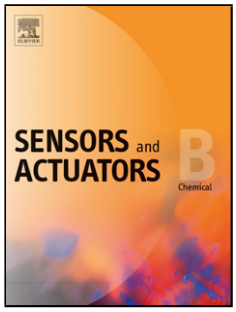

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Bienzymatic mediatorless sensing of total hydrogen peroxide with catalase and multi-copper enzyme co-adsorbed at carbon nanotube-modified electrodes

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Abstract

The rapid, sensitive, and accurate determination of hydrogen peroxide (H_2O_2) is of practical importance in physiological, pathological, and environmental fields. In this work, we propose a highly sensitive and selective amperometric biosensor for the detection of hydrogen peroxide. The biosensor consists of a glassy carbon electrode (GCE) covered with multi-walled carbon nanotubes (MWCNTs) and adsorbed enzymes: catalase (Cat) and either laccase (Lac) or bilirubin oxidase (BOX). The stability and durability of the electrode was improved by using glutaraldehyde (GAD). The determination of H_2O_2 by cyclic voltammetry and chronoamperometry experiments proved the synergy of the laccase and catalase co-adsorbed on the carbon nanotubes. Catalase from bovine liver catalyzed the transformation of H_2O_2 into water and oxygen, which was further transformed into water by multi-copper enzymes (MCO), either laccase from *Trametes versicolor* or bilirubin oxidase from *Myrothecium verrucaria*. The unique property of such a bienzymatic sensing layer is the ability to detect oxygen originating both from catalase activity and from the self-decomposition of H_2O_2. This makes it possible to evaluate the initial concentration of H_2O_2 in the analyzed sample.

Keywords: catalase, laccase, multi-cooper enzymes, direct electron transfer, biosensor, hydrogen peroxide