UDK 544.6

THE USE OF MELAMINE BARBITURATE IN CARBON-CONTAINING INKS FOR SCREEN-PRINTED ELECTRODES

Evdokimov A. A. (ITMO University), **Aliev T. A.** (ITMO University), **Domareva N. P.** (ITMO University)

Scientific supervisor – Dr. prof. Skorb E. V.

(ITMO University)

Electrochemical sensors based on carbon-containing materials are the most common sensors for the analysis of various biologically active substances and metal ions. The advantage of such sensors is the possibility of modifying the surface of the working electrode with polyelectrolytes and specific proteins for highly specialized analyses. The composition of inks for screen-printed electrodes includes various modifiers (binders) that hold electrically conductive carbon particles on the plastic surface, and a solvent that volatilizes during the manufacture and drying of the electrode. [1]. A significant interest in creating working samples of screen-printed electrodes is the use of cheap and affordable materials to minimize the cost of printing. In particular, there is a successful experience in the application of acetylcellulose as a binder for carbon-containing inks deposited on the surface of polyvinyl chloride (PVC) plastic [2].

The organic complex such as melamine barbiturate was used for the improvement of carbon-contained ink composition. This complex is a supramolecular self-assembly of melamine and barbituric acid interconnected by hydrogen bonds and formed at certain pH values [3]. It is assumed that melamine barbiturate promotes the binding of electrically conductive carbon particles (graphite, carbon nanotubes) into a single matrix together with the main modifier acetylcellulose into a single matrix that holds dried ink on the substrate surface (PVC) and slightly affecting the conductivity of the electrodes. The last property of the ready-made screen-printed electrode was investigated using cyclic voltammetry in the study of $[Fe(CN)6]^{3-}$/$[Fe(CN)6]^{4-}$ redox processes.

The obtained results demonstrate that experimental screen-printed electrodes with the addition of melamine barbiturate differ slightly or exceed in electrochemical parameters in comparison with the electrodes of the classical formulation (only acetylcellulose and carbon particles). The content of melamine barbiturate (5-15 wt. %) in the ink was analyzed to create the most electrically conductive carbon-containing inks.

References:

1. Michalkiewich, S., Skorupa A., Jakubczik M. Carbon materials in electroanalysis of preservatives: a review // Materials. – 2021. – Vol. 24.

2. Kadara R.O., Jenkinson N., Banks C.E. Characterisation of commercially available electrochemical sensing platforms // Sensors and Actuators B: Chemical. – 2009. – V. 138. – № 2. – Pp. 556-562.

3. Shilovskikh, V. V., Timralieva, A. A., Nesterov, P. V., Novikov, A. S., Sitnikov, P. A., Konstantinova, E. A., Kokorin, A. I., Skorb, E. Melamine-barbiturate supramolecular assembly as pH-dependent radical trap material // Chemistry – A European Journal. – 2020. – V. 26. - № 70. – Pp. 16603-16610.