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NON-INVASIVE MONITORING OF KIDNEY FUNCTION USING A CONDUCTOMETRIC CREATININE-SENSITIVE BIOSENSOR

Aim. Creatinine is an important biomarker widely used for assessment of kidney function and diagnosis of kidney diseases [1–3]. The aim of this work was to develop a conductometric creatinine-sensitive biosensor for rapid and non-invasive monitoring of kidney function using urine samples. **Methods.** Two pairs of planar thin-film interdigitated gold electrodes deposited on a ceramic substrate were used as a conductometric transducer. Different enzyme immobilization methods were investigated, and the analytical characteristics of the biosensor were evaluated using artificial urine samples and comparison with the Jaffe method. **Results.** Among the investigated immobilization methods, covalent cross-linking of creatinine deiminase in a glutaraldehyde drop showed the best analytical performance. The developed biosensor demonstrated a rapid response time of 25 s, high response stability (RSD = 1.6%) and reproducibility of membrane preparation (RSD = 2%). The effects of pH, ionic strength, buffer capacity, and protein concentration on biosensor performance were studied, and optimal operation conditions were established. The biosensor demonstrated high selectivity toward creatinine in the presence of human urine components, while responses to interferents did not exceed 10% of the creatinine signal. The limit of detection of biosensor was 5 μM , and the linear range was 5–1000 μM . The results of biosensor analysis of artificial urine samples demonstrated a strong correlation with the data of Jaffe method ($R = 0.98$), confirming the accuracy and reliability of the developed biosensor. **Conclusions.** A novel conductometric biosensor for urine creatinine determination was developed and optimized for non-invasive kidney function monitoring. The biosensor demonstrated high sensitivity, selectivity, stability, and strong correlation with the standard method, indicating its potential for clinical diagnostics. **Fundings.** This work was supported by the National Research Foundation of Ukraine within the framework of the project 2025.07/0161.

Keywords: conductometric biosensor, creatinine deiminase, creatinine, kidney diseases, urine analysis.

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