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Assessment of Phytoremediation of Pb-Anthracene Co-Contaminated Soils Using Vetiveira zizanioides, Heianthus annuus L., Zea mays and Glycine max

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Abstract : Phytoremediation is a green and sustainable approach to decontaminate and restore contaminated sites while maintaining the biological activity and physical structure of soils. A pot experiment was conducted for a period of 70 days to evaluate the remediation potentials of Vetiveira zizanioides, Heianthus annuus L., Zea mays, and Glycine max in concurrent removal of anthracene and Pb in co-contaminated soil. Sandy loam soils were polluted with Pb chloride salt and anthracene at three different levels (50mg/kg of Pb, 100mg/kg of Pb, and 100mg/kg of Pb+100mg/kg of anthracene) and laid out in a completely randomized design with three replicates. Shoot dry matter weight was significantly reduced ($p \leq 0.05$) in comparison to control treatments by 33%, 32%, 40%, and 6.7% when exposed to 100mg kg^{-1} of Pb, respectively in G.max, H.annuus, Z.mays, and vetiver. There was 42%, 41%, 48%, and 7.1% growth inhibition of shoot dry matter weight of G.max, H.annuus, Z.mays, and vetiver relative to control treatments when 100 mg Pb kg^{-1} was mixed with 100 mgkg^{-1} anthracene. Root and shoot metal concentration in G.max, H.annuus, Z.mays, and vetiver increased with increasing concentration of Pb. Translocation factor (TF < 1) obtained for G.max, Z.mays, and vetiver suggests that these plant species predominantly retain Pb in the root portion, while the TF value (TF≥1) obtained for H.annuus suggests that it predominantly retains Pb in the shoot portion. The extractable anthracene decreased significantly ($p \leq 0.05$) in soil planted with G.max, H.annuus, Z.mays, and vetiver, as well as in pots without plants. This accounted for 53% to 71% of anthracene dissipation in planted soil and 40% dissipation in unplanted soil. This result suggested that the plant species used are a promising candidate for phytoremediation.

Keywords : phytoremediation, heavy metals, polyaromatic hydrocarbon, co-contaminated soil
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