

## Nanochemical and Nanobiotechnology

### A Novel Amperometric Glutamate Biosensor Based on Glutamate Oxidase Adsorbed on Silicalite

O.O. Soldatkin<sup>1,2</sup>, B.O. Kasap<sup>3</sup>, O.V. Soldatkina<sup>1</sup>, D.Yu. Kucherenko<sup>1</sup>,  
I.S. Kucherenko<sup>1,2</sup>, B. Akata<sup>3</sup>, S.V. Dzyadevych<sup>1,2</sup>

<sup>1</sup> *Institute of High Technologies, Taras Shevchenko National University of Kyiv, Kyiv, Ukraine E-mail: [alex\\_sold@yahoo.com](mailto:alex_sold@yahoo.com)*

<sup>2</sup> *Laboratory of Biomolecular Electronics, Institute of Molecular Biology and Genetics of National Academy of Sciences of Ukraine, Kyiv, Ukraine,*

<sup>3</sup> *Micro and Nanotechnology Department, Middle East Technical University, Ankara, Turkey*

Glutamate is the major excitatory neurotransmitter in the central nervous system, which is involved in the main aspects of normal brain functioning. High-affinity Na<sup>+</sup>-dependent glutamate transporters is key proteins, which transport extracellular glutamate to the cytoplasm of nerve cells, thereby preventing continuous activation of glutamate receptors, and thus the development of neurotoxicity. Disturbance in glutamate uptake is involved in the pathogenesis of major neurological disorders. A number of techniques are available for measuring glutamate concentration, including optical methods, patch clamp, and microdialysis. However, mainly all of these techniques suffer from disadvantages, including: invasive sampling, temporal limitations, low signal-to-noise ratio, lack of economical feasibility, and/or ability to detect changes in glutamate transport under physiological conditions. These disadvantages limit the applicability of results regarding neurotransmitter kinetics. Electrochemical methods are considered as one of the most potential approach, because of their simplicity, rapidity, high sensitivity and specificity. Amperometric biosensors are considered as the most promising and successful among electrochemical biosensors.

In this study, we developed glutamate biosensor. Platinum disc electrodes were used as amperometric transducers. A biomembrane was based on glutamate oxidase adsorbed on different zeolites. It was shown that biosensors modified with silicalite are characterized by increased sensitivity. The influence of silicalite concentration on sensitivity of biosensors was studied. The proposed biosensors demonstrated high sensitivity. The linear range of detection was from 1 μM to 450 μM. An effect of solution parameters (ionic strength, pH, buffer capacity) on the operation of biosensors was studied. It was shown that they were characterized by good response reproducibility during 8 hours and operational stability for several days. These biosensors can be applied for analysis of glutamate in real samples.