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Synthesis and Characterization of Red Blood Cells Membrane - Coated Polyethylenimine as Hybrid Biomaterial Nanocomposite and its Application as Adsorbent Surface for Drugs

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ABSTRACT

This thesis is concerned with preparing a nanocomposite surface consisting of (red blood cell membranes, polyethyleneimine, and polyacrylic acid) and characterizing the prepared compound using different techniques. The surface has been prepared in several steps. Red blood cell membranes are extracted from human blood through the main blood bank and collected in a Petri dish.

The prepared polymers are also added in a ratio of 1:3 to each of the red blood cell membranes and polymers. Polymers are considered solid materials at a temperature of 50 C. Then the compositional, chemical and surface properties of the nanoparticles of the prepared surface are characterized and studied using techniques (FT-IR, SEM, TEM, TGA and XRD) from its aqueous solutions in several ways.

The results indicated that the adsorption process is S-type according to Giles classification and the equilibrium time is 40 min for Alizarin Red, Crystal Violet, and Disperse Red on CPA. Similarly, the analyses has shown that the measurements of adsorption for the three dyes decreased with increasing temperature at equilibrium, which means that the adsorption is exothermic. Langmuir and Freundlich isotherms are used, and the results has shown that the (model Freundlich isotherm) is fit with the experimental data, as it gives correlation coefficients (R²) greater than Langmuir's correlation coefficients.

Thermodynamic analysis indicates that the adsorption of the three AR ,CV and DR dyes on CPA surfaces are spontaneous from the negative charge of free energy ΔG° and the exothermic process from the negative charge of ΔH° , while the negative values of ΔS° are due to the regulation of the arrangement of adsorbent molecules on the surface. The pH values shown that the optimal pH for adsorbance is 4 for AR, DR dyes and 10 for CV dye. In contrast, the uptake information show that the percentage of removal of three dyes rises with higher weights of the adsorbents for CPA. The study indicate 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 illustrates that the adsorption of the three AR, CV and DR dyes on the surfaces (CPA) is consistent with the pseudo-second-order kinetic model.