Environmental Engineering and Management Journal *February 2018, Vol. 17, No. 2, 317-326*
http://www.eemj.icpm.tuiasi.ro/; http://www.eemj.eu

"Gheorghe Asachi" Technical University of Iasi, Romania

DEVELOPMENT AND EVALUATION OF SOL-GEL-BASED BIOSENSORS FOR CADMIUM IONS DETECTION

Melinda David[1], Mihaela Badea[2], Monica Florescu[2]*

[1]Faculty of Physics, University of Bucharest, Str. Atomistilor 1, 500025, Bucharest, Romania
[2]Faculty of Medicine, Transilvania University of Brasov, Str. N. Balcescu 56, 50019, Brasov, Romania

Abstract

The enzyme-based biosensor stability and its analytical performance depend on both the immobilization process and the matrix used for immobilization of the enzyme into a stable layer. In this paper, the development and evaluation of an optimal enzymatic layer for stable encapsulation of the acetylcholinesterase enzyme (AChE) through the sol-gel method onto mediated carbon-ink screen-printed electrodes was performed, obtaining electrochemical enzyme-based biosensors. The enzyme was immobilized on the surface of the working electrode using different combinations of three sol-gel precursors, tetraethoxysilane (TEOS), tetramethoxysilane (TMOS) and methyltrimethoxysilane (MTMOS) in different ratios, without usual addition of alcohol, by comparison with the well-known cross-linking immobilization method using glutaraldehyde. Only the best suitable precursor (TEOS) was kept for further analysis. The optimized biosensors were successfully used for the amperometric detection of Cd ions; the sensor exhibits high sensitivity (1.48 ± 0.14 %/µgl^{-1}) and a low detection limit of 0.19 µg/L. Potentialities, for a short-term-use or disposable sensors, are indicated.

Key words: electrochemical biosensors; screen-printed electrodes; sol-gel layer

Received: February, 2013; Revised final: June, 2014; Accepted: June, 2014; Published in final edited form: February 2018

* Author to whom all correspondence should be addressed: e-mail: florescum@unitbv.ro; Phone: +40-268-412185; Fax: +40-268-412185