

Adsorption of ibuprofen, ketoprofen, and paracetamol onto activated carbon prepared from effluent treatment plant sludge of the beverage industry

Angélica F. M. Streit; Gabriela C. Collazzo; Susanne P. Druzian; Rodrigo S. Verdi; Edson L. Foletto; Luis F.S. Oliveira; Guilherme L. Dotto

Abstract

The presence of emerging contaminants such as pharmaceuticals in aquatic means presents as a serious threat, since their real consequences for the environment and human health are not well known. Therefore, this work consisted of preparing and characterize sludge-derived activated carbons (beverage sludge activated carbon – BSAC and acid-treated beverage sludge activated carbon - ABSAC) to investigate their use in the pharmaceuticals adsorption in aqueous media. The morphology study has demonstrated that ABSAC, unlike BSAC, exhibited an abundant porous structure, with smaller particles and bigger roughness. Adsorption results indicated that the ABSAC was more effective than BSAC, since it presented superior surface area ($642 \text{ m}^2 \text{ g}^{-1}$) and total pore volume ($0.485 \text{ cm}^3 \text{ g}^{-1}$) values. Pseudo-second-order kinetic model was more suitable to predict experimental data. Sips model best described the equilibrium data, with maximum adsorption capacities of 145, 105, and 57 mg g^{-1} for paracetamol, ibuprofen, and ketoprofen, respectively. Besides, the sludge-derived adsorbent was highly efficient in the treatment of a simulated drug effluent, removing 85.16% of the pharmaceutical compounds. Therefore, the material prepared in this work possesses intrinsic characteristics that make it a remarkable adsorbent to be applied in the treatment of pharmaceutical contaminants contained in industrial wastewater.

Keywords

Sludge; activated carbon; adsorption; Pharmaceuticals; Simulated effluent