Phytoremediation: Biosorption and Rhizofiltration of Heavy Metals - A Dual Approach

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Heavy metals are an environmental hazard and a human health concern. They are difficult and costly to remove from the environment. Phytoremediation is an inexpensive and effective alternative method. The purpose of our research was to assess the effectiveness of a variety of plants to remediate heavy metal contaminated water. Water collected from a pond behind our high school was spiked with heavy metals to investigate the effectiveness of two different phytoremediation approaches, biosorption and rhizofiltratrion, with four different plant types, Brassica Juncea (Mustard Greens), Ludwigia Peploides (Creeping Water Primrose), Coriandrum Sativum (Cilantro), and Lemnoideae (Duckweed). Biosorption is when the heavy metal binds itself to biomass from aqueous solutions, whereas rhizofiltration is the uptake of heavy metals through living plant matter. The heavy metals chromium (Cr), arsenic (As), cadmium (Cd), mercury (Hg), and lead (Pb), were quantified using an inductively coupled plasma mass spectrometer (ICP-MS). The collected data were then analyzed using JMP® statistical software. Our results showed that overall, Ludwigia Peploides was significantly better at biosorption than the other competing plants, because it was significant ($p<0.05$) in absorbing Cr, As, Cd, Pb, and Hg. For rhizofiltration, both the Brassica Juncea and Coriandrum Sativum were significant in uptaking all metals ($p<0.05$), but Brassica Juncea was more effective than Coriandrum Sativum. These results suggest that both biosoprtion and rhizofiltration could be cheap, effective, and sustainable biotechnology for bioremediation of heavy metal contaminated water.