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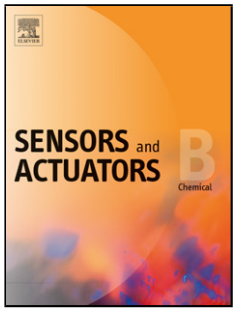

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Author: Kateryna Stepurska Sergei Dzyadevych Sergii Gridin

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Potentiometric enzyme biosensor for aflatoxin B1 detection - kinetic simulation

Kateryna Stepurska[a,b], Sergei Dzyadevych[a,b], Sergii Gridin[c,*]

[a] *Institute of High Tehcnologies, Taras Shevchenko National University of Kiev, Ukraine*
[b] *Instutute of Molecular Biology and Genetics of the NAS of Ukraine, Kiev, Ukraine*
[c] *Department of Physics, Wake Forest University, Winston Salem, NC, USA*

Abstract

We have investigated operation of a potentiometric biosensor based on reversible acetylcholinesterase inhibition for determination of aflatoxin B1. Biochemical reactions between the enzyme, substrate, and inhibitor are described using rate equations. Sensitivity study of biosensor response to the biochemical reaction rates was done by varying each rate constant. The response to substrate and inhibitor was used as a fitting target for evaluation of the biochemical reaction rates. Initial concentrations of the enzyme (2.0×10^{-5} M acetylcholinesterase), substrate (4.0×10^{-3} M acetylcholine chloride), and inhibitor (9.6×10^{-6} M aflatoxin B1) in the biosensor membrane act as the boundary conditions for the rate equations. This kinetic model allowed us to establish the effect of reaction rates on biosensor response and reproduce the response to different inhibitor concentrations. The results may be used for biosensor design and optimization.

Keywords: biosensor, acetylcholinesterase, aflatoxin, simulation

1. Introduction

Food quality and safety monitoring is one of the major concerns in today's society. Food may be contaminated at various stages of production, either chemically by small molecules (e.g. toxins, pesticides, residues of veterinary

*Corresponding author
Email address: gridins@wfu.edu (Sergii Gridin)