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SYNTHESIS AND INVESTIGATION OF GRAPHENE OXIDE AND POLY(ANILINE-ANTHRANILIC ACID) COPOLYMER COMPOSITES

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Carbon-based nanomaterials have attracted significant attention in sensor technology due to their unique physicochemical properties. Among them, graphene oxide (GO) stands out for its oxygen-containing functional groups (hydroxyl, epoxy, carboxyl), enabling strong interactions with other materials and making it highly promising for electrochemical sensing applications. Conducting polymers, such as polyaniline (PANI), offer tunable electrical properties and structural versatility. Incorporation of anthranilic acid (AA) further enhances these polymers by improving solubility and introducing functional groups for interactions with biomolecules. These materials have recently been widely explored for the sensitive and selective detection of biologically relevant compounds, including neurotransmitters such as serotonin [1]. Serotonin (5-HT) is a crucial neurotransmitter involved in regulating numerous physiological processes, including mood, behavior, appetite, and gastrointestinal function. Abnormal 5-HT levels are associated with various disorders, such as depression, anxiety, diabetes, and neurodegenerative diseases [2]. Therefore, accurate determination of 5-HT concentration is important. Electrochemical sensing offers a promising approach due to its high sensitivity, selectivity, low cost, and suitability for analysis in biological fluids. The aim of this study was to synthesize GO and poly(aniline-anthranilic acid) copolymer composites (GO/PANI-AA) and to perform their structural characterization.

GO was synthesized using a modified Hummers method with graphite as the starting material. Graphite oxidation was carried out using sulfuric acid, potassium persulfate and phosphorus (V) oxide. The resulting intermediate GO product was further oxidized by adding sodium nitrate and potassium permanganate. GO/PANI-AA composites were prepared in hydrochloric acid by dissolving GO, aniline (ANI), anthranilic acid (AA), and ammonium persulfate. The weight ratio of GO to ANI+AA was 1:1, while the molar ratio of ANI to AA in the composite was varied. The results demonstrated that the modification of GO with different PANI-AA copolymers significantly influenced the structural, morphological, and electrochemical properties of the resulting composites. SEM analysis revealed that the formation of the copolymer layer on the GO sheets led to a more homogeneous surface morphology compared to the pristine GO, indicating a uniform coating of the polymer matrix. XPS and Raman spectroscopies' results confirmed the successful formation of the composite. Electrochemical measurements revealed that the composite with an ANI to AA molar ratio of 1:3 exhibited the best electrochemical performance for electrode modification. The results suggest that GO/PANI-AA composites can be effectively used for electrode modification in electrochemical applications. The identified optimal composition provides a basis for further development of conducting polymer materials.

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