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Equilibrium Isotherms and Kinetic Studies of Removal of Methylene Blue Dye by Adsorption onto Miswak Leaves as a Natural Adsorbent

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ABSTRACT

In this research miswak leaves, agriculture wastes, available in large quantity in Saudi Arabia, was used as low-cost adsorbent for removing methylene blue (MB) dye. Equilibrium behavior of miswak leaves was investigated by performing batch adsorption experiments. The effects of [MB] 0, pH, contact time and adsorbent dose were evaluated. An alkaline pH (10.6) was favorable to the adsorption of MB dye. Adsorption isotherm models, Langmuir, Freundlich and Temkin were used to simulate the equilibrium data. Langmuir equation was found to have the highest value of R² compared with other models. Furthermore, it was found that miswak leaves have a high adsorptive capacity towards MB dye (200 mg/g) and show favorable adsorption of MB dye with separation factor ($R_L < 1$). In addition, pseudo-first-order, pseudo-second order and intra-particle diffusion were used to study the kinetics of MB adsorption onto miswak leaves. Adsorption process undergoes pseudo-second order kinetic as proved by the high value of R² and the low value of sum of squared error (SSE percentage). Results indicated that intra-particle diffusion is not the limiting step, and the adsorption process is spontaneous as indicated by the negative value of the .

KEYWORDS

Miswak Leaves, Salvadora Persica, Methylene Blue, Adsorption Isotherms, Adsorption Kinetics

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