

# Oxytetracycline nanosensor based on poly-*ortho*-aminophenol/multi-walled carbon nanotubes composite film

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**Abstract** Poly-*ortho*-aminophenol (PoAP) and multi-walled carbon nanotubes (MWCNTs) were deposited on the platinum electrode using cyclic voltammetry technique to form the Pt/PoAP/MWCNTs nanosensor for the electrochemical determination of oxytetracycline as analyte. This electrochemical nanosensor with good uniformity and high surface area was prepared in the presence of an ionic surfactant (sodium dodecyl sulfate) as electrolyte to suspend carbon nanotubes within the PoAP and improve the stability and electroactivity of the composite film. The surface morphology of the prepared nanosensor was characterized by scanning electron microscopy and showed a three-dimensional network structure. The influence of several parameters such as number of potential cycles, scan rate and pH of the solution on the electrochemical response of the resultant electrode was investigated. The prepared electrode functioned as a selective recognition element for oxytetracycline determination. It showed excellent electrochemical response to oxytetracycline at low oxidative potential in buffer solution of pH 2.0, with good stability and sensitivity. Under the optimal experimental conditions, the electrochemical response of the sensor was linear with respect to the concentration of oxytetracycline in a dynamic range of 0.2  $\mu\text{M}$ –0.25 mM. The detection limit of the fabricated nanosensor was calculated as 0.10  $\mu\text{M}$  (signal/noise = 3). This sensor was used successfully for

the oxytetracycline determination in real samples with recoveries of 96.9–103.5 %.

**Keywords** Electrochemical sensor · Multi-walled carbon nanotube · *Ortho*-aminophenol · Oxytetracycline

## Introduction

Conductive polymers, such as polypyrrole [1], poly-*ortho*-aminophenol (PoAP) [2, 3], polyaniline and their copolymers [4–6] have been extensively studied because of their various applications including corrosion inhibitors, batteries, organic electronics, electrochromic devices, sensors, etc. [7]. Multi-walled carbon nanotubes (MWCNTs), owing to their high surface area, electrical conductivity, chemical stability and mechanical strength have been used in electrochemical sensors [8, 9]. The high surface area and conductivity of MWCNTs may improve the redox properties of conductive polymers and facilitate the electron transfers [10–12]. Therefore, composites of conductive polymers and MWCNTs have been proposed for fabrication of a higher recognition capacity and sensitivity of the electrochemical sensor.

Oxytetracycline (OTC) as a drug (Scheme 1), is widely used for prevention and therapy of human and animal infection diseases and has a great activity against bacteria due to its broad-spectrum activity, good oral absorption, relatively low toxicity and low cost [13–15]. So, this drug is licensed for using in a variety of food-producing animals including cattle, sheep, pig and fish [16]. It is used as animal feed additive and in veterinary medicine as antibiotic. It is accumulated in diary food products, such as meat [17], honey [18], egg [19] and milk [20] which can be directly toxic or cause allergic reactions in some

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