

Fixed-bed system for adsorption of anionic acid dyes from binary solution onto quaternized kenaf core fiber

ABSTRACT

Water pollution due to the effluents from textile industries causes serious concern around the world. During the coloration process, the excess synthetic dyes are discharged into the wastewater stream. In the present research, kenaf core fiber (KCF) residue was chemically modified with (3-chloro-2-hydroxypropyl) trimethylammonium chloride (CHPTAC) to alter the surface properties and increase the surface area to develop more active sites that capture anionic dyes from aqueous solution. Fixed-bed adsorption studies were conducted to investigate the performance of using quaternized kenaf core fiber (QKCF) as an adsorbent for the removal of anionic acid dyes from a binary system. The effects of operational parameters, including inlet dye concentration, flow rate, and bed height, were studied in a fixed-bed column system, while other process parameters were fixed, i.e. pH and temperature at 7.5 and 27 °C, respectively. The fixed-bed column performed better with lower influent dye concentration, less flow rate of the influent, and a higher adsorbent bed depth. Overall, the present study showed that QKCF is a potential adsorbent for anionic dye removal from aqueous solutions in a fixed-bed column system.

Keyword: Binary system; Fixed-bed; Kenaf core fiber; Acid blue dye; Acid green dye; Quaternization