Biodegradation of Petroleum Hydrocarbons in Soils: Effects of Biosolids Addition and Role of Carbon

Dibyendu Sarkar[1], Rupali Datta[1], Michael Ferguson[1] (1) University of Texas at San Antonio, San Antonio, TX

Petroleum contamination results from leaking aboveground and underground storage tanks, spillage during transport of petroleum products, abandoned manufactured gas sites and various industrial processes. This contamination is hazardous to soil and water ecosystems, and is expensive to remediate. Bioremediation is an effective, economical and environmentally friendly treatment method in which microbes are used to degrade hydrocarbons. This is done either by bioaugmentation, where cultured microorganisms are introduced into a contaminated system, or biostimulation, in which additional nutrients are introduced primarily as fertilizers to stimulate microbial growth. Since fertilizers are highly soluble, their use could result in eutrophication of aquatic systems. Biosolids (sewage sludge) may be used as alternative nutrient sources, as they release nutrients slowly and in smaller quantities. Factors influencing the rate of microbial growth include soil moisture, temperature, population diversity, pH, oxygen supply and nutrient levels. Concentrations of carbon, nitrogen and phosphorus are a major factor in effective remediation of hydrocarbons in soils. Till date, many remediation efforts to clean up hydrocarbon-contaminated systems have, however, made exclusive use of commonly available inorganic N and P fertilizers to stimulate bacterial growth. Keeping this in mind, an eight-week laboratory incubation study was undertaken with a two-fold objective: (1) to demonstrate the ability (or inability) of biosolids in augmenting biodegradation of petroleum hydrocarbons in contaminated soils, and (2) to decipher the role of carbon in the overall rate of biodegradation. Preliminary results indicate that biosolids are capable of enhancing hydrocarbon biodegradation and that the rate of biodegradation decreases in carbon-deficient systems.