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Introduction to Session 3

Bioengineering Research

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Although advances are important in genetic engineering and other approaches to enhancing biological performance for production of fuels and chemicals, bioengineering research aimed at improving key process steps in critical if biological systems are to be applied to a broad range of products. In this session of the Symposium, several novel approaches to biological conversions are presented. Results of a semisolid state fermentation with baker's yeast indicate that these microbes can achieve the advantages of solid state fermentations observed with fungi. In another study, immobilized *Zymomonas mobilis* retain activity for two months in a fluidized bed reactor, maintain operation with nonsterile feeds without contamination, and achieve yields of 96% of theoretical under a variety of conditions. Oxygen transport and carbon dioxide removal are investigated in a tubular fermenter containing hydrophobic microporous hollow fibers with fermentations via immobilized whole cells on the shell side. The effects of such factors as media composition, bioreactor design, and mass transfer on the biomass growth rates and yields of extremely thermophilic bacteria that grow above 100°C are summarized. The importance of key process parameters on the economics of the simultaneous saccharification and fermentation of lignocellulose to ethanol are presented, and recent improvements as well as future opportunities for research are emphasized. Finally, a horizontal packed-bed reactor and an intermittently stirred tank reactor are shown to reduce carbon dioxide entrapment for anaerobic fermentations.