

Electrodeposition of zinc oxide nanoparticles on multiwalled carbon nanotube-modified electrode for determination of caffeine in wastewater effluent

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Abstract

We report on the development of an electrochemical sensor based on electrodepositing zinc oxide on multiwalled carbon nanotube-modified glassy carbon electrode for the detection of caffeine in pharmaceutical wastewater effluents. The measurements were carried out using cyclic voltammetry, electrochemical impedance spectroscopy, chronoamperometry and differential pulse voltammetry (DPV). DPV measurements showed a linear relationship between oxidation peak current and concentration of caffeine in 0.1 M HClO₄ (pH 1.0) over the concentration range 0.00388–4.85 mg/L and a detection limit of 0.00194 mg/L. The diffusion coefficient and Langmuir adsorption constant for caffeine were calculated to be $3.25 \times 10^{-6} \text{ cm}^2 \text{ s}^{-1}$ and $1.10 \times 10^3 \text{ M}^{-1}$, respectively. The sensor showed satisfactory results when applied to the detection of caffeine in wastewater effluents.