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Response surface methodology for removal of methyl violet dye using *Albizia stem bark Lebbeck* modified by $Fe_2(MoO_4)_3$ nanocomposite from aqueous solutions and assessment relative error by neural network model

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ABSTRACT

The applicability of *Albizia stem bark Lebbeck* modified by $Fe_2(MoO_4)_3$ nanocomposite, was studied for eliminating methyl violet dye from aqueous solutions. Identical techniques including (infrared, X-ray diffraction, and scanning electron microscopy) have been utilized to characterize this novel material. The impacts of variables including initial methyl violet concentration (X_1), pH (X_2), adsorbent dosage (X_3), and sonication time (X_4) came under scrutiny using central composite design under response surface methodology. The values of 20 mg L^{-1}, 0.03 g, 5.0, 3.0 min were considered as the ideal values for methyl violet concentration, adsorbent, pH, and contact time, respectively. Adsorption equilibrium and kinetic data were fitted with the Langmuir monolayer isotherm model and pseudo-second-order kinetics (R^2: 0.999) with maximum adsorption capacity (120.4 mg g^{-1}), respectively. Thermodynamic parameters ($\Delta G°$: –9.26 kJ mol^{-1}, $\Delta H°$: –29.24 kJ mol^{-1}, $\Delta S°$: –131.49 kJ mol^{-1} K^{-1}), also indicated methyl violet adsorption is feasible, spontaneous and exothermic. The observed outcome is the suitability of the artificial neural network model as a tool for mean square error (ANN = 0.190, and FL = 0.3397), for the removal of methyl violet dye. Overall results confirmed that *Albizia stem bark Lebbeck* modified by $Fe_2(MoO_4)_3$ nanocomposite is an effective adsorbent for removing the dyes from an aqueous solutions.

Keywords: Methyl violet dye; Adsorption; Isotherms; Central composite design; Response surface methodology; Neural network model

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