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Session 1

Feedstock Supply and Processing

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The availability of biomass feedstocks' as well as efficient and cost-effective processing technology, are key determinants of the economic viability of obtaining fuel additives and oxygenated chemicals from biomass. This series of papers examines biomass feedstock availability, and the impact of advances in hydrolysis and pretreatment methods on improving extents of conversion of cellulose to glucose. Significant progress has been made, but the economic impact of these advances will not be fully realized or documented until the first biomass conversion plants are built. In the meantime, these papers provide insights into the developments which enhance the prospects for implementation.

Biomass feedstocks will be available for properly located conversion plants - if the price is right. Based on the assumption of a constant biomass feedstock supply, economic analysis shows that the price of biomass will increase as this resource becomes scarce. Low-cost wood residues, for instance, are a limited supply. Availability of the feedstock will be a key factor, along with infrastructure considerations, in determining size and location of a conversion facility. One type of cellulosic material which could become widely available is switchgrass, a native grass which can be grown in most cropland regions, and has the potential to produce annual yields on the order of 6 to 8 dry tons per acre. Current analysis suggests that biomass feedstocks are likely to cost on average, $25 to 40/dry ton at the farmgate, depending on location and size of the industry.

Thorough examination of the shrinking bed hydrolysis concept shows that a stream of pentoses and hexoses can be obtained by carrying out hydrolysis in a reactor which facilitates compression of the biomass as it mass decreases during the conversion of the insoluble cellulose and soluble hemicelluloses to monosaccharides via acid hydrolysis. An alternate approach is to pretreat the biomass, and then follow pretreatment with enzyme hydrolysis. Aqueous based, hydrothermal pretreatments are attractive since these entail little or no addition of extraneous reagents, while

making the cellulose more susceptible to enzyme based hydrolysis. The approaches discussed in this session are steam explosion with added SO_2 or H_2SO_4 to pretreat residue from Douglas fir, use of hot liquid water and steam to obtain reactive, readily hydrolyzed fibers from sugarcane bagasse and Aspen; and pretreatment of wood sawdust by pressure cooking it in water in an agitated batch reactor with a specially designed pH monitoring system. The water in this system was controlled to near neutral pH, in order to minimize autohydrolysis during pretreatment.

These papers give an overview of the state-of-the-art, and experimental results based on a number of different lignocellulosic substrates. This session of the 19th Biotechnology Symposium shows that significant progress is being made in the generation, front end treatment, and hydrolysis of lignocellulosic substrates.