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Amperometric biosensors based on nafion coated screen-printed electrodes for the determination of cholinesterase inhibitors

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Abstract

Screen-printed electrodes coated with the nafion layer have been investigated for cholinesterase biosensor design. The butyrylcholinesterase (ChE) from horse serum was immobilised onto the nafion layer by cross-linking with glutaraldehyde vapours. The biosensors obtained showed better long-term stability and lower working potential in comparison to those obtained with no nafion coating. The sensitivity of a biosensor toward organophosphate pesticides is not affected by the nafion coating. The detection limits were found to be 3.5×10^{-7} M for trichlorfon and 1.5×10^{-7} M for coumaphos.

Keywords: Biosensor; Cholinesterase; Pesticide determination; Screen-printed

1. Introduction

Organophosphorus and carbamic pesticides are widely used in agriculture as insecticides due to their high efficiency and moderate toxicity for warm-blooded living organisms. Nevertheless, a certain amount of pesticides when transferred into the environment can cause various toxic effects on human beings within several weeks. Paraoxon residues, considered to be toxic for agriculture workers, were found on the citrus peel 28 days after the pesticide application [1]. In model experiments, trace amounts of organophosphates were determined in surface runoff 19 days after the simulated rainfall applied [2]. Standard chromatography analysis commonly used for pesticide detection is very reliable but there is a need of fast and inexpensive testing devices, especially for field application.

The toxic effect of organophosphorus and carbamic pesticides is mainly related to their ability to irreversibly bind acetylcholinesterase and hence to prevent the transmission of nerve impulses [3]. The anticholinesterase effect, being very specific, dictates the limited threshold values of pesticide content in surface, ground and drinking waters,

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