UPTAKE OF HEAVY METALS BY NONLIVING BIOMASS AND REMOVAL OF METALS BY SELECTED PLANT SPECIES

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Discharge and disposal of waste contaminated with heavy metals have resulted in the pollution of environment. The sources and the hazardous effects of chromium (Cr), lead (Pb) and nickel (Ni) were briefly described. The concepts of biosorption and phytoremediation were discussed as cost effective biological techniques to remediate contaminated environments.

This study reports the potential ability of non-living biomass of *Cabomba caroliniana* and *Hydrilla verticillata* to remove Cr and Pb from aqueous solutions, respectively. Effects of contact time, biosorbent dosage, pH of the medium, initial concentration of metal ion and protonation of the biosorbent on heavy metal-biosorbent interactions were studied through batch sorption experiments.

Cr(III) was removed more effectively and rapidly than Cr(VI) by *C. caroliniana* while Pb(II) was efficiently removed by *H. verticillata*. The pH of the medium significantly affected the extent of biosorption. The optimum pH for the Cr(III) and Cr(VI) removal were 5.00 and 2.00 respectively. However, the maximum removal of Pb(II) was observed at pH 4.00. Surface titrations on the biosorbents showed that their surfaces are positively charged at low pH, and negatively charged at pH higher than 4.00 and 3.50 for *C. caroliniana* and *H. verticillata*, respectively. Protonation of the *C. caroliniana* biosorbent increased its capacity for removal of Cr(III), while decreasing that of Cr(VI). Percentage removal of all three metal ions increased with increasing biosorbent dosage. Moreover, adsorption capacity at the equilibrium increased with increasing initial metal ion concentration. FT-IR spectra of the biosorbents confirmed the involvement of hydroxyl functional groups on the surface of *C. caroliniana* in the chromium removal process while both hydroxyl and C=O of acylamide functional groups on *H. verticillata* involved in the Pb(II) binding process. Kinetic and equilibrium data showed that the sorption process of each metal ion followed pseudo second-order kinetic model and both Langmuir and Freundlich isothermal models. The desorption of Pb(II) from the metal loaded biosorbent was also investigated.

Further, the ability of serpentine and non-serpentine ecotypes of *Fimbristylis ovata* to take up Ni from serpentine soil was also compared in this research. Serpentine ecotype exhibited a better adaptation to grow in serpentine soil for a longer period. However, accumulation of Ni in the shoots of *F. ovata* was independent of the ecotype and it was enhanced due to the application of ethylenediaminetetraacetic acid into soil.