ABSTRACT

Dong-Hee Kang, PhD, Purdue University, August, 2006. Phytoremediation of Iron Cyanide Complexes in Soil and Groundwater. Major Professor: M. Katherine Banks.

High concentrations of cyanide in soil can result from contamination by road salt, electroplating waste, and residuals from manufactured gas plants. The most toxic species is “free” cyanide, but this form of cyanide is generally rare in contaminated soil and groundwater. Iron cyanides are often predominant in environmental samples and have low toxicity. Unfortunately, free cyanides are the thermodynamically favorable species in solution, and degradation of iron cyanide compounds to the free cyanides can be accelerated by sunlight and microorganisms.

There were two objectives of this research project. The first objective was to investigate the potential for phytoremediation of cyanide contaminated soils using cyanogenic plants. The second objective was to assess the fate and transport of cyanide compounds in vegetated soil. The results indicate that germination and root

growth for cyanogenic plants were higher than for the non-cyanogenic plant. In addition, root biomass had higher cyanide concentrations than plant shoots. After 4 months of plant growth, the soil cyanide concentration was reduced approximately 25~30%. The mineral sorption capacity for cyanide was greatest for clay at low pH. Acid extractable elements also enhanced the adsorption capacity of the clays. Manganese oxide and laccase enhanced oxidation of ferrocyanide to ferricyanide resulted in a more mobile contaminant. In addition, the use of phytoremediation to reduce landfill leachate volume, and cyanide and fluoride concentrations in groundwater was assessed. Cyanide was degraded by the plants while fluoride accumulated in biomass. The results reported in this dissertation can be used in the design of phytoremediation projects for cyanide impacted soil and groundwater.