

ENHANCED REMOVAL OF Cr(VI) FROM WASTEWATER USING CHEMICALLY MODIFIED *Eichhornia crassipes* BIOSORBENT

A.M.S.R. Abeysinghe¹ and N. Priyantha^{2*}

¹Department of Environmental and Industrial Sciences, University of Peradeniya, Peradeniya, Sri Lanka.

²Department of Chemistry, University of Peradeniya, Peradeniya, Sri Lanka.

*namalpriyantha@sci.pdn.ac.lk

Water found in nature is heavily contaminated by pollutants discharged from industrial effluents. Among various pollutants, heavy metals and their compounds are considered the most hazardous substances causing water pollution. The use of plant-based materials has recently gained interest as a viable alternative to existing chemical methods for heavy metal removal. This study focuses on investigating the adsorption characteristics and effectiveness of *Eichhornia crassipes* (EC) as a biosorbent for Cr(VI) removal from contaminated water. This plant was selected due to its abundance as an invasive aquatic weed, low-cost, and the presence of functional groups in its roots and leaves enhancing its potential for heavy metal adsorption. EC plants were collected, separated into roots and leaves, followed by air-drying and oven-drying to remove any remaining moisture. The dried material was ground and sieved to prepare particles of uniform size for adsorption experiments. Although raw leaf and root particles of EC result in less than 10% removal of Cr(VI), the biosorbents modified with 0.10 mol L⁻¹ HCl demonstrate a significant improvement in their adsorption capacity, showing 76% and 84% removal by HCl-modified root and leaf of EC, respectively, under the optimum conditions of 1.50 g dosage and 500 – 710 µm particle size. Higher concentrations of HCl are not suitable for modification, as the adsorbent surface would be denatured. On the other hand, smaller particle sizes do not interact effectively with the solution due to their floating behaviour; hence, particles of less than 200 µm are not recommended. The protonation of active sites on the biosorbent through acid modification is responsible for binding with negatively charged Cr(VI) species, Cr₂O₇²⁻, thereby enhancing the adsorption characteristics. Furthermore, the biosorbent is positively charged at the ambient pH, at which the experiments are performed, which is lower than the pH at the point of zero charge, providing further evidence of Coulombic attraction between the adsorbate and the adsorbent. These findings demonstrate that HCl-modified EC has potential for removing Cr(VI) from aqueous solutions, making it a sustainable option in wastewater treatment.

Keywords: Adsorption, Biosorption, Cr(VI), *Eichhornia crassipes*, Wastewater