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Removal of hexavalent chromium from aqueous solutions using almond green hull adsorbent magnetized by Fe_3O_4: isotherm, kinetic and thermodynamic studies

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ABSTRACT

In this study, the efficiency of almond green hull magnetized by Fe_3O_4 in the removal of hexavalent chromium from aqueous solutions was investigated. Structural characteristics of this adsorbent were determined by Fourier Transform Infrared Spectroscopy (FTIR), scanning electron microscopy (SEM), energy-dispersive X-ray spectroscopy (EDX), vibrating-sample magnetometer (VSM) and Brunauer–Emmett–Teller (BET). The parameters examined for the removal of Cr(VI) included pH (2–12), initial concentration of hexavalent chromium (10–100 mg/L), adsorbent dose (0.1–0.8 g/L), contact time (1–60 min), and temperature (5–50°C). Finally, the isotherm and kinetics of the adsorption process were investigated. The result of this study showed that removal of Cr(VI) was higher in acidic pH. By increasing the adsorbent dose, contact time, temperature and reducing the initial concentration of the pollutant, the removal efficiency increased. In optimal conditions, the maximum removal efficiency of Cr(VI) by almond green hull magnetized by Fe_3O_4 was equal to 100% and maximum adsorption capacity was 25 mg/g, (optimal conditions: pH = 2, adsorbent dose: 0.8 g/L, initial concentration of Cr(VI): 20 mg/L, time: 60 min, temperature: 50°C). The results showed that the adsorption process is more consistent with Langmuir isotherm and pseudo-second order kinetics. The thermodynamic results of the adsorption process showed that this process was endothermic and spontaneous. In summary, the adsorption process on almond green hull magnetized by Fe_3O_4 can be used as a new and efficient method in the removal of Cr(VI) from aqueous solutions.

Keywords: Hexavalent chromium; Green almond hull; Fe_3O_4; Isotherm; Kinetics, Thermodynamic

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