Equilibrium and kinetic studies on the adsorption of humic acid onto cellulose and powdered activated carbon

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ABSTRACT

The removal of humic acid (HA) from aqueous solution onto cellulose (CE) and powdered activated carbon (PAC) was investigated in a batch adsorption system as a function of pH, sorbent mass and contact time. The optimum conditions for HA uptake by CE were 2–3, 50 mg and 30 min, respectively. For PAC, they were 2, 50 mg and 30 min, respectively. PAC and CE sorbents were characterized by Fourier transform infrared spectroscopy and scanning electron microscopy. The kinetic adsorption data was analysed on the basis of Lagergren pseudo-first-order, pseudo-second-order, Bangham and the interparticle diffusion models. The Lagergren pseudo-first-order fitted the kinetic data best. Experimental sorption data were fitted on different adsorption isotherm models, and it was established that the fitting followed the order: Langmuir > Freundlich > Temkin > Dubinin–Radushkevich (D–R). According to the Langmuir isotherm models, the maximum adsorption capacities of CE and PAC for HA were 89.3 and 30.4 mg g⁻¹, respectively.

Keywords: Humic acid; Cellulose; Activated carbon; Kinetics; Adsorption; Modelling

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