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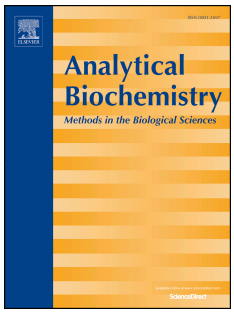

Au nanoparticles-ZnO composite nanotubes using natural silk fibroin fiber as template for electrochemical non-enzymatic sensing of hydrogen peroxide

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Au nanoparticles-ZnO composite nanotubes using natural silk fibroin fiber as template for electrochemical non-enzymatic sensing of hydrogen peroxide

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ABSTRACT

A novel electrochemical sensor based on the composite of gold nanoparticles/zinc oxide nanotube (AuNPs/ZnO-NTs) was constructed and its application as hydrogen peroxide (H_2O_2) non-enzymatic sensor was investigated. ZnO-NTs were prepared by a biomineralization strategy in which silk fibroin fiber (SFF) was used as template, and thus the ZnO-NTs inherited the advantages of SFF such as mechanical stability, flexible biomimetic morphology and biocompatibility. The AuNPs/ZnO-NTs was further prepared by the electrostatic absorption of AuNPs onto the surface of ZnO-NTs, and found to be capable to catalyze the reduction of H_2O_2. The working potential was 0.05 V, which was far higher than those in literatures, indicating the strong anti-interference ability in the real application. The catalytic current was linearly proportional in the concentration range of 1 μM-3.0 mM with a sensitivity of 1336.7 μA mM^{-1} cm^{-2}. The detection limit was estimated to be 0.1 μM (S/N=3). Such a high sensitivity was attributed to the electrocatalytic property of ZnO and high electron transfer ability of AuNPs/ZnO-NTs structure. Moreover, the final detection results of H_2O_2 in real samples showed the acceptable accuracy compared with the traditional potassium permanganate titration, exhibiting the prospect to be used as an applicable sensor in actual detections.

KEYWORDS: ZnO nanotubes composite; silk fibroin fiber; hydrogen peroxide; electrochemical catalysis; non-enzymatic sensor.

Introduction

Small biological molecules, such as saccharides [1], hydrogen peroxide (H_2O_2) [2,3], amino acids [4] and nucleotides [5], usually related to special physiological functions and play pivotal roles in life process. Among them, H_2O_2 is an important metabolic product in chemical and food industries and cell proliferation and death [6,7], even is recognized as a biomarker for cancer