A Sensor for Detection of 4-nitrophenol Based on a Glassy Carbon Electrode Modified with a Reduced Graphene Oxide/Fe₃O₄ Nanoparticle Composite

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A simple sensor, based on a glassy carbon electrode (GCE) modified with a reduced graphene oxide (RGO) and Fe₃O₄ nanoparticle composites (Fe₃O₄NPs), was developed for detection of 4-nitrophenol (4-NP). The surface morphology of the prepared reduced graphene oxide/Fe₃O₄ nanoparticle composites was characterized by scanning electron microscopy (SEM). The RGO/Fe₃O₄NPs modified GCE was confirmed by cyclic voltammogram (CV) and electrochemical impedance spectroscopy (EIS). The electrochemical behaviors of the as-obtained RGO/Fe₃O₄NPs toward 4-NP were investigated with differential pulse voltammetry (DPV) and square wave voltammetry (SWV). Under the optimal experimental conditions, the linear relationship between the peak current and the concentration of 4-NP was obtained from DPV in the range from 0.2 to 10 μM, 20 to 100 μM and SWV in the range from 0.2 to 10 μM. And respectively, the limit of detection (LOD) of 4-NP was 0.26 μM and 0.86 μM for DPV and SWV. The sensor was used to determine the level of 4-NP in tap water samples with good recovery, highlighting the sensor's feasibility for industrial applications. The proposed sensor provided an efficient performances and acceptable stability for the detection of 4-NP in the water.

Keywords: DPV, electrochemical detection, Fe₃O₄, RGO, 4-NP

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