Synthesis Characterization of Soot Chitosan Nanocomposite and its Application as Adsorbent

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ABSTRACT

This thesis is concerned with preparing the soot and chitosan nanocomposite (ACS_1) and diagnosing the prepared compound using different techniques. The surface of ACS_1 was prepared by several steps; the soot was extracted from the paraffin candle by it is collected clean, dry flask, adding chitosan to it in a ratio of 1:2, then treating it with acetic acid and drying at 60 ºC. ACS_1 was treated with 10% nitric acid to obtain the soot- chitosan activated nanocomposite (ACS_2). The structural, chemical and surface properties of surfaces nanoparticles (ACS_1& ACS_2) were diagnosed and studied using (FT-IR, BET, SEM, XRD) techniques. Then study the adsorption efficiency of the prepared nanocomposites ACS_1 and ACS_2 in terms of the adsorption capacity of Alizarin Red S(AR), crystal violet (CV) and dispersed red (DR) dyes from their aqueous solutions using several methods, followed by studying the factors affecting on the adsorption, such as the equilibrium time, weight of the material Absorbent, temperature and pH result from the adsorption process. The results indicated that the adsorption process was S-type according to Giles classification and the equilibrium time was 20 min for AR,CV, and DR on ACS_1 & ACS_2. Similarly, the analyses showed that the measurements of adsorption for the three dyes decreased with increasing temperature at equilibrium, which means that the adsorption was exothermic. Langmuir and Freundlich isotherms were used, and the results showed that the (model Freundlich isotherm) is fit with the experimental data, as it gives correlation coefficients (R_2) greater than Langmuir's correlation coefficients. Thermodynamic analysis showed that the adsorption of the three AR ,CV and DR dyes on ACS_1 and ACS_2 surfaces were spontaneous from the negative charge of free energy ΔG^o and the exothermic process from the negative charge of ΔH^o, while the negative values of ΔS^o were due to the regulation of the arrangement of adsorbent molecules on the surface. The pH values showed that the optimal pH for adsorbance was 4 for AR , DR dyes and 10 for CV dye. In contrast, the uptake information showed that the percentage of removal of three dyes rises with higher weights of the adsorbents for both ACS_1 and ACS_2. The study showed that the adsorption kinetics of AR, CV and DR dyes fit well with first-order and second-order kinetic models. Hence, the experimental adsorption data showed that the adsorption of the three AR ,CV and DR dyes on the surfaces (ACS_1,$ACSC_2$) is consistent with the pseudo-second-order kinetic model.