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PII: S2214-9937(16)30104-X
DOI: doi: 10.1016/j.susmat.2017.04.004
Reference: SUSMAT 43

To appear in: *Sustainable Materials and Technologies*

Received date: 4 December 2016
Revised date: 17 March 2017
Accepted date: 16 April 2017

Please cite this article as: M. Laabd, H. Chafai, A. Essekri, M. Elamine, S.A. Al-Muhtaseb, R. Lakhmiri, A. Albourine , Single and multi-component adsorption of aromatic acids using an eco-friendly polyaniline-based biocomposite. The address for the corresponding author was captured as affiliation for all authors. Please check if appropriate. Susmat(2017), doi: 10.1016/j.susmat.2017.04.004

Single and multi-component adsorption of aromatic acids using an eco-friendly polyaniline-based biocomposite

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Abstract

The polyaniline coated with an agricultural waste (Argan nut shell) was prepared via in-situ chemical polymerization and used as an adsorbent material for removal of trimellitic (Tri), hemimellitic (Hemi) and pyromellitic (Pyro) acids from water in single and multi-component systems. The obtained results indicate that the adsorption process was strongly influenced by experimental parameters. The greatest adsorption efficiency was obtained at pH 6, adsorbent dose = 0.5 g/L, T = 25 °C, contact time = 90 min and initial concentration of 20 mg/L. The experimental data for single component systems fitted very well to pseudo-second-order kinetic model (R^2 = 0.999). The intraparticle diffusion model suggests that the adsorption of Tri, Hemi and Pyro acids takes place in two successive stages representing the progressive adsorption and equilibrium. The single component adsorption equilibrium data were successfully described by the Langmuir isotherm model ($R^2 \geq 0.995$). The maximum monolayer adsorption capacity of polyaniline/*Argan*-nut-shell composite was found to be 209.64, 143.68 and 267.38 mg/g for Tri, Hemi and Pyro acids, respectively. In binary and ternary systems, the competitive behavior of the adsorption process was successfully predicted by an extended Langmuir isotherm model, with interaction parameters obtained from measured single data. Furthermore, the values of thermodynamic parameters ($\Delta H° > 0$, $\Delta S° > 0$ and $\Delta G < 0$) indicate that the adsorption processes were spontaneous, endothermic and physisorption in nature.