Comparative Study of the Electrochemical Signal of Neonicotinoids and Tetronic Acid Amides on Screen Printed Electrodes With and Without the Use Of N2a Cells.

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Abstract

The extensive use of pesticides in agriculture has caused significant concern in public health therefore cell-based sensors have been proved as potentially useful method for studying their effects. The objective of this work was to investigate the possibility of using carbon screen printed electrodes (SPE) in combination with the use of N2a cells for the direct voltammetric determination of 5 neonicotinoids (imidacloprid, clothianidin, thiacloprid, acetamiprid and thiamethoxam) and 3 tetronic acid amide insecticides (spiromesifen, spirodiclofen and spirotetramat). The insecticide cytotoxicity in N2a cells was determined after 30 min treatment with concentrations 3, 10, 30 and 100 μM by the propidium iodide (PI) uptake assay. Cyclic voltammetry (CV) and differential pulse voltammetry (DPV) were performed to compare signals from plain carbon screen printed electrodes and from N2a cells.

CYTOTOXICITY

(Propidium iodide uptake)

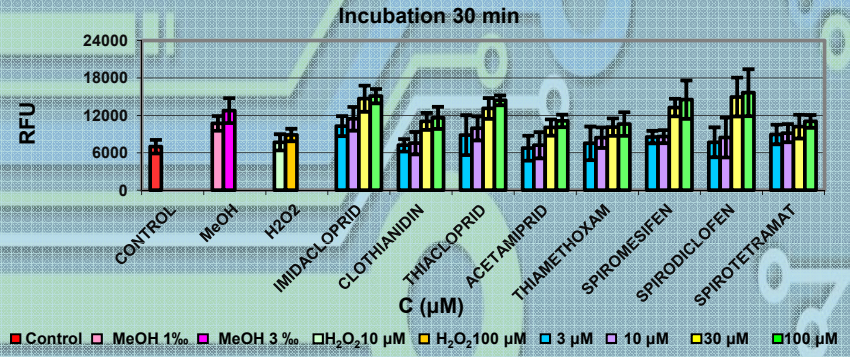


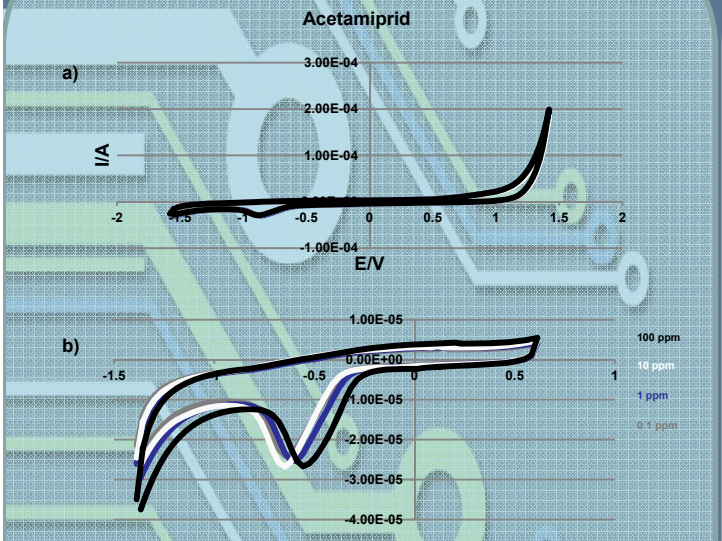
Fig. 1 Cytotoxicity of N2a cells after 30 min incubation with different concentrations of the insecticides. The cytotoxicity is depicted as the relative fluorescence units of propidium iodide on the cells after incubation with different pesticide concentrations.

POTENTIOSTAT DEVICE

W.E.= working electrode
C.E.= counter electrode
R.E.= reference electrode

Fig. 2 The instrument is a compact and hand-held potentiostat – galvanostat. It is connected to a PC via its USB port in the laboratory for electrochemical experiments. The sensors comprise a standard three electrode configuration with a carbon working and counter electrode and an Ag/AgCl reference electrode.

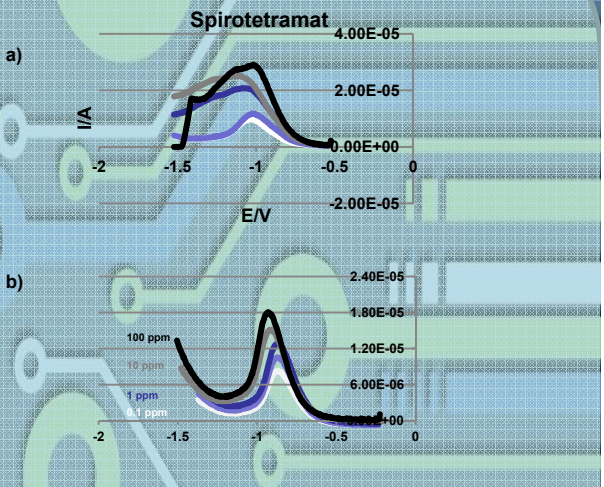
CYCLIC VOLTAMETRY



•The different insecticide concentrations are depicted clearly with N2a cells

Fig. 3 CV experiments were performed to study the behavior at a) Britton-Robinson buffer pH 7.5 and b) cells in PBS buffer pH 7.4. The scan rate was 50 mV/s and the number of cycles was 10.

DIFFERENTIAL PULSE VOLTAMETRY



• N2a cells gave sharper picks than Britton –Robinson buffer in every insecticide

Fig. 4 DPV experiments were performed to study the behavior at a) Britton-Robinson buffer pH 7.5 and b) cells in PBS buffer pH 7.4. The DPV measurement parameters were pulse amplitude 50 mV, pulse width 50 ms, scan rate 25 mV/s. Comparison of measurements with a) Britton-Robinson buffer and b) cells in PBS buffer for Spirotetramat.

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