PROTOCOLS TO ENHANCE BIODEGRADATION OF HYDROCARBON CONTAMINANTS IN SOIL

Murray R. Gray[1,*], Dwijen K. Banerjee[1], Marvin J. Dudas[2], Michael A. Pickard[3]

1. Department of Chemical and Materials Engineering, University of Alberta, Edmonton, AB T6G 2G6
2. Department of Renewable Resources, University of Alberta, Edmonton, AB T6G 2E3
3. Department of Biological Sciences, University of Alberta, Edmonton, AB T6G 2E9

Bioremediation Journal, in Press, 2000

Abstract

Protocols were developed to determine whether microbial metabolism limits the ultimate removal of contaminants from soil. Two soils were used; a creosote contaminated soil and a soil contaminated with crude oil. A laboratory-scale slurry-phase bioreactor was used to maximize the rate of desorption of components from the soil to the aqueous phase. The protocols to enhance the ultimate removal of hydrocarbons were as follows: stimulation of the bacterial cultures with either naphthalene or a mixture of anthracene and phenanthrene, the use of static conditions to enhance bacterial attachment to the non-aqueous phase liquids in the soil, and increased incubation temperature. Addition of the PAH compounds did not stimulate removal of individual target compounds, classes of compounds or total thermally-extractable organics. A comparison of well-mixed and static culture conditions showed equivalent removal, except for the lightest PAH and petroleum fractions which were removed more under well-mixed conditions. Increasing the temperature to 30 °C from 21 °C gave more rapid initial removal of petroleum components, but the ultimate removal was unaffected. Removal of components from the creosote-contaminated soil was unaffected by temperature. These results suggest that desorption of contaminants from the soils limited the ultimate removal of contaminants, not the biological activity.

Keywords: Slurry-phase bioreactor, Mixing, Nutrient addition, PAH degradation, Hydrocarbon degradation