
Evaluation of graphene quantum dots and natural deep eutectic solvents modified binders on the electrochemical properties of composite electrode

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This work presents a novel and eco-friendly approach to electrochemical sensing through the development of a composite electrode modified with Natural Deep Eutectic Solvents (NADES) and graphene quantum dots (GQDs) [1]. The unique combination of NADES and GQDs offers an unexplored synergistic effect, providing a sustainable alternative to conventional binder modifiers by enhancing electrical conductivity, charge transfer kinetics, and electrochemical sensitivity [2]. NADES was synthesized using a 1:2 molar ratio of choline chloride and urea, acting as both a dispersing and stabilizing medium for GQDs obtained via glucose pyrolysis. The GQD/NADES mixture was incorporated into a carbon paste electrode, partially replacing a specific proportion of the mineral oil binder. The resulting sensor was thoroughly characterized using cyclic voltammetry, electrochemical impedance spectroscopy (EIS), scanning electron microscopy (SEM), and spectroscopic techniques. Compared to the unmodified electrode, the GQD/NADES-modified electrode exhibited approximately a 40% increase in current density during acetaminophen oxidation, with no observable surface fouling. Additionally, the sensor demonstrated a low limit of detection (LOD) of 0.065 μM and a linear response range from 1 to 40 μM . These findings indicate that integrating GQDs with a green NADES matrix can significantly enhance electrochemical performance, reduce detection limits, and improve analytical sensitivity, introducing a promising strategy for designing sustainable electrochemical sensors for environmental monitoring of pharmaceutical contaminants.

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References:

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