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Microwave assisted synthesis of xanthan gum-cl-pol (acrylic acid) based-reduced graphene oxide hydrogel composite for adsorption of methylene blue and methyl violet from aqueous solution

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Abstract

In the present study, facile and efficient method was adopted for the synthesis of graft copolymer hydrogel by graft copolymerization of acrylic acid (AA) onto xanthan gum (XG) biopolymer in the presence of N,N'-Methylenebisacrylamide (MBA), and ammonium persulfate (APS) as a cross-linking agent and initiator, respectively, under microwave irradiation. The optimization of hydrogel were selected based on the maximum swelling degree in water media and an optimum hydrogel was further impregnated with reduced graphene oxide (rGO) to form XG-cl-pAA/rGO hydrogel composite. The Fourier transform infrared (FT-IR), X-ray diffraction analysis (XRD), Thermogravimetric analysis (TGA), Scanning electron microscopy (SEM) were used to study the structure, thermal stability and morphology of XG-cl-pAA and XG-cl-pAA/rGO. The adsorption of methyl violet (MV) and methylene blue (MB) were study in batch mode and results shows adsorption highly dependent on solution pH, contact time, concentration and adsorbent loading. The XG-cl-pAA/rGO exhibited a very high adsorption potential, and the adsorption process followed the pseudo-second-order rate model and Langmuir adsorption isotherm with a maximum adsorption capacity (Q_{max}) of 1052.63 mg/g and 793.65 mg/g at 25°C for MV and MB, respectively. We recommend XG-cl-pAA/rGO as environmentally benign, readily recoverable/recyclable material with excellent adsorption capacity for application in dyes removal.

Keywords: Biopolymer; Hydrogel composite; reduced graphene oxide**;** Microwave irradiation; Adsorption; Isotherm

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