversion of grasses to sugars. Lignocelluloses from grasses, such as switch grass, are resistant to bioconversion by various aromatic constituents, which include both lignins and phenolic acid esters. However, Akin and coworkers demonstrated the use of selected white rot fungal enzymes, which lack cellulases that could be used to produce delignified lignocellulosic materials, resulting in improved bioconversion.

Dr. Shi-You Ding presented an exposé on the use of new imaging tools now available at the National Renewable Energy Laboratory. Dr. Ding presented state-of-the-art applications of imaging and how it can be used to understand how plant cell wall microfibril structure changes during biomass conversion processes. Researchers now have the ability to

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examine the microfibril at the nanometer scale using atomic force microscopy, which allows for the imaging of biomaterials at atomic scale without extensive sample preparation or change in the original structure. Dr. Ding described how he has used this technique to visualize cellulases directly under aqueous conditions. His findings have resulted in a new model of the molecular structure of the cellulose microfibril in the plant cell wall.

Other presentations were focused on techniques to reduce biomass recalcitrance by applying thermal tolerant enzymes, supplementation with "accessory enzymes," or by using blocking agents, such as bovine serum albumin to prevent nonspecific absorption of enzymes to lignin. Dr. Deidre Willies from the Thayer School of Engineering at Dartmouth College presented data indicating that corn stover and lignin adsorb large amounts of cellulases and outlined methods that could be used to present adsorption and enhance cellulose digestion.

The presentations and resulting discussion during the session highlighted the need for more research that will advance our understanding of the natural resistance of plant cell walls to microbial deconstruction. It is this property that is largely responsible for the high cost of lignocellulose conversion; and yet to take the steps toward sustainable energy use we must overcome the chemical and structural properties that have evolved in biomass to prevent its deconstruction.