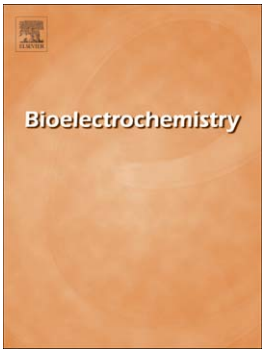

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Amperometric inhibition biosensors based on horseradish peroxidase and gold sononanoparticles immobilized onto different electrodes for cyanide measurements

Aisha Attar[a,b], Laura Cubillana-Aguilera[b], Ignacio Naranjo-Rodríguez[b], José Luis Hidalgo-Hidalgo de Cisneros [b], José María Palacios-Santander[b*], Aziz Amine[a*].

[a] *Faculty of Science and Techniques, University Hassan II, Mohammedia, BP 146, Mohammedia, 20650, Morocco*

[b]*Departamento de Química Analítica, Instituto Universitario de Investigación en Microscopía Electrónica y Materiales (IMEYMAT), Facultad de Ciencias, Universidad de Cádiz, Campus Universitario de Puerto Real, Polígono del Río San Pedro, S/N, 11510 Puerto Real, Cádiz, Spain*

* Corresponding authors
E-mail addresses: azizamine@yahoo.fr (A. Amine) josem.palacios@uca.es (J.M. Palacios-Santander)

J.M. Palacios-Santander
Tel. +34 956 016357
Fax +34 956 016460

A. Amine
Tel. +212 661 454198
Fax +212 523 315353

Abstract

New biosensors based on inhibition for the detection of cyanide and the comparison of the analytical performances of nine enzyme biosensor designs by using three different electrodes: Sonogel-Carbon, glassy carbon and gold electrodes were discussed. Three different horseradish peroxidase immobilization procedures with and without gold sononanoparticles were studied. The amperometric measurements were performed at an applied potential of −0.15 V vs. Ag/AgCl in 50 mM sodium acetate buffer solution pH = 5.0. The apparent kinetic parameters (K_{mapp}, V_{maxapp}) of immobilized HRP were calculated in the absence of inhibitor (cyanide) by using caffeic acid, hydroquinone, and catechol as substrates. The presence of gold sononanoparticles enhanced the electron transfer reaction and improved the analytical performance of the biosensors. The HRP kinetic interactions reveal non-competitive binding of cyanide with an apparent inhibition constant (K_i) of 2.7 μM and I_{50} of 1.3 μM. The determination of cyanide can be achieved in a dynamic range of 0.1–58.6 μM with a detection limit of 0.03 μM which is lower than those reported by previous studies. Hence this biosensing methodology can be used as a new promising approach for detecting cyanide.

Keywords: cyanide; enzyme biosensor; horseradish peroxidase; Sonogel-Carbon; gold sononanoparticles.