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Adsorption of Cd(II) on lotus stalks-derived activated carbon: batch and column studies

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ABSTRACT

This paper reports a study of adsorption of Cd(II) from aqueous solutions using activated carbon made from lotus stalks (LSAC). The properties of LSAC were characterized by scanning electron microscopy and BET surface area. Zeta potential was also determined. The batch Cd(II) adsorption on LSAC was performed to study the different sorption parameters (time, pH, temperature and ionic strength) that influence the adsorption of Cd(II) onto LSAC and to explore the adsorption mechanisms. Bench-scale column tests were also carried out to determine breakthrough curves with varying flow rates and fixed-bed heights. In general, the theoretical q_e calculated using the pseudo-second-order kinetic model agreed better with the experimental data than the first-order one. Among the three widely-used isotherms (Langmuir, Freundlich, and Temkin models), the Langmuir model appeared to describe the experimental results best. The Adam–Bohart equation was appropriate for relative concentration ranging from 0.01 up to 0.5 in this study. The pH of the initial solution affected the sorption of Cd(II) on LSAC to the greatest extent, and presence of Mg^{2+} resulted in a larger competition to the active sites than Na^+, implying ion exchange and electrostatic attraction adsorption mechanisms.

Keywords: Activated carbon; Lotus stalks; Cd(II) adsorption; Breakthrough curve

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