New Electrochemical Immunosensor of Au/Holey Graphene Oxide and Au/ZnO for Sensitive Detection of Carcinoembryonic Antigen

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A sandwich-type electrochemical immunosensor was developed using Au/ZnO as a nonenzymatic label for the ultrasensitive detection of a tumour biomarker carcinoembryonic antigen (CEA). Au nanoparticle-decorated holey graphene oxide (Au/HGO) was synthesized according a simple hydrothermal procedure and modified on an electrode to have enhanced conductivity, large surfaces areas and good adsorption of immobilizing antibodies (Ab₁). Subsequently, horseradish-peroxidase (HRP)-functionalized Au/ZnO (Ab₂/HRP-Au/ZnO) was fabricated to label the secondary antibodies (Ab₂). The Ab₂/HRP-Au/ZnO catalysed the reduction of H₂O₂ in the sandwich-type immunoreactions. An enhanced sensitivity was obtained. Moreover, the proposed immunosensor showed a wide linear range from 0.001 ng/mL to 100 ng/mL with a detection limit of 0.6 pg/mL (S/N = 3) under the optimal experimental conditions. The disposable immunosensor has high sensitivity, long-term stability, and has clinical value in cancer screening and in appropriate point of care diagnostics.

Keywords: Au nanoparticle/holey graphene oxide; Au/ZnO; signal amplification; sandwich-type electrochemical immunosensor

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