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Kinetics and Modelling of Drug Adsorption using Activated Carbon Derived from Cocoa Cob Waste

Candelaria Tejada Tovar[1], Angel Villabona Ortíz[2], Abigail Camargo Avila[3], Diofanor Acevedo*[4], Nórida Pájaro Gómez[5]

[2,3,5]Faculty of Engineering, Chemical Engineering program, Research Group IDAB, University of Cartagena Av. El Consulado, St. 30 No. 48-152. Colombia.
[1,4]Faculty of Engineering, Research Group Innovation, Agricultural and Agro-industrial Development, University of Cartagena Av. El Consulado, St. 30 No. 48-152. Colombia.

Abstract: Residual cocoa biomass was used for the generation of low temperature activated carbon, which was prepared and characterized by scanning electron microscopy (SEM) to determine the chemical composition of cocoa, and thus evaluate its use as an adsorbent to remove amoxicillin and ibuprofen, taking as a hypothesis that activated charcoal prepared from cocoa cob waste (shell, pulp and mucilage) is a good adsorber for removing ibuprofen and amoxicillin in aqueous solution. The removal averages were compared following an experimental design 2^2, by applying a two-way ANOVA for each contaminant. The biomass was thermally pre-treated at low temperature and impregnated with a solution of $ZnCl_2$ at different concentrations (50,33.33 and 25% v $ZnCl_2$ /v H_2O). The adsorption kinetics of the batch system were determined and modeled, establishing that the best conditions of amoxicillin adsorption were given at pH 6 and impregnation of 50% v v^{-1}, reaching a removal rate of 77.4% and that the kinetic model that best fitted the experimental removal data was Elovich with an R^2 between 0.9886 and 0.9949; while for ibuprofen taking into account the impregnation of activated carbon and the initial drug concentration (20,30 and 40 ppm), it was obtained that the higher the drug concentration, the higher the removal percentage giving a maximum result of 68% removal at 40 ppm and impregnation 50% v v^{-1}, while for activated carbon with impregnation 25% v v^{-1} and 20 ppm a removal rate of 29.15% was obtained and the experimental data of adsorption kinetics at optimum conditions according to the surface response method had a good fit to the pseudo-first order model with an R^2 between 0.779 and 0.9164.

Keywords: Adsorption, activated carbon, biomaterial, removal.

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