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Optimization of phenol adsorption onto gastropod shell dust using response surface methodology (RSM)

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The ability of the gastropod shell dust for removal of phenol from water through adsorption has been investigated in the present study. The effect of various parameters viz. contact time, pH effect (pH 2–10), adsorbent dose (0.05–0.5 g/100 ml) and initial phenol concentration (5–20 mg/l) has been investigated to determine the adsorption capacity of gastropod shell dust. The adsorbent was characterized by SEM and FTIR study. The batch mode study results were optimized by Response Surface Methodology (RSM). Based on ANOVA statistical value, the adsorption of phenol onto gastropod shell dust has been found to be highly significant, with very low probability (p) values (<0.0001). The experimental equilibrium data showed good agreement with Langmuir isotherm model. The maximum adsorption capacity was found to be 56.89 mgg⁻¹ at 333 K. Kinetics of the adsorption process was tested by pseudo-first-order and pseudo-second-order kinetics and intra-particle diffusion mechanism. Pseudo-second-order kinetic model provided a better correlation for the experimental data studied in comparison to the pseudo-first-order model. Intra-particle diffusion was not the sole rate-controlling factor. The activation energy of the adsorption process (E_a) was found to be –0.268 kJmol⁻¹ indicating physisorption nature of phenol adsorption onto gastropod shell dust. A thermodynamic study showed spontaneous nature and feasibility of the adsorption process and negative enthalpy (ΔH₀) value indicated that the adsorption process was exothermic. Finally it can be concluded that gastropod shell dust can be used as an effective and low- cost adsorbent to remove phenol from aqueous solution.

Biography

Naba Kumar Mondal presently holds the position of Assistant Professor in the Department of Environmental Science, The University of Burdwan, India. He has more than 16 years of teaching and research experience in both Education and Environmental Science (Master's degree). His research interest includes: Adsorption chemistry, nutrient dynamics, indoor pollution, soil chemistry, plant physiology etc. He has published about 120 papers in reputed international and national journals. He has been serving as a guest editor and reviewer in many prestigious international journals.

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