Synthesis of Nanocomposites Based on Gold and Nickel as Sensitive Electrochemical Sensor for Determination of Salmonella Typhimurium in Food Industry

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In this work, an electrochemical sensor based on gold and Nickel nanoparticles decorated on nanocomposites of c-CNTs and PEDOT modified GCE was developed to determine Salmonella as a poisoning microorganism in food samples. The electrodeposition method was applied for the synthesis of bimetallic Au-Ni nanoparticles on a nanocomposite of c-CNTs and PEDOT modified GCE (Au-Ni NPs/c-CNTs-PEDOT/GCE), and the anti-Salmonella Typhimurium antibodies were immobilized on modified GCE (Ab/Au-Ni NPs/c-CNTs-PEDOT/GCE). The structural analyses using SEM, XRD and EDS showed that the high densities of bimetallic nanoparticles were distributed on rod-like and porous structures of c-CNTs-PEDOT. An electrochemical study using CV and DPV techniques showed Ab/Au-Ni NPs/c-CNTs-PEDOT/GCE was a sensitive, stable and selective Salmonella sensor. The linear range, limit of detection and sensitivity were obtained 1-120 μM , 0.64 nM and 4.6789 $\mu\text{A}/\mu\text{M}$, respectively. Comparison of the sensing properties of this study with the other reported Salmonella sensors indicated the broad linear range was obtained for Ab/Au-Ni NPs/c-CNTs-PEDOT/GCE that was attributed to the capture of Salmonella on Au-Ni NPs-labeled antibodies which are placed on the porous network c-CNTs-PEDOT/GCE. The prepared sensor was examined for determination of Salmonella in a real sample of egg and the results illustrated the acceptable values of recovery (91 to 98.5%) and RSD (2.84 to 3.71%) which is attributed to validation and precision of this method for analyses of food samples.

Keywords: Salmonella; Differential pulse voltammetry; Bimetallic Au-Ni nanoparticles; Carboxylated CNTs; Electrodeposition

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