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Kinetics Isotherm equilibrium studies of Malachite green on Agricultural waste material and using low cost carbon

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Abstract: In this research five low cost carbon adsorbents, namely, Sorghum Vulgare Carbon (SVC), Zea Mays Carbon (ZMC), Sorghum Vulgare Varity Carbon (SVVC), CeibaPeutandra Carbon (CPC), Projobisjuliflora Carbon (PJC) were prepared for the adsorption of Malachite green(MG). Adsorption was studied as a function of pH (2-12), adsorbent dose (0.2-1.6g), contact time (5-40mints), initial MG concentration (50-100mg/L); agitation seed (120-180rpm) and characterization of FT-IR, UV-visible and XRD. From the results obtained it was observed that with the increase in the pH value, the percentage MG removal increases from 48.62,52.33,38.74,46.68, and 55.03% to 94.48,95.15 , 95.45,94.54 ,and 94.84% for SVC,ZMC,SVVC,CPC, and PJC adsorbents, respectively. Additionally the percentage MG removal increased from 45.86, 43.12, 56.71, 47.78, and 39.81% for SVC, ZMC, SVVC, CPC, and PJC adsorbents ,respectively, by increasing, adsorbent dose from 0.2g to 1.6g.Hence optimize adsorbent dose for SVC, ZMC, SVVC, CPC, and PJC adsorbents 0.8,1.0,1.2,1.4, and 1.6g, respectively. The experimental data were analyzed by the Langmuir, Freundlich, Temkinisotherm,Redlich Peterson Isotherm, Dubinin- Radushkevich constants and BET. Results showed that the maximum monolayer adsorption capacity of SVC, ZMC, SVVC, CPC, and PJC adsorbents for the adsorption of MG was 20.99, 21.64, 21.5- 21.58 and 20.9 mg/g respectively. The kinetic data were fitted to the pseudo-first-order, pseudo-second-order,Intraparticle diffusion models, Elovich, Natrajan and Khalaf,Bhattacharaya and Venkobachar models. Adsorption of these adsorbents surveyed Langmuir adsorption isotherm models and pseudo-second-order kinetics.Kinetics parameters were evaluated to predict the nature of adsorption. These outcomesspecify the endothermic and spontaneous nature of the adsorption process.

Keywords : Agricultural waste, low cost carbon, Malachite green, optimization, Batch adsorption, Kinetics.

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