

Removal of Metal Ions (II) Using a Synthetic Bis(2-Pyridylmethyl)Amino-Chloroacetyl Chloride- Ethylenediamine-Grafted Graphene Oxide Sheets

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Abstract : The functionalization of graphene oxide sheets by ethylenediamine (EDA) was accomplished followed by the grafting of bis(2-pyridylmethyl)amino group (BPED) onto the activated graphene oxide sheets in the presence of chloroacetylchloride (CAC) produced the martial [(Go-EDA-CAC)-BPED]. The physic-chemical properties of [(Go-EDA-CAC)-BPED] composites were investigated by Fourier transform infrared (FT-IR), X-ray photoelectron spectroscopy (XPs), Scanning electron microscopy (SEM) and Thermogravimetric analysis (TGA). Moreover, [(Go-EDA-CAC)-BPED] was used for removing M(II) (where M=Cu, Ni and Co) ions from aqueous solutions using a batch process. The effect of pH, contact time and temperature were investigated. More importantly, the [(Go-EDA-CAC)-BPED] adsorbent exhibited remarkable performance in capturing heavy metal ions from water. The maximum adsorption capacity values of Cu(II), Ni(II) and Co(II) on the [(GO-EDA-CAC)-BPED] at the pH of 7 is 3.05 mmol.g⁻¹, 3.25 mmol.g⁻¹ and 3.05 mmol.g⁻¹ respectively. To examine the underlying mechanism of the adsorption process, pseudo-first, pseudo-second-order, and intraparticle diffusion models were fitted to experimental kinetic data. Results showed that the pseudo-second-order equation was appropriate to describe the three metal ions adsorption by [(Go-EDA-CAC)-BPED]. Adsorption data were further analyzed by the Langmuir, Freundlich, and Jossensadsorption approaches. Additionally, the adsorption properties of the [(Go-EDA-CAC)-BPED], their reusability (more than 10 cycles) and durability in the aqueous solutions open the path to removal of metal ions (Cu(II), Ni(II) and Co(II)) from water solution. Based on the results obtained, we conclude that [(Go-EDA-CAC)-BPED] can be an effective and potential adsorbent for removing metal ions from an aqueous solution.

Keywords : graphene oxide, bis(2-pyridylmethyl)amino, adsorption kinetics, isotherms

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