

Full Paper

A Novel Voltammetric Sensor Based on Tb₂(WO₄)₃ Nanoparticles for Sulfadiazine Determination

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Abstract- This article is focused on the development of a sensitive voltammetric electrode for sulfadiazine using nanoparticles of Tb₂(WO₄)₃ to modify a carbon paste electrode (CPE). The behaviour of the modified-CPE was evaluated through cyclic voltammetry (CV), electrochemical impedance spectroscopy (EIS), and fast Fourier transform square wave voltammetry (FFTSWV). The results revealed an irreversible sulfadiazine oxidation peak around 0.85 V vs. the Ag/AgCl reference electrode. The physicochemical properties of the nano-material were investigated using scanning electron microscopy (SEM), X-ray powder diffraction (XRD) and transmission electron microscopy (TEM). Some effective parameters such as, pH, percentage of modifier, amplitude and frequency on sensor sensitivity were studied and optimized. The analytical curve was then obtained in the concentration ranges of 0.01–1.0 μM and 1.0–100 μM with a detection limit of 4.10 nM by fast fourier transform square wave voltammetry. Also the electron transfer coefficient (α) was determined as a value 0.66 for the sulfadiazine oxidation. The drug analysis in pharmaceutical formulation was also carried out and recovery percentages in the range of 97–102% were recorded. The sensor presented a good reproducibility and repeatability with acceptable RSD values (3.8%, 1.02% respectively) and long-term stability (almost one month).

Keywords- Tb₂(WO₄)₃ nanoparticles; Modified carbon paste electrode; sulfadiazine; Fast Fourier transform square wave voltammetry
