Efficient Removal of Sulfamethoxazole onto Sugarcane Bagasse-derived Biochar: Two and Three-parameter Isotherms, Kinetics and Thermodynamics

Abstract.

In this work, bagasse, an agricultural waste was used for the development of environmentally benign biochar (CBG) and the thermal pyrolysis product applied for adsorption of sulfamethoxazole (SMX) from water using a batch technique. The pseudo-first-order model best described the adsorption kinetics. Equilibrium adsorption data were modelled using six two-parameter and five three-parameter isotherm equations and the best-fitting models obtained using five error functions. The Sips isotherm best predicted the equilibrium data with an estimated adsorption capacity of 128.8 mg g-1. Error analysis showed that three-parameter isotherms best explained the experimental data. The thermodynamic functions, viz. enthalpy (ÄH =-24.72 kJ mol-1), Gibbs free energy (ÄG =-15.67 kJ mol-1), entropy (ÄS = 32.65 kJ mol-1), showed that the reaction is spontaneous and exothermic. The mechanism of adsorption involved charge-assisted hydrogen bonding (-)CAHB. The amount of CBG required for the removal of 99 % of SMX in a given volume of effluent was predicted. The results attest that CBG is an effective low-cost adsorbent for SMX adsorption.

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