Removal of chromium (VI) from aqueous solution using treated oil palm fibre

Abstract

This study proposed an oil palm by-product as a low-cost adsorbent for the removal of hexavalent chromium [Cr (VI)] from aqueous solution. Adsorption of Cr (VI) by sulphuric acid and heat-treated oil palm fibre was conducted using batch tests. The influence of pH, contact time, initial chromium concentration and adsorbent dosage on the removal of Cr (VI) from the solutions was investigated. The optimum initial pH for maximum uptake of Cr (VI) from aqueous solution was found to be 1.5. The removal efficiency was found to correlate with the initial Cr (VI) concentration, adsorbent dosage as well as the contact time between Cr (VI) and the adsorbent. The adsorption kinetics tested with pseudo first order and pseudo second order models yielded high R^2 values from 0.9254 to 0.9870 and from 0.9936 to 0.9998, respectively. The analysis of variance (ANOVA) showed significant difference between the R^2 values of the two models at 99% confidence level. The Freundlich isotherm ($R^2 = 0.8778$) described Cr (VI) adsorption slightly better than the Langmuir isotherm ($R^2 = 0.8715$). Difficulty in desorption of Cr (VI) suggests the suitability of treated oil palm fibre as a single-use adsorbent for Cr (VI) removal from aqueous solution.

Keywords: Chromium (VI); Adsorption; Treated oil palm fibre; Kinetic; Isotherm