

Improved peroxide biosensor based on Horseradish Peroxidase/Carbon Nanotube on a thiol-modified gold electrode

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ABSTRACT

A new 3-dimensional (3D) network of crosslinked Horseradish Peroxidase/Carbon Nanotube (HRP/CNT) on a thiol-modified Au surface has been described in order to build up the effective electrical wiring of the enzyme units with the electrode. The synthesized 3D HRP/CNT network has been characterized with cyclic voltammetry and amperometry which results the establishment of direct electron transfer between the redox active unit of HRP and the Au surface. Electrochemical measurements reveal that the high biological activity and stability is exhibited by the immobilized HRP and a quasi-reversible redox peak of the redox centre of HRP was observed at about -0.355 and -0.275 V vs. Ag/AgCl. The electron transfer rate constant, k_s and electron transfer co-efficient α were found as 0.57 s^{-1} and 0.42 , respectively. Excellent electrocatalytic activity for the reduction of H_2O_2 was exhibited by the developed biosensor. The proposed biosensor modified with HRP/CNT 3D network displays a broader linear range and a lower detection limit for H_2O_2 determination. The linear range is from 1.0×10^{-7} to 1.2×10^{-4} M with a detection limit of $2.2.0 \times 10^{-8}$ M at 3σ . The Michaelies–Menten constant K_{app} M value is estimated to be 0.19 mM. Moreover, this biosensor exhibits very high sensitivity, good reproducibility and long-time stability.

Keywords: Three-dimensional networks; Hrp; Carbon nanotube; Direct electron transfer; Biosensors; Hydrogen peroxide

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