Chemically modified graphene oxide as a versatile adsorbent for the removal of organic pollutants and uranyl ions from aqueous system

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Abstract

Graphene oxide has been emerged as a versatile adsorbent in the field of wastewater treatment due to the ease of dynamic functionalities within the aromatic structure. We have developed NH_3 modified graphene oxide system for the removal of organic pollutants and uranyl ions from water system. Modification of graphene oxide by aq. ammonia causes reduction of –COOH groups into $–CONH_2$ and therefore reduces hydrophilic character of graphene oxide nanosheets. Model contaminants considered for his study were uranyl ion, ionic dyes and 4-nitrophenol. Batch adsorption results indicates that uranyl ions removal occurs at pH 6 whereas as optimum removal of 4-nitrophenol was achieved in a wide pH range of 2-5. Consistent removal of organic azo dyes was observed in the pH range of 5-9. Adsorption isotherm studies indicated that uranyl ion adsorption follows Langmuir as well as Freundlich isotherm models suggesting dual nature of mechanism. However, dual nature of adsorption mechanism was observed in case of dyes and 4-nitrophenol. On the other hand, cationic dye follows Freundlich model and anionic dye & 4-nitrophenol satisfies Langmuir model. Kinetic study reveals that removal of different type of contaminates by NH_3 modified graphene oxide system follows pseudo second order kinetics. Thermodynamic studies revealed endothermicity and spontaneity of the adsorption process.