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Modification of amperometric carbon electrode with Pt-Pd nanoparticles for lactate analysis

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Lactic acid is a typical metabolite of living organisms. It is an end product of sugar utilization in lactic bacteria and an important component of a number of foodstuffs. Detection of the lactate content is of great importance in clinical diagnostics, fermentation industry, and control of the quality of food products. The lactate concentration in blood is a clinical-diagnostic marker of hypoxia, lactic acidosis, shock state, sharp myocardial infarction, and is significant in prognosis of reanimation therapy.

The work was aimed at the development of a sensitive element of the amperometric sensor, based on carbon electrodes modified with Pt-Pd nanoparticles and enzyme lactate oxidase, for the lactate analysis in the presence of interfering substances, such as uric and ascorbic acids. The carbon screen printed planar electrodes 1 mm in diameter («BVT Technologies», Czech Republic) were used. The conditions of electrochemical deposition of a mixture of Pt-Pd nanoparticles were chosen.

The voltamperometric characteristics of the modified sensor were studied, the enzyme stabilization was carried out. An influence of the medium parameters on the biosensor operation was comprehensively investigated. The working characteristics of the biosensor were thoroughly analyzed, its stability and selectivity were investigated. An increase in the bioselective membrane activity as a result of using Pt-Pd nanoparticles was shown.

The developed biosensor for the measurement of lactate concentration is characterized by the linear range 0.05 mM to 1.5 mM, and sensitivity of $6 \text{ nA} \cdot \text{M}^{-1} \cdot \text{cm}^{-2}$.

The developed sensor can be used in wine production for the selective detection of lactate in raw material during fermentation and control of the final quality of wine, as well as in food industry, clinical diagnostics, and pharmacology.