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An enzyme amperometric sensor for toxicant determination

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Abstract

An enzyme sensor with amperometric recording of the analytic signal for determination of a number of cholinesterase (ChE) inhibitors (P-, Cl-containing pesticides, heavy metals) has been developed. It consists of a mercury film-covered silver electrode and ChE immobilized in the nitrocellulose film in the presence of glutaraldehyde. It is shown that the enzyme electrode can be used as a component of an enzyme reactor for the determination of ChE inhibitors and activators under flow conditions.

INTRODUCTION

The determination of traces of some compounds known as cholinesterase (ChE) effectors in foodstuffs and other environmental sectors is an important problem in view of recent attention to environmental control. A variety of methods for the analysis of organophosphorus compounds based on their inhibiting activity towards ChE has been reviewed [1]. Among them is the technique proposed by Giang and Hall [2] where the residual activity of the enzyme was measured by means of the titration of the acetic acid resulting from acetylcholine hydrolysis, and by the galvanostatic method for the determination of the activity of immobilized enzyme as described by Goodson et al. [3] as used in the automatic monitoring of insecticides levels in water and air. Razumas et al. [1] proposed a bioamperometric method for the reliable determination of as little as 10^{-7} M organophosphorus insecticides using a native ChE. The native ChE has also been used in the chromato-enzyme method for the analysis of traces of organophosphorus pesticides [4], as well as in electrochemical detectors for liquid chromatography [5]. The recent advances in enzyme electrode construction are due to the progress in enzyme immobilization techniques and rapid development in the field of electrochemical sensors. This has contributed greatly to "reagent-free" analysis [6,7]. A high selectivity operation and the advantages of automated and semi-automated systems for real-time monitoring on the basis of enzyme sensors have ensured their importance now. A selective

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