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Amperometric enzyme biosensor for glucose determination based on matrix of mesoporous silica composite and Ir nanoparticles

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The purpose of this work is the development and optimization of amperometric biosensor for glucose determination based on metal nanoparticles and mesoporous silica composite.

Nanomaterials are used as "electronic wires'' to shorten the pathway of electron transfer, to enhance the electron transfer between the enzyme redox center and the electrode surface, retaining at the same time the biological activity of enzymes.

In the work, the functionalization of surfaces of amperometric transducers with Ir nanoparticles was performed aimed at the improvement of biosensor sensitivity and selectivity. The voltage-current characteristics of obtained transducers were studied, the operation of Ir nanoparticles-modified amperometric sensors was investigated concerning their sensitivity towards hydrogen peroxide. The method of enzyme immobilization on the surface of amperometric transducers was optimized to meet the conditions of functioning in real samples. Comparing the activities of non-modified and modified transducers, the change in the biosensor sensitivity was shown.

The analytical characteristics of amperometric transducers were studied. The developed biosensor based on metal nanoparticles and silica composite demonstrated significantly higher sensitivity; thus, it can be used in further experiments with real samples. The optimized biosensor had the following characteristics: linear range of glucose determination 0.05÷4 мМ, sensitivity 106 mA • M^{-1} • cm^{-2}, detection limit 0.1 μM.

The matrix of mesoporous silica composite and nanometals, in its turn, opens new possibilities for enzyme immobilization and the development of new electrochemical biosensors.