A review of the toxicology presence and removal of ketoprofen through adsorption technology

Jordana Georgin; Dison S. P. Franco; Katia da Boit Martinello; Eder C. Lima; Luis F. O. Silva

Abstract

The present review was carried out to analyze the works developed using the adsorption technology to remove the anti-inflammatory ketoprofen (KET). The main factors that inflated the KET adsorption were analyzed. It was found that, among the developed adsorbents, those from ZnAl/biochar, algae-derived porous carbon, and powdered activated carbon were highly efficient, reaching maximum capacities of 1081, 443, and 362 mg g^{-1}, respectively. It was found that the adsorption capacity tends to be higher when the pH is close to the value of pK_a of the KET and when the adsorbent has a higher pH_{pzc}. From the kinetics of KET adsorption, it was found that the adsorbent dosage and the initial KET concentration causes an inverse effect on the equilibrium time and adsorption capacity for all the system. Isothermal studies confirmed the predominance of monolayer adsorption present on homogeneous surfaces corresponding to the Langmuir isotherm; however, it is also possible to observe more heterogeneous surfaces corresponding to the Freundlich and Sips isotherm. The thermodynamics nature of the process was found to be exothermic and endothermic, demonstrating a possible relation with the Gibbs solvation energy. The adsorption mechanism indicates that the KET tends to be adsorbed due to physical interactions (hydrogen bonding, π-π interactions). In general, the adsorption technique proved to be an efficient technology in removing KET, where several adsorbents have already been developed and successfully applied in its removal. The next step is to overcome the laboratory scale barrier and apply these materials to treat real effluents. In addition, studies should be more focused on continuous and multi-component processes, providing results for future real-scale applications.

Keywords

Adsorption, Ketoprofen , Ecotoxicology , Water resources