Session 3

Bioprocessing Research

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The production of fuels and chemicals from diverse biological resources such as crops and waste by-products requires the integration of numerous processing steps. Not only can an incremental improvement in one step improve an overall process, but new developments and approaches in processing technology can also dramatically alter the processing sequence and result in a step-change in process performance. Bioprocessing ultimately involves conversion, and a wide range of operations such as chemical reaction, hydrolysis, fractionation, mixing, separation, and fermentation are required to process a raw and complex material into a desired, refined fuel or chemical product. This session thus naturally represented a wide range of research areas and included over 70 contributions.

The dominant theme of the presentations was hydrolysis, and of particular interest was dilute acid hydrolysis and its optimization. Of the numerous substrate materials studied, which included rice waste, bagasse, paper sludge, wheat straw, and solid waste, there was a particular interest in corn stover, and contributions described rheological properties, hydrolysis, and simultaneous saccharification and fermentation of this material. Numerous products were also considered including ethanol, lactic acid, butanol, fumaric acid, arachidonic acid, and erythritol.

Another theme of this year's session was reactor configuration. Several contributions highlighted the benefit of multistage reaction configurations, in which independent stages improved the overall operation. For example, two-stage fermentation might include two separate reactors with different microorganisms and conditions, each completing one portion in the complete conversion of the raw material into the product.

Tools continue to be developed to quantify and understand bioprocesses, including neural network models of complex bioprocesses as well as molecular probes to understand responses at the level of gene expression. Several contributions dealt with environmental concerns, such as odor abatement and solubilization of inorganic phosphates.

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All aspects of biotechnology for the production of fuels and chemicals rely on bioprocessing. Based on the new developments presented in this session and the volume of contributions and interest in this area, we are optimistic for continued progress and improvements in bioprocessing.