

Preparation and characterization of poly(ethyl hydrazide)-grafted oil palm empty fruit bunch fibre for the removal of Cu(II) ions from an aqueous environment

ABSTRACT

Poly(ethyl hydrazide)-grafted oil palm empty fruit bunch fibre (peh-g-opefb) was successfully prepared by heating poly(methyl acrylate)-grafted opefb (pma-g-opefb) at 60 °C for 4 h with a solution of hydrazine hydrate (15% v/v) in ethanol. The Fourier transform infrared spectrum of the product shows a secondary amine peak at 3267 cm⁻¹, with amide carbonyl peaks at 1729 cm⁻¹ and 1643 cm⁻¹. The chelating ability of peh-g-opefb was tested with copper ion in aqueous solution. A batch adsorption study revealed that maximum adsorption of copper ion was achieved at pH 5. An isotherm study showed the adsorption follows a Langmuir model, with a maximum adsorption capacity of 43.48 mg g⁻¹ at 25 °C. A kinetic study showed that the adsorption of copper ion rapidly reaches equilibrium and follows a pseudo-second-order kinetic model, with a constant rate of 7.02 × 10⁻¹ g mg⁻¹ min⁻¹ at 25 °C. The Gibbs free energy, ΔG^0 , value is negative, indicating a spontaneous sorption process. Entropy, ΔS^0 , gives a positive value, indicating that the system is becoming increasingly disordered after the adsorption of copper ion. A positive enthalpy value, ΔH^0 , shows that the endothermic process takes place during the adsorption and is more favourable at high temperatures.

Keyword: Copper; Isotherm; Kinetic; Poly(ethyl hydrazide).