http://dx.doi.org/10.7124/bc.000AD1

Optimization and adaptation of amperometric biosensor based on lactate oxidase for measuring lactate concentration in blood serum samples

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Aim. Lactic acid is a crucial human metabolite with numerous physiological roles and applications in various fields. It serves as a biomarker for conditions like hypoxia and kidney and liver issues and is used as a food additive and quality marker for food and beverages. Due to its broad usage, there is a demand for fast, reliable, and easy methods to analyze lactate. Biosensor measurement methods are emerging as they are quick, affordable, easy to use, and portable. This study aims to analyze existing biosensor systems for lactate determination and to adapt and optimize an amperometric biosensor based on lactate oxidase for measuring lactate in blood serum samples. **Methods.** The bibliographic analysis was carried out using the analytical tools of the well-known bibliographic knowledge bases — Scopus and Web of science, as well as using the CiteSpace program.The functioning of the developed biosensor was carried out using a three-electrode system of amperometric measurements, consisting of a working electrode, an auxiliary electrode and a reference electrode (Ag/AgCl). Bioselective membranes based on 10% lactate oxidase applied to the surface of the working electrode were created as a sensitive element of the biosensor. Measurements were performed in 25 mM HEPES buffer with pH 7.4 in chronoamperometry mode. **Results.** Using bibliographic knowledge bases and the CiteSpace program, the best options for the development of biosensors for the determination of lactate in biological fluids were analyzed. Also, as part of this study, the selection of the optimal method of immobilization of the biosensor on the surface of the amperometric transducer was performed. The stability and reproducibility of biosensor responses when working with model and real samples were investigated. Adaptation of the optimized biosensor for measurement of lactate concentration in blood serum samples was carried out. **Conclusions.** The data obtained using the publication analysis parameters built into bibliographic systems were analyzed, and the directions for the development of biosensor methods of lactate determination were determined. The amperometric biosensor for measuring lactate concentration was optimized and adapted. Analysis of a number of blood serum samples using the proposed biosensor and a standard measurement method was performed and a high correlation of the results was shown.
Fundings. The work was supported by the National Research Fund of Ukraine within the framework of the project competition «Science for the reconstruction of Ukraine in the war and post-war periods» (project 2022.01/0043).

K e y w o r d s:biosensor, amperometric transducer, lactate oxidase, real blood samples