

Amperometric Biosensing of L-Glutamate Using Reduced Graphene Oxide and Glutamate Oxidase [†]

Ieva Sakinyte-Urbikiene ^{*}, Vidute Gureviciene and Julija Razumiene

Life Sciences Center, Institute of Biochemistry, Vilnius University, Sauletekio Av. 7,
LT-10257 Vilnius, Lithuania; vidute.gureviciene@gmc.vu.lt (V.G.); julija.razumiene@gmc.vu.lt (J.R.)

^{*} Correspondence: ieva.sakinyte@gmc.vu.lt; Tel.: +37060179928

[†] Presented at the XXXV EUROSENSORS Conference, Lecce, Italy, 10–13 September 2023.

1. Introduction

The RGO-based biosensor has been tested for L-glutamate detection in wild-type rat brain samples. For this purpose, 50 μL of the diluted brain in 1.5 ml sodium phosphate buffer solution was added to 1 mL of the electrochemical cell and the electrochemical signals were recorded. The concentration of L-glutamate was calculated using the calibration curve. It was found that different brain samples contain from 10.4 ± 0.3 to 26.8 ± 2.3 $\mu\text{mol/g}_{\text{brain}}$ of L-glutamate.

Table S1. Concentrations of L-glutamate in brain samples obtained using RGO-based biosensor.

No.	C (L-glutamate), $\mu\text{mol/g}_{\text{brain}}$ ($n=3$)	SE
1	15.9	± 1.2
2	10.4	± 0.3
3	17.9	± 0.6
4	17.0	± 0.8
5	12.7	± 1.1
6	26.8	± 2.3

Table S2. Comparison of analytical performance of Pt- and RGO-based biosensors.

Electrode material	Operating voltage, V	Linear detection range, mM	Sensitivity, $\mu\text{A} \cdot \text{mM}^{-1} \cdot \text{cm}^{-2}$	$K_{\text{M}}^{\text{app}}$, mM
Pt	+0.6	0.0005 – 0.15	3.6	0.34 ± 0.02
RGO	-0.1	0.05 – 0.5	5.4	1.68 ± 0.4

The sensitivity of the Pt biosensor operating at +0.6 V was found to be $3.6 \mu\text{A mM}^{-1} \text{cm}^{-2}$, apparent Michaelis constant $K_{\text{M}}^{\text{app}} = 0.34 \pm 0.02$ mM, while RGO-based biosensor operating at -0.1 V demonstrated sensitivity of $1.5 \pm 5.4 \mu\text{A mM}^{-1} \text{cm}^{-2}$ and $K_{\text{M}}^{\text{app}} = 1.68 \pm 0.4$ mM. The linearity of calibration curves ranged from 0.05 to 0.5 mM and from 0.0005 to 0.15 mM of RGO- and Pt-based biosensors, respectively.