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Chromium(VI) removal from water using fixed bed column of polypyrrole/Fe3O4 nanocomposite

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ABSTRACT

The adsorption of Cr(VI) using polypyrrole/Fe3O4nanocomposite adsorbent was investigated in a continuous flow fixed-bed column. The effects of composition of the nanocomposite, adsorbent mass, influent Cr(VI) concentration and flow rate on the adsorption characteristics of adsorbent was explored at pH 2. Experimental results confirmed that the breakthrough curves were dependent on bed mass, initial Cr(VI) concentration and flow rate. Three kinetic models; Yoon–Nelson, Thomas, Bohart–Adams were applied to the experimental data to predict the breakthrough curves using linear regression and to determine the characteristic parameters of the column that are useful for process design. The Yoon–Nelson and Thomas models were found appropriate for description of the whole breakthrough curves, whereas the Bohart– Adams model could only predict the initial part of the breakthrough curves. Using environmental water, the PPy/Fe3O4nanocomposite demonstrated its effectiveness in Cr(VI) removal below acceptable level by processing 5.04 L water with initial 76.59 mg/L Cr(VI) concentration using only 2 g of adsorbent mass. It can be concluded therefore that PPy/Fe3O4media provides alternative solution to ameliorate water contaminated with Cr(VI).