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# Synthesis of efficient activated carbon from *Peltophorum pterocarpum* for the adsorption of Safranin O and its investigation on equilibrium, kinetic, and thermodynamic studies

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**ABSTRACT**

Activated carbon with efficient adsorption capacity was prepared using *Peltophorum pterocarpum* leaves impregnated with phosphoric acid. The prepared activated carbon (PAC) was characterized for their surface functional groups by Fourier transform infrared spectroscopy and for their surface morphology and chemical composition by Scanning Electron Microscopy with Energy Dispersive X-ray analysis. X-ray diffraction and Raman studies revealed that the graphitic and nanocrystalline nature of PAC. The surface area (409.01 $m^2/g$) of the PAC was determined by Brunauer Emmet and Teller method and the material was found to be mesoporous. The thermal stability of PAC was studied with thermogravimetric analysis. The effects of contact time, adsorbent dose, initial dye concentration at different temperatures and pH on the removal percentage of Safranin O (SO) dye were investigated. With increase in contact time, adsorbent dose, pH, and temperature, an increase in the removal of SO dye was observed. The experimental data were examined using Langmuir, Freundlich, and Dubinin–Radushkevich adsorption isotherms. The Langmuir model gave the best fit for the uptake of SO dye confirming that the adsorption of SO dye onto PAC was homogeneous in nature with mono layer adsorption capacity of $6.325 \times 10^{-4}$ mol/g. Pseudo-first-order and pseudo-second-order models were used to determine the adsorption kinetics and it was observed that the adsorption of SO dye followed the pseudo-second-order model ($R^2 = 0.999$). Thermodynamic parameters $\Delta G^\circ$, $\Delta H^\circ$, and $\Delta S^\circ$ were evaluated to determine the spontaneity and endothermic nature of the adsorption process.

*Keywords: Peltophorum pterocarpum*; Safranin O; Activated carbon; Kinetics; Isotherms

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