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Mathematical approach to artificial neural network on Methyl violet removal with magnetically coated activated carbon

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ABSTRACT

In this study, new magnetic activated carbon (Fe_3O_4-AC) was synthesized from activated carbon which was obtained from the inner bark of acorn with the activation of H_3PO_4 and its effectiveness in Methyl violet (MV) removal from aqueous solutions was investigated. Characterization of the samples was done by scanning electron microscopy–energy-dispersive X-ray spectroscopy, X-ray diffraction and Fourier-transform infrared spectroscopy. In MV adsorption on Fe_3O_4-AC, pH (2–10), initial MV concentration (25–150 mg/L), amount of adsorbent (0.1–1.0 g), adsorption time (5–180 min) and temperature (298–318 K) adsorption parameters were investigated. The compatibility of MV and Fe_3O_4-AC adsorption with Langmuir and Freundlich isotherm models was investigated, and it was determined that Langmuir isotherm which proposed single-layer adsorption, was the most compatible isotherm for adsorption at three different temperatures. The highest maximum adsorption capacity with Langmuir isotherm was obtained as 156.25 mg/g at 298 K. The pseudo-second-order kinetic model had a better fit with the best correlation to the kinetic data. Thermodynamic parameters ($\Delta G°$, $\Delta H°$ and $\Delta S°$) were calculated from the Van't Hoff plot of $\ln K_d$. $1/T$ in order to discuss the removal mechanism of MV. Then, in MV removal process under different conditions, experimental results were compared with the artificial neural network model.

Keywords: Adsorption; Dye removal; Methyl violet; Artificial neural network; Activated carbon

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