A Simple Acetylcholinesterase Biosensor Based on Ionic Liquid/Multiwalled Carbon Nanotubes-Modified Screen-Printed Electrode for Rapid Detecting Chlorpyrifos

Dongfei Chen^{1,2}, Jiayun Fu^{1,2}, Zengning Liu^{1,2}, Yemin Guo^{1,2}, Xia Sun^{1,2,*}, Xiangyou Wang^{1,2}, Zhiqiang Wang^{1,2}

¹ School of Agriculture and Food Engineering, Shandong University of Technology, No.12, Zhangzhou Road, Zibo 255049, P.R. China

² Shandong Provincial Engineering Research Center of Vegetable Safety and Quality Traceability, No. 12, Zhangzhou Road, Zibo 255049, Shandong Province, PR. China

*E-mail: sunxia2151@sina.com

doi: 10.20964/2017.10.12

Received: 5 April 2017 / Accepted: 19 May 2017 / Published: 12 September 2017

A simple, low cost and sensitive electrochemical biosensor was developed for detection of chlorpyrifos, based on an acetylcholinesterase/multi-walled carbon nanotubes/ionic liquid composite modified screen-printed electrode (AChE/MWCNTs/IL/SPE). In this study, incorporating MWCNTs and IL formed a relative uniform microarchitecture on the electrode surface to promote electron transfer and enhance electrochemical response, hence, the fabricated biosensor exhibited obvious electrochemical signal in the redox probe $[\text{Fe}(\text{CN})_6]^{3-/4-}$ during the detection. AChE as a biorecognition element was immobilized onto the successfully modified SPE, which enabled sensitive determination of chlorpyrifos owing to high affinity of organophosphate pesticides toward the AChE. The morphologies and electrochemistry behaviors of AChE/MWCNTs/IL/SPE were investigated by using cyclic voltammetry (CV) and scanning electron microscopy (SEM), respectively. Under optimal conditions, chlorpyrifos could be detected in the wide linear range of $0.05 - 1.0 \times 10^5 \mu\text{g/L}$ with a detection limit of $0.05 \mu\text{g/L}$. The biosensor also showed other advantages such as convenient preparation, good reproducibility, excellent stability and high sensitive. Moreover, the biosensor could also be used for directly analysis of real vegetable samples, which would provide a new promising tool for pesticide residues tests.

Keywords: AChE; ionic liquid; multi-walled carbon nanotubes; chlorpyrifos

[FULL TEXT](#)

© 2017 The Authors. Published by ESG (www.electrochemsci.org). This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution license (<http://creativecommons.org/licenses/by/4.0/>).