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Adsorption of crystal violet from aqueous solution by chemically modified phoenix tree leaves in batch mode

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ABSTRACT

In this study, phoenix tree leaves were modified by NaOH solution, and modified tree leaves (MTL) were obtained. Then, MTL were characterized by Brunauer-Emmett-Teller, FTIR, and scanning electron microscopic and selected as adsorbent to remove crystal violet (CV) from aqueous solution in batch mode. FITR analysis showed that hydroxyl and carbonyl groups on the surface of MTL. The experiments were carried out to discuss the influence of significant variables, such as the value of initial pH, adsorbent dosage, and salt concentration. The results demonstrated that the optimal pH was found to be nearly 8, and coexisted salt was disadvantage of CV adsorption. The equilibrium adsorption data were fitted using three adsorption isotherm models, the Langmuir, Freundlich and Redlich–Peterson (R–P) equations by nonlinear regressive method. The results showed that R–P model provided the best correlation, followed by the Langmuir model. Adsorption capacity (q_m) obtained from Langmuir equation was 510.3 mg/g at 293 K. The pseudo-first-order and pseudo-second-order equations were applied to the adsorption kinetic data, and the kinetic process was fitted better by the pseudo-second-order model. The thermodynamic parameters (ΔH°, ΔS°, and ΔG°) were evaluated at different temperatures. It was concluded that CV adsorption process be endothermic and spontaneous in nature. The spent leaves can be recovered by diluted hydrochloric acid solution and reused for three cycles with similar regeneration efficiency.

Keywords: Phoenix tree leaves; Adsorption; Crystal violet; Regeneration; Thermodynamic

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