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Session 5

Specialty Chemicals with Emphasis on Environmentally Benign Products and Processes

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Most industrial chemicals in use today are manufactured by petrochemical processes. These processes are very energy-intensive since they normally are operated at high temperatures and pressures. In addition, the raw materials are petroleum-based. Their uses therefore exert a strong dependence on oil supply. The need for an alternative has resulted in the development of many biological processes for the production of industrial chemicals. These processes generally are very environmentally friendly. The starting materials are sugars which are biodegradable. Any of these which are not converted in the bioreactors can easily be removed in the wastewater treatment plants. The catalysts in most cases are microorganisms. At the end of the production cycle, they can be killed in waste deactivation systems. Biological processes therefore do not release harmful materials to the environment.

The papers in this session discuss the production of various products by biological routes. The first paper concerns with the production of 1,3-propanediol from sugars by genetically engineered microorganisms. The sugars are first converted to glycerol, which subsequently is converted to the final product of interest. The second paper discusses a mathematical model which can be used to optimize an integrated process for the production of lactic acid from wheat starch. Results from the simulation and optimization studies are presented. The third paper presents a fermentation process using a recombinant Escherichia coli strain for dehydroshikimate production. Acetate production was minimized by using controlled glucose feed based on dissolved oxygen concentration measurements. The fourth paper discusses a fermentation process for the production of succinic acid from fumaric acid. In this process, a recombinant E. coli strain with amplified fumarate reductase genes is used. The next paper presents the results of studies on the

production of cellulases in transgenic tobacco whole plants and cell cultures.The last paper discusses the production of ethanol from starch derived from babassu coconut, which is the fruit of a Brazilian native palm. The technical and economical aspects of the process are discussed with results obtained in a 500-liter/day industrial plant.