Cowpea pod (Vigna unguiculata) biomass as a low-cost biosorbent for removal of Pb(II) ions from aqueous solution

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Abstract

The use of cowpea pod (CPP) biomass for the removal of Pb(II) ions from aqueous solution was investigated. The effects of factors such as dosage concentration (0.2 to 1.6 g L−1), pH (2 to 8), contact time (5 to 120 min), metal ion concentrations (10 to 80 mg L−1) and temperature (20 to 50 °C) were examined through batch studies. The biosorption data conformed best to the Langmuir model at the three working temperatures (20, 30 and 40 °C) as revealed by the correlation coefficients (R 2) which were greater than 0.940. The maximum sorption capacity of the CPP for Pb(II) was 32.96 mg g−1 at 313 K. Furthermore, the kinetic data fitted well to the pseudo-second-order model as it had the lowest sum of square error (SSE) values and correlation coefficients close to unity (R 2 > 0.999). The thermodynamic parameters (ΔG°, ΔS° and ΔH°) showed that the biosorption process was spontaneous, feasible and endothermic. The results obtained in the present study indicated that cowpea pod biomass could be used for the effective removal of Pb(II) from aqueous solution.