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A sensitive electrochemical sensor for rapid determination of methadone in biological fluids using carbon paste electrode modified with gold nanofilm

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Abstract

A novel and effective electrochemical sensor for the determination of methadone (MET) at pH 9.0 using gold nanoparticles, electrodeposited on a multi-walled carbon nanotube modified carbon paste electrode (GNPs/MWCPE), is introduced. The voltammetric behavior of MET at this modified electrode was studied using cyclic and square wave voltammetric techniques and the results were compared with those obtained at the multi-walled carbon nanotube modified carbon paste electrode (MWCPE).The oxidation of MET was irreversible and exhibited an adsorption controlled process at the GNPs/MWCPE and a diffusion controlled process at the MWCPE. The effect of various experimental parameters including pH, scan rate, and accumulation potential and time on the voltammetric response of MET was investigated. At the optimum conditions, the concentration of MET was determined using square wave voltammetry (SWV) in a linear range of 0.1 to 500.0 μmol L^{-1} with a correlation coefficient of 0.9901 at the GNPs/MWCPE, and 0.5 to 300.0 μmol L^{-1} with a correlation coefficient of 0.993 at the MWCPE and the detection limits were found to be 0.005 and 0.3 μmol L^{-1}, respectively. The proposed electrode was successfully applied to the determination of MET in a pharmaceutical dosage form, urine and saliva samples. The effects of common interferences, namely some of different cations and anions, on the current response of MET were investigated. This revealed that the