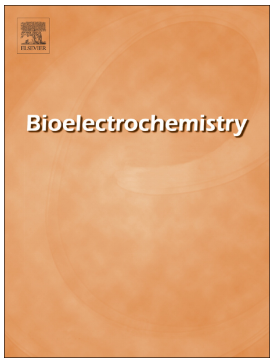

Gold nanoparticles/4-aminothiophenol interfaces for direct electron transfer of horseradish peroxidase: Enzymatic orientation and modulation of sensitivity towards hydrogen peroxide detection

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Gold nanoparticles/4-aminothiophenol interfaces for direct electron transfer of horseradish peroxidase: enzymatic orientation and modulation of sensitivity towards hydrogen peroxide detection.

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ABSTRACT

Hydrogen peroxide electrochemical detection by horseradish peroxidase has been widely studied. The use of gold nanoparticles to prepare electrode/enzyme bioconjugates has attracted attention due to their catalytic properties. In this work, it is reported the use of gold nanoparticles and 4-aminothiophenol as a scaffold to obtain a suitable matrix for enzyme bioconjugation with horseradish peroxidase. A critical factor in biosensors design and development is the enzymatic electrochemical activity understanding. Comparison of voltammetric studies of the heme prosthetic group showed a reversible electrochemical behavior when the enzymes were immobilized in a well-dispersed gold deposit; on the other hand, a discrete redox response was observed on a randomly deposited gold electrode. These results show that the distance between enzymes is essential. Hydrogen peroxide catalysis and the enzymatic behavior were analyzed considering two types of nanoparticles dispositions. The catalytic behavior observed in the well-dispersed nanoparticles configuration suggests a preserved enzyme folding, a decrease of steric impediments, and appears to be a better immobilization strategy. In contrast, the randomly electrodeposited gold electrode decreased the enzyme orientation and the electrochemical activity. The advantages of this methodology are the electrode fabrication affordable cost and the enzymatic direct electron transfer response improvement.

Keywords: Gold nanoparticles; direct electron transfer; horseradish peroxidase; hydrogen peroxide reduction; enzyme kinetics.