

## ABSTRACT

Heavy metal bioaccumulation potential of two common aquatic plants viz. water lettuce (*Pistia stratiotes*) and duckweed (*Spirodela polyrrhiza*) have been studied. The test metals selected were Pb(II) and Cr(VI), either singly or in combination. The test plants were noted to be hyperaccumulators of both the metals. Compared to duckweed, water lettuce has higher uptake potential. However, accumulation of Pb was found to be higher than Cr. Metal uptake in bimetallic condition was significantly less than their individual treatment indicating competitive interaction of metals. Estimation of residual metals in the culture solution and the absence of post-treatment leaching of the absorbed metals also led credence to the effective accumulation. Batch culture experiments effectively demonstrated increased metal removal by water lettuce plant.

Impacts of metal accumulation on some metabolic parameters were evaluated through estimation of phytomass, contents of chlorophyll and soluble protein, chlorophyll fluorescence and peroxidase activity. Significant declines were noted in the phytomass and in contents of chlorophyll and soluble protein depending on the type of metals - their concentrations and contact periods. Chlorophyll fluorescence excitation spectra and chlorophyll-a fluorescence induction curves from specific treatment revealed considerable changes compared to the control and possible consequences of these changes have been discussed. Peroxidase activity was accelerated due to the metal exposures and that response varied with the plants, treatment conditions and the metal types. Synergistic effects were evident during the combined metal treatment. Significant correlations shown by these parameters suggested their utility as biomarkers.

As a corollary to the above mentioned metabolic response studies, assessment of important biomolecules like glutathione and total non-protein sulfhydryl were made. Possibility of the induction of phytochelatin, a metal chelating peptide, in the test plants were also evaluated. Significant decrease in

glutathione content with concomitant increase in total non-protein sulfhydryl level due to Pb treatment indicated the synthesis of phytochelatin. Sephadex G-50 fractionation and reverse-phase HPLC analysis of plant extracts from specific treatments confirmed phytochelatin induction thereby indicated its involvement in Pb detoxification. Conversely, Cr treatment increased the glutathione level and also that of total non-protein sulfhydryl. While HPLC analysis failed to detect any phytochelatin induction. Presumably, Cr detoxification mechanism differs from that of Pb. Moreover, this differential response of the two metals and significant correlation of responses with metal concentrations suggested their suitability as "biomarkers".