

REMOVAL OF Pb(II) FROM AQUEOUS SOLUTIONS BY *Hydrilla verticillata* USING A FIXED-BED COLUMN: BIOSORPTION AND DESORPTION STUDIES

D.M.R.E.A. Dissanayake

Postgraduate Institute of Science

University of Peradeniya

Sri Lanka

Pb(II) is a heavy metal, used in the paint industry, battery manufacture and even in plumbing domestic pipes. Pb(II) toxification can occur by inhalation, oral or skin contamination, which can be carcinogenic to human. Therefore, it is essential to remove Pb(II) from the contaminated environment. Removal of heavy metals from aqueous systems includes conventional, physico-chemical methods, such as ion-exchange, membrane filtration, chemical precipitation, etc. These techniques are expensive and require intervention of the environment. Objectives of this study was to investigate the capacity of dead *Hydrilla verticillata* biomass to remove Pb(II) from contaminated aqueous systems in fixed-bed method and a suitable desorbent to recover the adsorbed Pb(II) ions from the biosorbent.

H. verticillata was dried at 60 °C for 24 h, ground with mortar and pestle and sieved. Fixed-bed column studies were carried out as a function of influent flow rate and bed height at room temperature. Eluent samples were collected at 15 min intervals and analyzed in an atomic absorption spectrophotometer. HNO₃, NaOH, Na₂CO₃ and NaNO₃ solutions were screened as desorbents in batch desorption processes. Fixed-bed column desorption studies were conducted to optimize the metal recovery using 0.50 mol L⁻¹ Na₂CO₃ at different flow rates and different bed heights. Biosorbent surface was characterized by Fourier transform infrared (FTIR) spectroscopy.

Fixed-bed column studies with the dried biomaterial removed 66.70 ± 0.74% of Pb(II) in the aqueous systems after 750 min at a flow rate of 3.0 mL min⁻¹ at 10.0 cm bed height. The breakthrough time was decreased with increasing flow rates, where the lowest adsorption percentage of 47.71 ± 0.04% was observed for 10.0 mL min⁻¹ influent flow rate. With increasing bed height the breakthrough time was increased where, for a 10.0 cm bed height the adsorption percentage was 55.77 ± 0.66%, for 15.0 cm it was 59.54 ± 1.33% and for 20.0 cm it was 63.63 ± 2.37% at 7.0 mL min⁻¹ influent flow rate. HNO₃ showed the highest desorbing percentage at pH 1.0 giving 100% desorption in batch desorption studies. A fixed-bed column packed with metal loaded *H. verticillata* was also eluted with 0.50 mol L⁻¹ Na₂CO₃ and the percentage of desorption was significantly increased up to 100% at a bed height of 10.0 cm and flow rate of 3.0 mL min⁻¹.

These findings suggest that the *Hydrilla verticillata* can be used as an efficient biosorbent to remove Pb(II) from aqueous systems in a fixed-bed column and the adsorbed Pb(II) can be recovered using Na₂CO₃.