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Adsorption Capacity of the as-Synthetic Graphene Oxide for the Removal of Alizarin Red S Dye from Aqueous Solution

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ABSTRACT

This research was aimed to study the adsorption of Alizarin Red S (ARS) dye using graphene oxide (GO) as an adsorbent compared with bare graphite powder (BGP). For optimum conditions, the effects of the initial concentration of ARS, solution pH, adsorbent dosage, and contact time were investigated in detail. The optimum conditions for this work were consisted of 350 mg/L initial concentration of ARS with 0.02 mg adsorbent at pH 2.0. The adsorption equilibrium was completely reached within 30 min. The maximum adsorption capacity of GO was 88.50 mg/g which was higher than that of BGP (34.13 mg/g). The adsorption kinetics well fitted using a pseudo second-order kinetic model. The intraparticle diffusion model described that the intraparticle diffusion was not the only rate-limiting step. In thermodynamics diversion, changes in free energy (ΔG), enthalpy (ΔH) and entropy (ΔS) were also evaluated. The overall adsorption process was exothermic and spontaneous in nature. The adsorption isotherms for GO and BGP fit well with the Langmuir and Freundlich models, respectively. It is, therefore, evident that the as-prepared GO can be used as a high potential adsorbent for the anionic dye and it can be reused for fourth time of adsorption.

Keywords: Graphene oxide; Alizarin Red S; Adsorption isotherm; Thermodynamics; Kinetics.

INTRODUCTION

Textile dyeing process is an important source of an environmental pollution. One of the most problems of textile wastewater in addition to both toxic and carcinogenic nature is color effluent. Particularly, alizarin red S (ARS) is one of anionic dyes which is widely used for dyeing textile materials. The removal of ARS is crucial process from both economical and environmental points of view[1]. Various techniques for the removal of ARS from wastewater have been studied over the years, such as co-precipitation[2], photocatalysis[3], gliding arc discharge[4], Fenton and Fenton like process[1], electrochemical treatment[5], fungal degradation[6], Photocatalysis[7] and adsorption[8-9]. Among those techniques, adsorption has been found to be promising process superior to the other techniques