Development of H$_2$O$_2$ biosensor based on nickel ferrite and gold nanocomposites

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Abstract: An electrochemical biosensor based on PDDA-AuNP-NiFe$_2$O$_4$NPs-CNTs-CHIT (Poly(diallyldimethylammonium chloride)-gold nanoparticles-nickel ferrite nanoparticles-carbon nanotubes-chitosan) and PoPD (Poly(o-phenylenediamine)) film immobilized HRP (Horseradish peroxidase) onto glassy carbon electrode (GCE) surface was successfully fabricated for hydrogen peroxide detection. According to cyclic voltammetric study, the modified electrode presented the kinetic parameters such as charge transfer rate constant of 0.39 s$^{-1}$ and low $K_m$ (0.02 mM). The results also exhibited a linear range from 1 µM to 7000 mM ($R^2 = 0.998$) with a detection limit of 0.32 µM, sensitivity (0.20 mA mM$^{-1}$ cm$^{-2}$), stability (1.62 %RSD, n = 5) and reproducibility (2.94 %RSD, n = 5) at the optimal condition ($E_{applied}$ at -0.7 V in 0.05 M phosphate buffer pH 7.4). As high effectiveness for H$_2$O$_2$ analysis, this method can be applied for carcino embryonic antigen (CEA) immunosensor for the further work.

Keywords: Hydrogen peroxide biosensors; Nickel ferrite; Gold nanoparticles