Hazardous Bismarck Brown Dye Adsorption on Graphene Oxide and Its Chitosan and Ethylenediaminetetraacetic Acid Derivatives

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ABSTRACT

Polymeric adsorbents are developed for removal toxic Bismarck Brown (BB) dye. Hummer's method was used to prepare graphene oxide (GO) from graphite with minor alterations. The other two derivatives were made by grafting GO with Chitosan (GO/CS) and ethylenediaminetetraacetic acid (GO/CS/EDTA). Fourier transform infrared spectroscopy (FTIR) was used to analyze their chemical structure. Batch studies were carried out to investigate the adsorption systems of GO and its derivatives against the toxic BB dye, and they showed a good reaction to the adsorption from their aqueous solutions. The effect of pH value on the adsorption systems was investigated and found pH values depending on the type of the adsorbents. It was found that pH 3.0 and 5.0 were the best for the adsorption of BB dye onto GO, GO/CS, and GO/CS/EDTA, with an agitation time of up to 45 min. Adsorption isotherms were determined using Langmuir and Freundlich. The Langmuir model was found to be more appropriate for the experimental results of the adsorption of BB dye on the prepared adsorbents. According to kinetic studies, the pseudo-second-order model fits the experimental data the best. According to the thermodynamic characteristics determined, the adsorption process was spontaneous and endothermic.

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