Abstract

This study is focused on the removal of Dextropropoxyphene (DPP) and Paracetamol (PAR) from aqueous solutions by adsorption on the economical biosorbent fibers of *Luffa Cylindrica (LC)*, which was initially characterized by different analytical techniques (FTIR, MEB and DRX). The specific surface of these fibers was determined by the adsorption / desorption isotherms of N_2, it was estimated at 123 $m^2.g^{-1}$.

The sorption study in a batch system was carried out by checking the effect of a few parameters, namely: the amount of biosorbent, the initial concentration of adsorbate, the initial pH and the temperature of the medium.

The modeling of the adsorption process was based on the mathematical approach of the modified Redlich-Peterson (RP) isotherm equation proposed by Feng-Chin-Wu, in which the dimensionless form, corresponding to the optimal curve, allows to evaluate the key parameter α. The same α value was obtained for both pharmaceutical compounds and the $b_{RP}Ce^{\alpha}$ values were 2 for DPP and 10 for PAR.

The linear regression of the Redlich-Peterson isotherm equation was also confirmed by analysis of variance (ANOVA). The results obtained showed that the probability value (p-value) was less than 5%, with adjusted correlation coefficients (R_{adj}^2) of 0.9515 and 0.9283 for DPP and PAR, respectively.

The kinetic study showed that the binding of the two solutes is pseudo-second order and that intra-particle diffusion is not the only limiting step.

From a thermodynamic point of view, the adsorption of DPP and PAR is spontaneous and exothermic and the disorder appears to decrease at the liquid-fiber interface.

The optimization of the main factors, which prevail the adsorption process, was carried out by a three-level full factorial design (PFC) 2^3. The optimal approximations led to maximum adsorption yields of 71.56% and 53.63% for PAR and DPP respectively, corresponding to the estimated values (pH = 6, C = 60 ppm and m_{LC} = 0.4g). This optimization was confirmed by the composite desirability function (D = 0.7731) which made it possible to conclude that the compromise adopted was reasonable.

Keywords: Adsorption, *LC* fibers, PAR, DPP, Modified RP isotherm, ANOVA, FFD, desirability.