Sorption characteristics of peat from Brunei Darussalam for the removal of rhodamine B dye from aqueous solution: adsorption isotherms, thermodynamics, kinetics and regeneration studies

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\textbf{ABSTRACT}

This work reports the application of peat as cheap and effective adsorbent for the removal of rhodamine B dye (RhB) from aqueous solution. The effects of contact time, settling time and pH were studied to obtain the optimum conditions for adsorption studies. Optimum contact time was 4 h with 1 h settling time and ambient pH was used throughout the study. Adsorption isotherms, namely Langmuir, Freundlich, Temkin, Dubinin–Radushkevich, Redlich–Peterson and Sips, were employed in this study together with error functions to predict the most suitable isotherm model for the adsorption process. The Sips isotherm was found to be the best fit model. The maximum adsorption capacities ($q_{\text{max}}$) obtained for the adsorption at 298, 313, 324, 334 and 344 K are 162.87, 166.22, 172.45, 186.82 and 201.19 mg g$^{-1}$, respectively. Thermodynamic parameters indicate that the adsorption was spontaneous, feasible and endothermic in nature. Pseudo second order kinetic model fitted well to the adsorption of RhB on peat. Regeneration of peat adsorbent was carried out by washing with water or using either acid or base treatment. For spent peat which was desorbed using base treatment, the removal efficiency was maintained even after five cycles, indicating that peat can be regenerated and reused effectively.

\textbf{Keywords:} Peat; Rhodamine B; Adsorption; Isotherms; Kinetics

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