Adsorption of Some Organic Dyes on the Surface particles of Nanocellulose

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Abstract

In this study, locally available cellulose microcrystalline were used to produce the Nanocellulose surface. The Nanocellulose surface was prepared by several steps, by hydrolysis acids for cellulose microcrystalline. The Nanocellulose surface characteristics were diagnosed using (Fourier-transform Infrared Spectroscopy, Field Emission Scanning Electron Microscopy Analyzes, Thermogravimetric Analysis, Nitrogen Adsorption-Desorption Analysis, Atomic force microscopic, and X-Ray diffraction) techniques.

The adsorption capacity of the prepared Nanocellulose surface has studied by the adsorption of the three dyes (Disperse yellow, Reactive blue, and Safranin) from their aqueous solutions using the Batch Method. Several different variables that affect the adsorption process were studied, such as equilibrium time, temperature, and pH. The results indicated that the adsorption of the three dyes applied curve of type (S) according to Giles classification, the equilibrium time was (10 min) for the three dyes. The experimental adsorption data fitted with the pseudo-second. order kinetic model.

The effect of temperature was studied within the range of (15-35) °C. The results showed that the dye removal decreases with increasing temperature, meaning that the adsorption process is exothermic. Results were used to determine the adsorption isotherm of (Langmuir, Freundlich, and Timpken) isotherm model. The results showed Freundlich isotherm was the most suitable with experimental data, it gives correlation coefficients (R2) larger than Langmuir and Timken correlation coefficients. Also, results of thermodynamic studies showed that the adsorption process was spontaneous from the negative charge in change free energy (ΔG°), and the process is exothermic due to negative charge in enthalpy (ΔH°), while the change in entropy (ΔS°) was positive because of the Irregularity and disorganization of the adsorbate molecules on the Nanocellulose surface. The results showed that the adsorption process affected by the pH, by affecting on adsorption capacity of the three dyes on the Nanocellulose surface.