ASSESSMENT OF THE EFFICACY OF CHELATE-ASSISTED PHYTOEXTRACTION ON LEAD UPTAKE AND BIOMASS AT VARIOUS TIMES AFTER EMERGENCE OF SESBANIA EXALTATA

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Abstract: Lead (Pb), a naturally occurring grayish soft metal, is the fifth most prevalent metal used commercially in the United States. Although the health effects of Pb have been recognized for centuries, Pb continues to be one of the most useful and most widely used metals primarily because of its beneficial properties and economic importance. Soil acts as a sink for these anthropogenic sources of Pb and depending upon the reactant surface, pH, and other factors, Pb can bind tightly to the soil with a retention time of 150 to 5000 years. Lead contaminated soil can become a long-term source of exposure to humans and grazing animals. The most common methods of managing the ever-growing number of contaminated sites are either removal and burial or isolation. Using plants to remove toxic metals from soils (phytoremediation) is emerging as a potential strategy for cost-effective and environmentally sound remediation of contaminated soils. The success of phytoremediation lies in the plant's ability to produce sufficient biomass while accumulating high concentration of the metal. In this study, the concept of using older more mature plants for phytoextraction of contaminated soils was examined. Plants were grown in the greenhouse at Jackson State University (JSU) in a growth medium consisting of delta top soil and peat (2:1) that had been amended with either 0, 1000 or 2000 mg Pb/kg soil (supplied as lead nitrate). Plants were harvested 6, 8, and 10 weeks after emergence. Six days before each harvest chelates (ethylenediaminetetraacetic acid [EDTA] and acetic acid [HAc] alone or in combination) were applied to the root zone as an aqueous solution in 1:1 ratio with the metal. We observed the highest levels of lead uptake in Sesbania root and shoot tissues during week 8, with the addition of EDTA + HAc. Root and shoot biomass increased with increasing time up to week 8. By week 10, we saw a decrease in biomass with increasing levels of Pb in the soil. We concluded from the results of this study that chelate amendments can increase uptake of Pb in roots and shoots of Sesbania exaltata and that 8 weeks after emergence may be the optimal time for chelate assisted phytoextraction by this species.

Keywords: Lead, chelates, phytoextraction, exchangeable, phytoremediation

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