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# Adsorption of carcinogenic dye Congo red onto prepared graphene oxide-based composites

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**ABSTRACT**

Graphene oxide (GO), graphene oxide/chitosan (GOCS), and graphene oxide/poly(*n*-butyl methacrylate-co-methacrylic acid) (GOpBCM) composites were prepared as adsorbents for removal of carcinogenic dye Congo red (CR) from aqueous solutions. They were characterized by various techniques, including Fourier-transform infrared spectroscopy, field emission scanning electron microscopy, and X-ray diffraction spectroscopy. Adsorption equilibrium isotherms, adsorption kinetics and thermodynamic studies of the batch adsorption process were done to evaluate the fundamental adsorption properties of the dye CR. The results indicate that the adsorption of CR on the adsorbents was high pH and temperature-dependent. The maximum adsorption of 1,666 mg/g occurred at pH 3.0 for an initial dye concentration of 500.0 mg/L by GOCS, whereas, the maximum adsorption obtained from an initial dye concentration 300.0 mg/L was 1,000 mg/g for GO and GOpBCM at pH 3.0 and 7.0 respectively. The experimental equilibrium adsorption data were explored by three different two-parameter models Langmuir, Freundlich and Temkin isotherms. The Langmuir model was well agreed with experimental data for all adsorbents. The kinetic models, namely pseudo-first-order, pseudo-second-order, and intraparticle-diffusion are employed to understand the mechanism of the adsorption process, and it fitted very well the pseudo-second-order kinetic model for all adsorbents. The calculated thermodynamic parameters revealed that the adsorption is a spontaneous and endothermic process.

*Keywords:* Graphene oxide; Grafting; Composites; Adsorption isotherm; Congo red; Pseudo-second-order

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