

Comparative Isotherms Studies on Adsorptive Removal of Methyl Orange from Wastewater by Watermelon Rinds and Neem-Tree Leaves

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Abstract : Watermelon rinds powder (WRP) and neem-tree leaves powder (NLP) were used as adsorbents for equilibrium adsorption isotherms studies for detoxification of methyl orange dye (MO) from simulated wastewater. The applicability of the process to various isotherm models was tested. All isotherms from the experimental data showed excellent linear reliability (R^2 : 0.9487-0.9992) but adsorptions onto WRP were more reliable (R^2 : 0.9724-0.9992) than onto NLP (R^2 : 0.9487-0.9989) except for Temkin's Isotherm where reliability was better onto NLP (R^2 : 0.9937) than onto WRP (R^2 : 0.9935). Dubinin-Radushkevich's monolayer adsorption capacities for both WRP and NLP (q_D : 20.72 mg/g, 23.09 mg/g) were better than Langmuir's (q_m : 18.62 mg/g, 21.23 mg/g) with both capacities higher for adsorption onto NLP (q_D : 23.09 mg/g; q_m : 21.23 mg/g) than onto WRP (q_D : 20.72 mg/g; q_m : 18.62 mg/g). While values for Langmuir's separation factor (RL) for both adsorbents suggested unfavourable adsorption processes (RL : -0.0461, -0.0250), Freundlich constant (n_F) indicated favourable process onto both WRP (n_F : 3.78) and NLP (n_F : 5.47). Adsorption onto NLP had higher Dubinin-Radushkevich's mean free energy of adsorption (E : 0.13 kJ/mol) than WRP (E : 0.08 kJ/mol) and Temkin's heat of adsorption (b_T) was better onto NLP (b_T : -0.54 kJ/mol) than onto WRP (b_T : -0.95 kJ/mol) all of which suggested physical adsorption.

Keywords : adsorption isotherms, methyl orange, neem leaves, watermelon rinds

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