Synthesis, characterization and preparation of nickel nanoparticles decorated electrochemically reduced graphene oxide modified electrode for electrochemical sensing of diclofenac

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Abstract

In this work, nickel nanoparticles (NiNPs) and graphene oxide (GO) were synthesized and characterized independently using UV-Vis, FTIR, high resolution transmission electron microscopy (HRTEM), scanning electron microscopy (*SEM) and energy dispersive spectroscopy* (*EDS) techniques. Then, a new glassy carbon electrode modified with electrochemically reduced graphene oxide decorated with nickel nanoparticles (NiNPs/ERGO/GCE) was constructed by electrodeposition. The novel platform, NiNPs/ERGO/GCE, was characterized using SEM, electrochemical impedance spectroscopy (EIS) and cyclic voltammetry (CV). SEM analysis clearly revealed efficient incorporation of NiNPs into the graphene sheets on the surface of the electrode. The prepared platform was used for the determination of diclofenac (DIC),* a non-steroidal anti-inflammatory drug (NSAID). *A significant enhancement in the peak current response for DIC was observed at the composite modified electrode compared to the unmodified electrode. The NiNPs/ERGO composite modified electrode demonstrated excellent square wave voltammetric response towards the determination of DIC in the working range of 0.25–125 µM. The limit of detection (LOD) and limit of quantification (LOQ) of the proposed method was found to be 0.09 and 0.3 µM, respectively. The developed sensor was validated successfully for real sample analysis in pharmaceutical formulation and human urine samples with good recovery results. The proposed sensor also displayed good repeatability, reproducibility, long-term stability and selectivity towards potential interferents. Hence, it is a promising material for electrochemical sensing of diclofenac and other similar drugs and biologically active compounds in real samples.*

Keywords*: Nickel nanoparticles, electrochemically reduced graphene oxide, square wave voltammetry, non-steroidal anti-inflammatory drug, diclofenac*