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Session 3

Bioprocessing Research

GUIDO ZACCHI[1] AND SHIH-PERNG TSAI[2]

[1]Lund University, Lund, Sweden;
and [2]Argonne National Laboratory, Argonne, IL

Biotechnology and new processing technologies offer the potential for production of fuels and chemicals from renewable raw materials. Bioprocesses can also give increased yield, functionality, and purity and also offer distinct environmental advantages since they are performed at low temperature with high specificity. The number of new industrial processes is still rather limited and progress in all process parts (e.g., pretreatment of raw materials, bioreactor design, downstream processing, and waste handling), is required to make full use of the potential.

The Bioprocessing Research session at the Twentieth Symposium on Biotechnology for Fuels and Chemicals focused on new and innovative approaches for biological production of fuels and chemicals, and new unit operations for enhanced conversion in advanced bioreactors and for separations in product recovery. The papers in this session presented improvements in all areas aforementioned.

Several of the papers addressed the use of waste materials including paper fines, mixed solid wastes, industrial food wastes, and activated sludge biomass, which reduces the production cost but also introduces more complex materials to process.

Ethanol is still the main product in this session and papers on production from various raw materials (e.g., cornstarch, softwood, *Quercus sp.*, secondary paper fines and mixed solid waste comprising construction lumber waste, almond tree prunings, wheat straw, office waste paper and newsprints) were covered. However, a variety of other products were also addressed (e.g., xylitol, lactic acid and fumaric acid) and also more special chemicals like vanillin and phenylethyl alcohol.

The improvement of bioreators included two presentations on ethanol production, a fluidized-bed bioreactor for simultaneous saccharification and fermentation of starch and a CSTR-fermenter with cell recycle, and one presentation on a novel fibrous bed bioreactor for biofiltration of odorous compounds.

Two papers on downstream processing were presented. One on recovery and purification of phenylethyl alcohol using membrane filtration and

hydrophobic exchange, and one on electrodialysis for separation of acetate from a fermentation broth.

One paper addressed the integration of the bioreactor with the downstream processing using a two-zone fermenter-extractor system for simultaneous saccharification and extractive fermentation.

The use of biotechnology for waste treatment was addressed in two papers on bioremediation of oil-impacted prairie soils and removal of radioactive elements (e.g., uranium, thorium and plutonium) from aqueous waste solutions by biosorption to eggshell membrane.