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Session 6A

Biomass Pretreatment and Hydrolysis

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This year's session highlighted several exciting advances in the field of pretreatment and hydrolysis of lignocellulosic biomass. Iogen Corporation (Ottawa, Canada) announced the successful completion of their demonstration plant and first shipment of ethanol. The facility uses wheat straw as its feed source. Other highlights included the announcement by Dr. Guido Zacchi (Lund University, Sweden) that the ribbon will be cut this month at their new bioethanol pilot plant; the capacity will be 2 ton/day of feedstock (primarily softwood residue). Mr. Daniel Schell (National Renewable Energy Laboratory, CO, USA) detailed the production of high sugar streams from pretreating corn stover with dilute acid at the NREL pilot plant. Finally, Mr. David Gregg (University of British Columbia, Canada) and Dr. Henning Jorgensen (Royal Veterinary and Agricultural University, Denmark) also announced construction of new pilot plants for treatment of softwoods primarily by organosolv, and wheat straw possibly by alkali treatment, respectively. Several trends emerged from these presentations:

Water balance: Dr. Zacchi and Mr. Schell both emphasized the importance of minimizing water usage. Dr. Zacchi's group has studied water recycle and Mr Schell has minimized water usage by increasing the solids contents in the pretreatment reactor to 30%wt. Dr. Zacchi in particular demonstrated the importance of water recycling by showing results from his group's sophisticated cost engineering model.

Enzyme/Pretreatment Synergy: Mr. Brian Foody (Iogen Corp.) demonstrated that formulating cellulase preparations specifically for the pretreated biomass (e.g. wheat straw) increases hydrolysis efficiency. He also showed that increasing beta-glucosidase activity sufficiently makes SHF less costly than SSF. Dr. Liisa Viikari (VTT Biotechnology) demonstrated that xylanase activity can be an important component for increasing cellulose conversion yields. Dr Viikari also showed that laccase enzyme can aide in removing lignin.

Operating Experience: Mr. Foody emphasized that their demonstration plant will be operated around the clock to better replicate the experience of trying to run a full scale plant.

Modeling Hydrolysis with Polymer based models: Dr. Wyman discussed the need for more sophisticated models to describe what occurs during pretreatment. Most often hydrolysis of hemicellulose is described by 1st order rate kinetics. However, when Dr. Wyman's group compared batch and flow-through kinetics, they discovered that mass transfer results became important and polymer type models led to more accurate predictions. Their results also suggest that long DP xylans can readily enter into solution.