ABSTRACT

Cofield, Naressa. Ph.D., Purdue University, May 2005. Hydrophobicity, Toxicity and Lability of PAH-Contaminated Soil Undergoing Phytoremediation. Major Professor: M. Katherine Banks.

Phytoremediation has been shown to be a viable technology for remediation of contaminated soils. This study evaluated the impact of phytoremediation, bioremediation (unplanted-fertilized control) and natural attenuation (unplanted-unfertilized control) on soil from a manufactured gas plant contaminated with recalcitrant polycyclic aromatic hydrocarbons. Two greenhouse studies investigated the potential transport, dissipation and plant translocation of the 16 EPA priority pollutants by fescue (*Festuca arundinacea*), switchgrass (*Panicum virgatum*) and zucchini (*Curcubita pepo Raven*).

The greatest reduction in degradation was observed for planted (fescue and switchgrass) and fertilized treatments corresponding to an overall reduction of 67% in total PAHs compared to 57% in unplanted-unfertilized treatments. There was no significant difference in plant biomass and microbial numbers between plant species. Root PAH concentrations were shown to correlate well with root biomass. PAH degraders (organisms/g-dry soil), nematode survival (%), and earthworm survival (%) were strongly correlated with PAH concentrations in soils. Soil moisture was also shown to be significantly correlated with all toxicity assays. Reductions in soil hydrophobicity were observed in both planted and unplanted treatments after 12 months with the greatest reduction occurring in unplanted-fertilized and unplanted-unfertilized treatments. Soil water retention increased in switchgrass treatments, which were strongly correlated with predictions of water retention.

Zucchini enhanced degradation of 50% and 75% for 2-3 ring and select 5-ring PAHs, respectively after 90 days of treatment with increases of 3 orders of magnitude in rhizosphere microbial numbers. Negligible amounts of PAHs were detected in the plant roots and shoots, with no detectable concentrations in the fruit. Labile contaminant concentrations were shown to strongly correlate with estimates of pore water

concentrations. Strong correlations also were noted between labile PAH concentrations and nematode and earthworm bioassays. In this study, phytoremediation was effective for reducing contaminant concentrations, soil toxicity, soil water repellency, and enhancing availability of more recalcitrant compounds. Hence, overall goals of phytoremediation should shift from a system focused primarily on contaminant dissipation to one where reestablishment of a favorable environment for ecosystem sustainability and improved soil quality are key objectives.