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Introduction to Session 4

Bioengineering Research

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Commercialization of biotechnology processes to convert biomass into fuels and/or chemicals will require the successful integration of a complex sequence of individual steps into facile, cost effective processes. Classical process engineering techniques have historically been applied to evaluate process options and facilitate the evolution of dominant processes that meet demanding economic goals. This unit operations approach to process analysis/development is particularly effective when final processes must be selected from a potentially large combination of raw materials, microorganisms, reactor designs, and downstream processes. The six papers of this technical session are encouraging examples of the potential benefits of process engineering and modeling; however, additional developments are required to complete the cycle from technical feasibility to viable processes suitable for commercial operation.

H. K. Rohatgi (Jet Propoliion Lab) discusses a user friendly computer model developed by modification of the commercial ASPEN simulator to generate detailed cost analysis of the entire process for ethanol production. D. A. Hogsett (Dartmouth College) presents data on a direct microbial conversion process for cellulase production, cellulose hydrolysis, and fermentation to produce ethanol from cellulosic biomass in one process step with a single microbial system (*Clostridium thermosaccharolyucum*) for ethanol production. M. H. Ely (TVA) presents a hybrid biomass pretreatment process that combines dilute sulfuric acid and enzymatic hydrolysis to increase fermentable sugars for the subsequent fermentation processing. G. P. Philippidas (SERI) combines mathematical modeling with experimentation to demonstrate the benefits of the simultaneous saccharification and fermentation (SSF) process for the production of ethanol from cellulosic biomass. S. T. Yang (Ohio State Univ) develops a fermentation

system that combined a packed bed bioreactor for high cell density operation with continuous extraction (tertiary amine) to produce propionic acid. M. M. Shah (Auburn Univ) reviews a novel extractive fermentation system in which the fermentation products (acetone/butanol) were continuously extracted into oleyl alcohol, which circulated through a semipermeable (silicone) membrane within the bioreactor.