

Functionalized activated carbon derived from palm kernel shells for the treatment of simulated heavy metal-contaminated water

ABSTRACT

Heavy metal contamination in water poses a great risk to human health as well as to the lives of other creatures. Activated carbon is a useful material to be applied for the treatment of heavy metal-contaminated water. In this study, functionalized activated carbon (FAC) was produced by the induction of nitro groups onto activated carbon using nitric acid. The resulting material was characterized in detail using the XRD, Raman, BET, FTIR, and FESEM techniques. The FAC was used for the treatment of heavy metal-contaminated water using different adsorption parameters, i.e., solution pH, contact time, adsorbent dosage and heavy metal ion concentrations, and these parameters were systematically optimized. It was found that FAC requires 90 min for the maximum adsorption of the heavy metal ions; Cr⁶⁺, Pb²⁺, Zn²⁺ and Cd²⁺. The kinetic study revealed that the metal ion adsorption follows the pseudo-second-order. The Freundlich and Langmuir isotherms were applied to determine the best fitting adsorption isotherm models. The adsorption capacities were also determined for each metal ion.

Keyword: Heavy metals; Activated carbon; Metal adsorption; Water contamination; Water purification