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Assessment of the effectiveness developed low cost SPE systems using dry banana peel powder for the separation and pre-concentration of Cd (II) and Pb (II) in water

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Abstract

Most heavy metals are highly toxic, non biodegradable, non thermo-degradable and can be readily accumulated to toxic levels persisting in the environment. Therefore, development of analytical methods for the determination of toxic heavy metal levels in natural water systems has been a highly researched area in the recent years. Biosorption is conveniently superior to the conventional methods of metal removal like chemical precipitation, solvent extraction, reverse osmosis, *etc.* in terms of cost, efficiency at low metal concentrations, and green chemistry.
In this research, the ability of dry banana peel powder to act as a biosorbent for Cd(II) and Pb(II) was investigated with the intention of developing a low-cost solid phase extraction (SPE) system.

The optimum contact times for Cd(II) and Pb(II) were determined in single metal systems. The concentrations of metal ions at the equilibrium were determined by varying the initial metal concentration and the contact time between the banana peel powder and metal ions. These data was used to calculate biosorption capacities and separation factors. The effect of the particle size on sorption capacity was tested using two particle sizes (less and greater than 250μm). Particles with the size of < 250μm showed better sorption capacity. The overall biosorption capacity reflecting the biosorbent quality was calculated using the metal uptake. The banana peel powder biosorbent is relatively easy to prepared, and hence can be considered as a substitute to expensive SPE sorbents. Banana peel powder has a significant biosorption capacity that can be further optimized by the manipulation of experimental and physical conditions. These systems showed a separation factor (Sf) of $0<Sf<1$, hence can be considered as a favourable isotherm. Therefore, banana peel biosorbent can be used as an effective biosorbent for Cd(II) and Pb(II) ions for the development of low cost SPE systems.

Keywords: Biosorption, solid phase extraction, Langmuir Isotherm, metal ion removal, separation factor.