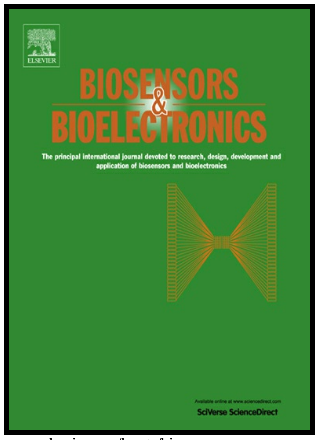
Author's Accepted Manuscript



www.elsevier.com/locate/bios

A highly sensitive impedimetric aptasensor for the selective detection of acetamiprid and atrazine based on microwires formed by platinum nanoparticles

L. Madianos, G. Tsekenis, E. Skotadis, L. Patsiouras, D. Tsoukalas

PII: S0956-5663(17)30700-5
DOI: https://doi.org/10.1016/j.bios.2017.10.034
Reference: BIOS10059

To appear in: *Biosensors and Bioelectronic*

Received date: 24 July 2017
Revised date: 26 September 2017
Accepted date: 15 October 2017

Cite this article as: L. Madianos, G. Tsekenis, E. Skotadis, L. Patsiouras and D. Tsoukalas, A highly sensitive impedimetric aptasensor for the selective detection of acetamiprid and atrazine based on microwires formed by platinum nanoparticles, *Biosensors and Bioelectronic,* https://doi.org/10.1016/j.bios.2017.10.034

A highly sensitive impedimetric aptasensor for the selective detection of acetamiprid and atrazine based on microwires formed by platinum nanoparticles

L. Madianos[a], G. Tsekenis[b], E. Skotadis[a], L. Patsiouras[a], D. Tsoukalas[a*]

[a] Department of Applied Physics, National Technical University of Athens, Athens, 15780, Greece

[b] Biomedical Research Foundation of the Academy of Athens, Athens, 11527, Greece

*Corresponding authors e-mails: madleo@mail.ntua.com, dtsouk@central.ntua.gr, tel:

+30 2107721679

Department of Applied Physics, National Technical University of Athens, Iroon Polytexneiou 9, 15780, Greece

Abstract

A novel impedimetric biosensor was developed for the detection of the two extensively used pesticides, acetamiprid and atrazine. By employing the sputtering and e-beam lithography techniques, platinum nanoparticles (Pt NPs) were deposited in a bridge-like arrangement, in between interdigitated electrodes (IDEs). The resulting Pt NP microwires were chemically functionalized to allow the covalent immobilization of aptamers against the two target analytes onto the sensor surfaces. The biosensing platform facilitated charge transfer through the microwire-bridged IDEs, while upon analyte binding to the immobilized aptamers electron transfer was hindered, resulting in an increase of the electrochemical cell's impedance. The combination of Pt NPs microwires and aptamers allowed the sensitive and highly selective detection of acetamiprid with a linear range of response in the range of 10 pM to 100 nM with a limit of detection (LoD) at 1 pM, and of atrazine with a linear range of responses from 100 pM to 1 μM and a LoD at 10 pM respectively. Its performance was tested against a number of other commonly used pesticides as well as in real water samples.

Keywords

platinum nanoparticles; microwires; aptamer; pesticides; impedance; biosensor; electrochemical

1. Introduction

In the past decades, pesticides have been widely employed to increase crop yields and improve the quality of agricultural products. These compounds, albeit indispensable in the modern agricultural field, are also a major source of contamination of the natural environment, with serious health concerns associated with their use (Carter and Blizard, 2016; Fratrić et al., 2017; Metayer et al., 2016). Two of the most