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MSL ACADEMIC ENDEAVORS

Exploration of Nanomaterials-based electrochemical sensors for peroxynitrite detection

College of Sciences and Health Professions

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Abstract

Peroxynitrite (PON, ONOO-) plays an essential role in several cardiovascular dysfunctions and other diseases triggered by oxidative stress. The precise detection of this analyte in biological systems is of paramount importance not only to understand the genesis and development of diseases, but also to design and assess efficient therapies. We fabricated highly sensitive and selective electrochemical sensors based on transition metal-decorated graphene nanocomposites as catalytic interfaces for peroxynitrite quantification. The interfaces of metal-decorated graphene nanostructures were immobilized on carbon electrodes by electro-grafting, electro-depositing, and drop-casting techniques. The morphology and surface chemistry of the nanostructured materials were characterized using Scanning Electron Microscopy (SEM), Energy Dispersive X-ray Analysis (EDXA), and X-ray Photoelectron Spectroscopy (XPS). The electrochemical catalytic activities of the prepared interfaces were measured using cyclic voltammetry and amperometry, and Electrochemical Quartz Crystal Microbalance (EQCM). The results showed that the incorporation of the metal nanoparticles into graphene sheets have significantly increased the sensitivity of the peroxynitrite sensors. The presence of metal-functionalized graphene oxide amplified the current response to PON aliquots in aqueous solutions. It also allowed the application of less positive potentials and thus resulted in more differentiation between peroxynitrite and other interfering analytes that have higher oxidation potentials.