**Ackee apple (Blighia sapida) seeds: a novel adsorbent for the removal of Congo Red dye from aqueous solutions**

**Abstract**

The ability of ackee apple (AA) seeds to remove Congo Red (CR) dye from aqueous solution was investigated. AA was characterised using thermo gravimetric analyser, scanning electron microscopy, Braunauer Emmett Teller, pHpzc, elemental analysis and Boehm titration. The effects of operational parameters such as adsorbent dosage, contact time, initial dye concentration and solution pH were studied in a batch system. pH has a profound influence on the adsorption process. Maximum dye adsorption was observed at pH 3.0. The reaction was fast, reaching equilibrium in 90 min. Adsorption data were best described by Langmuir isotherm and the pseudo-second-order kinetic model with a maximum monolayer coverage of 161.89 mg·g−1. Both boundary layer and intraparticle diffusion mechanisms were found to govern the adsorption process. Thermodynamic parameters such as standard free energy change (Δ *G* 0), standard enthalpy change (Δ *H* 0), and standard entropy change (Δ *S* 0) were studied. Values of Δ *G* 0 varied between−30.94 and−36.56 kJ·mol−1, Δ *H* 0 was 25.61 kJ·mol−1, and Δ *S* 0 was 74.84 kJ·mol−1·K−1, indicating that the removal of CR from aqueous solution by AA was spontaneous and endothermic in nature. Regeneration and reusability studies were carried out using different eluents. AA gave the highest adsorption efficiency up to four cycles when treated with 0.3 M HCl. AA was found to be an effective adsorbent for the removal of CR dye from aqueous solution.