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Introduction to Session 5

Biotechnology, Bioengineering, and Environmental Problems

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During the last five years, there has been an increasing awareness of the impact of waste disposal on the quality of our air, land, and water resources, and a coincident increase in efforts to address this problem. The problem can be attacked in three ways:

1. Change processes to reduce or eliminate the wastes they produce;
2. Treat the waste that cannot be eliminated, rather than simply disposing of it; and
3. Remediate existing waste disposal sites by either containing or destroying the hazardous or toxic material.

Biotechnological techniques have been used extensively in the treatment of waste, especially wastewater, but have not been widely adopted as a means of cleaning up existing hazardous waste sites. In fact, the EPA formally approved the use of biotechnology for site remediation only in 1990. Bioremediation is gaining acceptance as an alternative to the more traditional methods of thermal and chemical treatment, which have been shown in many cases, to simply transfer the problem from one medium to another (e.g., from land to air as hazardous wastes are burned).

There has been considerable scientific interest in the application of biotechnology to the remediation of many different types of waste problems. The papers in this session demonstrate the potential of bioremediation for treatment of existing contaminated soils, and for the prevention of soil and water contamination from such disparate pollutants as organic chemicals, inorganic acids, and heavy metals. The microbial population in soil contaminated with Aroclor 1260, a polychlorobiphenyl, is shown

in one paper to be capable of degrading Aroclor 1242 at low concentrations. Soil contaminated with 2,4,6-trinitrotoluene (TNT) and related compounds is shown in another paper to contain microorganisms that will degrade these compounds if a cometabolite was added. Results presented in another paper indicate that it is possible to remove a variety of heavy metals from water using either green algae or ground rice hulls.

Two papers look at the use of biotechnology for the prevention of soil and groundwater contamination. One project takes the view that poultry processing waste is a resource that could be biologically converted to salable products: single-cell protein, ethanol, and citric acid. The other project is aimed at preventing the production of sulfuric acid in mine tailings by introducing bacteria that produce exopolysaccharides to plug pores and exclude oxygen. Without oxygen, the biological processes that produce sulfuric acid cannot proceed.

Finally, a paper is presented that shows how the use of hybrid systems, in this case biological and chemical sequential treatment of contaminated soil from manufactured gas plant sites, can result in a more effective and cheaper approach than the use of either alone.