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Optimization, equilibrium and kinetic studies on ibuprofen removal onto microwave assisted – activated *Aegle marmelos correa* fruit shell

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ABSTRACT

Micro pharmaceutical pollutant, ibuprofen, was removed from aqueous solutions by microwave irradiated thermally activated *Aegle marmelos correa* fruit shell (MTAS). The main and interactive effects of five process variables such as adsorbent dose (0.125–0.5 g L^{-1}), initial ibuprofen concentration (100–300 μg L^{-1}), contact time (1–3 h), pH (2–12) and temperature (20°C–40°C) were investigated via response surface methodology based on Box–Behnken statistical design. The optimum values of the key variables were estimated using Derringer's desirability function. The optimal values were found to be adsorbent dose 0.241 g, initial ibuprofen concentration 150 μg L^{-1}, pH 8.69, temperature 33.57°C and contact time 1.42 h with maximum desirability of 91%. The equilibrium data obeyed Redlich–Peterson isotherm which showed that the MTAS was heterogeneous and ibuprofen was adsorbed in multilayers. The kinetic investigation showed that the ibuprofen was chemisorbed on MTAS surface following Avrami's fractional-order kinetics. The thermodynamic parameters revealed that ibuprofen adsorption process was spontaneous and endothermic. Regeneration of exhausted MTAS found to be possible via acetic acid as eluent.

Keywords: Adsorption; Box–Behnken; Ibuprofen; *Aegle marmelos correa* fruit shell; Equilibrium

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