Deep eutectic solvent-impregnated graphene oxide for the removal of drug contaminants from water

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Abstract

The presence of pharmaceutical compounds (PCs) in aquatic environments poses significant risks to both human health and ecological systems [1]. In this study, a novel nanocomposite was developed by impregnating graphene oxide (GO) with a hydrophobic eutectic solvent (HES). This material was applied for the removal of antibiotics from water. Out of ten natural HESs evaluated, the GO composite infused with trioctylphosphine oxide and levulinic acid (GO@TOPOLevA) demonstrated the highest adsorption efficiency. The successful incorporation of HES into the GO structure was validated through a range of characterization techniques, including FTIR, XRD, TGA, Raman spectroscopy, SEM, TEM, and SEM-EDX. Adsorption tests under optimized conditions revealed high removal capacities. Kinetic analysis indicated that the process followed a pseudo-second-order model, while thermodynamic data confirmed that the adsorption was spontaneous and endothermic. Advanced statistical physics models offered deeper insight into the molecular-level adsorption mechanism [2], density functional theory (DFT) calculations, and molecular dynamics (MDs) simulations further clarified the interactions between the adsorbent and the contaminants [3]. Additionally, the material retained its efficiency over five reuse cycles, underscoring its potential for real-world applications.

References

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Figures

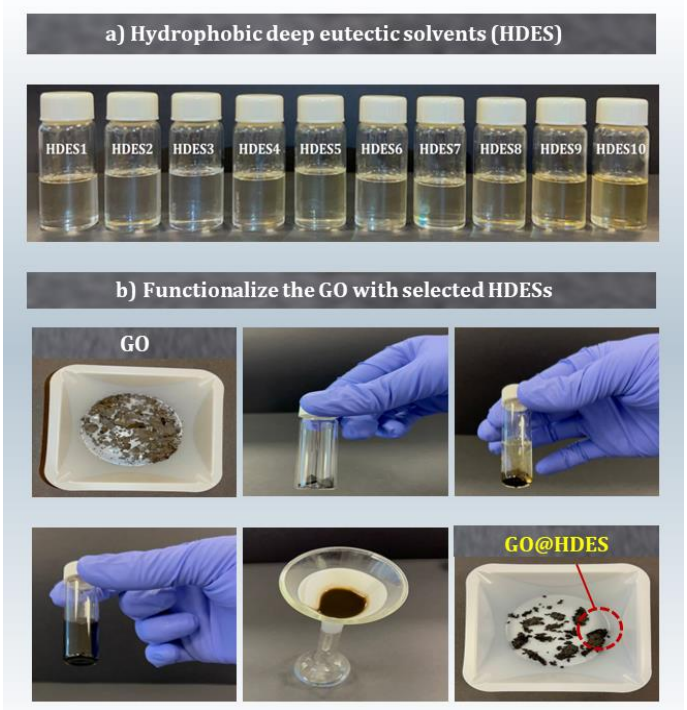

Figure 1. Novel GO@DES adsorbents for water treatment.