

Removal of nickel(II) from aqueous solution by *Vigna unguiculata* (Cowpea) pods biomass

Upenyu Guyo, Kudakwashe Sibanda, Edith Sebata, Fidelis Chigondo, Mambo Moyo

Abstract

The potential to remove nickel(II) ions from aqueous solution using a biosorbent prepared from *Vigna unguiculata* pods (VUPs) was investigated in batch experiments. The batch mode experiments were conducted utilising independent variables such as pH (2 to 8), contact time (5 to 120 min), dosage concentration (0.2 to 1.6 g), nickel(II) concentrations (10 to 80 mg L⁻¹) and temperature (20 to 50°C). The biosorption data fitted best to the Freundlich biosorption model with a correlation coefficient (R^2) of 0.993 and lowest chi square value of 31.89. The maximum sorption capacity of the VUP for nickel(II) was 27.70 mg g⁻¹. Kinetics studies revealed that the biosorption process followed the pseudo-second order model as it had the lowest sum of square error value (0.808) and correlation coefficient close to unity ($R^2 = 0.998$). The calculated thermodynamic parameters showed that the biosorption process was feasible, spontaneous and endothermic. Consequently, the study demonstrated that VUP biomass could be used as a biosorbent for the removal of nickel(II) from aqueous solution.