

Electrochemical Detection of Oxytetracycline using MWCNT and Sugarcane Carbon modified Graphite Electrode

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Abstract

This study aims to develop a simple, fast, highly sensitive and low-cost sensing technology to detect oxytetracycline (OTC) in the environment. Oxytetracycline is a tetracyclic antibiotic with good antibacterial ability. However, the misuse of antibiotics can lead to drug resistance and drug residues, causing harm to the health of humans and livestock. It also affects the fixation and degradation of organic pollutants in the soil. However, the sensors currently on the market are expensive and difficult to implement in general life. Waste graphite has the characteristics of lower cost, good properties and easy modification, while achieving waste reuse.

This study compares graphite electrodes modified by CeO₂-Co₃O₄ QDs@porous carbon and CeO₂-Co₃O₄ QDs@porous carbon/MWCNT and MWCNT composite materials to prepare an electrochemical sensor with high sensitivity. CeO₂-Co₃O₄ QDs@porous carbon/MWCNT modified graphite electrode has high sensitivity for detecting OTC, with a linear calibration range of 1.007×10^{-8} M to 2.04×10^{-7} M (i.e. 0.005–0.1 ppm) and 1.007×10^{-7} M to 1.209×10^{-4} M (i.e. 0.5–60 ppm). The calibration line of MWCNT composite modified graphite electrode is $y = 6E-06x + 7E-05$, $R^2 = 0.9835$. The limit of detection (LOD) and limit of quantification (LOQ) are 0.61 ppb (1.23 nM) and 2.03 ppb (4.09 nM) respectively ($S/N = 3$). The results show that the waste graphite rod electrochemical sensor is successfully used to detect OTC. The sensor proposed in this study shows some advantages, including simplicity and low cost of electrode preparation. This method provides a new way to prepare electrochemical sensors for detecting OTC.

Keywords: oxytetracycline, multi-walled carbon nanotubes, electrochemical detection, bagasse carbon, graphite electrode.