Adsorption of ketoprofen and paracetamol and treatment of a synthetic mixture by novel porous carbon derived from *Butia capitata* endocarp

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Abstract

In this work, endocarp of the species Butia capitata was employed as precursor material to prepare a novel activated carbon with intrinsic properties to remove ketoprofen and paracetamol from water efficiently. The activated carbon presented a predominantly microporous structure, with an average pore diameter of 1.23 nm, a total pore volume of 0.449 cm3 g−1, and a high specific surface area, 820 m2 g−1. The adsorption kinetics showed a rapid initial decay for both pharmaceuticals, with the system entering equilibrium after 120 min for ketoprofen and 180 min for paracetamol. The pseudo-second-order model presented the best fit for ketoprofen and the Elovich model for paracetamol. The adsorption equilibrium data show that temperature can increase or decrease the adsorption capacity, being found a maximum adsorption capacity of 108.79 and 100.60 mg g−1 for the ketoprofen and paracetamol, respectively. The Freundlich and Langmuir models presented the best statistical adjustments for the adsorption of ketoprofen and paracetamol, respectively. The thermodynamic analysis confirmed an endothermic process for ketoprofen (ΔH0 = 11.98 kJ mol−1) and exothermic for paracetamol (ΔH0 = -13.37 kJ mol−1). The recycle tests revealed that the adsorbent has an average decrease for removal percentage of only 1.88 % for ketoprofen and 1.57 % for paracetamol. Estimations costs indicate that the price of 1 kg of activated carbon costs is 2.39 USD at minimum. Last, the material presented a highly efficient adsorptive activity to treat a synthetic mixture containing several pharmaceutical compounds and salts, reaching 84.82% removal.

Keywords

Butia capitata, Activated carbon, Ketoprofen, Paracetamol, Synthetic mixture