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0273-2289/94/4546—0003$03.00

Introduction to Session 1

Thermal, Chemical, and Biological Processing

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The thermal, chemical, and biological processing of renewable resources into value-added products encompasses a wide range of technologies. The articles in this session address cellulose pretreatment, acid or enzyme hydrolysis, and research on the fermentation characteristics of the resulting sugar streams.

The use of several temperatures to optimize hydrolysis of hemicellulose in a percolation process is presented, and the action of dilute acid is characterized by fundamental studies of its role in steam explosion pretreatments. Acid hydrolysis reduces the degree of polymerization of cellulose and hemicellulose, and ultimately results in the formation of glucose. It is well known that the glucose can then be further degraded by the acid into undesirable products including hydroxy-methyl furfural, levulinic acid, and humic substances. Several articles address the kinetics of this process, as well as approaches that minimize undesirable side reactions while maximizing conversion and yield.

In some cases, valuable products can be achieved by selectively dehydrating glucose to several types of organic acids. Reaction selectivity is important, and is addressed in the article that examines pillared-clay as a catalyst.

Biological aspects of biomass conversion are also addressed. The pretreatment and posttreatment of molasses have an impact on the quality of the final product, and the rate in which alcohol is formed during fermentation. Similarly, fermentation of pretreated switch grass to 2,3-butanediol and related products is again impacted by the type of pretreatment, which in this case includes the use of ammonia.

The storage of various biomass materials is a critical consideration since biomass materials are generally harvested over a short period of time,

but must be stored and kept available for plant operation throughout the year. The influence of storage conditions on the production of fermentable sugars, and the determination of final yields, is also described.

This session provides an overview of the latest developments in the thermal, chemical, and biological processing of biomass materials and fermentable sugars to a variety of products. The presentations are organized to promote discussions on the technical aspects of these technologies, as well as the interactions between these technologies in an overall biomass processing scheme.