831/E2

Effect of EDTA on chromium uptake and translocation of selected, potential phytoextractant wild plants, under contaminated conditions

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Phytoremediation is a novel strategy that uses plants to remove heavy metal contaminants from contaminated soil and water. The aim of this study is to improve the removal of trivalent chromium from terrestrial environment using selected wild plants in Sri Lanka. In this study, Tithonia diversifolia, Achyranthes aspera and Cassia occidentalis plant species were introduced to pots contaminated with 250.00 and 350.00 mg kg^{-1} of Cr^{3+} by dry weight of soil. The pH of the tested soil sample was 6.59. Different concentrations of EDTA (1.00 mmol kg^{-1} - 10.00 mmol kg^{-1}) were applied to the soil, to check whether there was an enhancement of Cr^{3+} extraction upon applying the chelating agent. The separated plant materials (shoot and root) were digested and analyzed by atomic absorption spectroscopy after 60 days of planting. The amount of Cr^{3+} extracted by plants increased with increment of Cr^{3+} concentrations of soil. Achyranthes aspera and Cassia occidentalis indicated good tolerability to both trivalent Cr concentrations while Tithonia diversifolia showed poor tolerability to both Cr^{3+} concentrations. Addition of EDTA increased the extracted Cr^{3+} by plants. Among these three plant species, the highest Cr^{3+} extraction (285.84 mg kg-1 by dry weight of plant) was obtained by Achyranthes aspera, in the presence of 350.00 mg kg^{-1} Cr^{3+} and 10.00 mmol kg^{-1} EDTA concentrations. At these Cr^{3+} and EDTA concentrations, 285.84 mg kg^{-1} of chromium was accumulated by Cassia occidentalis whereas Tithonia diversifolia couldn't tolerate these conditions and died. In every combination of trivalent Cr and EDTA concentrations, Cr^{3+} accumulation was higher in roots than shoots of the three plant species. According to the results, the Bioconcentration factor (BCF) and Translocation factor (TF) ranged between 0.04-0.82 and 0.13-2.34, respectively for Achyranthes aspera. The BCF and TF ranged between 0.03-0.10 and 0.07–0.17 for Tithonia diversifolia and 0.03-0.31 and 0.18–0.84 for Cassia occidentalis, respectively. In this study, Achyranthes aspera species showed the highest dry biomass production [2.09 (± 0.27) g]. It is possible to conclude that application of the chelating agent EDTA to the soil can increase the Cr accumulation in plants. Although EDTA enhances the Cr accumulation, it also resulted in low biomass production. Therefore, further studies are required to investigate optimum EDTA concentration.

Keywords: Chelating agents, phytoremediation, terrestrial, chromium contamination

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