Session 1
Thermal, Chemical, and Biological Processing

Introduction to Session 1

Thermal, Chemical, and Biological Processing

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Historically, this session has dealt primarily with thermal, chemical, and biological processing of biomass to produce fuels and chemicals. Over the past few years, however, greater attention has been devoted to such issues as downstream processing, product recovery, and integrated process development. This year's session continues the trends of treating a broader range of subjects and increasing attention to process integration issues. It is more and more obvious that commercialization of the various processes for converting biomass to fuels and chemicals will require an *integrated* approach since each part of the process can profoundly affect all other parts.

Pretreatment of the lignocellulosic material to enhance its reactivity is crucial to economic viability of biomass conversion processes. However, the factors governing the effectiveness of pretreatments and the influence of the pretreatment method and its process parameters on hydrolysis, fermentation, and product recovery are still poorly understood. In this session two new pretreatments were introduced: a lignin extraction process using ammonium hydroxide and cellulose dissolution in zinc chloride followed by acid hydrolysis.

Effective utilization of pentose sugars, particularly xylose, is also essential for process feasibility. Three papers approach this subject from two very different angles: (1) catalytic conversion of xylose to xylulose, which is then fermented to ethanol; (2) fermentation of glucose/xylose mixtures by genetically engineered bacteria or yeasts. The use of recombinant organisms in biomass conversion is a particularly noteworthy example of employing the latest tools of molecular biology for commodity fuels production. As with conventional mutated organisms, the lignocellulosic feedstocks, pretreatment processes, fermentation media, and fermentation/separation technology will need to be developed concurrently with these genetically enhanced organisms to allow their full metabolic potential to be realized.

Although economical production of fuel ethanol remains the major objective in biomass conversion, other large-volume oxychemicals also have great commercial potential. Lactic acid and succinic acid are two such oxychemicals which are treated in this session. Separation of these organic acids from the aqueous phase is a particular challenge that is addressed here by using membrane and absorption methods.

Overall, this session helped highlight how far we have come in biomass conversion to fuels and chemicals. . . and how far we have left to go.