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Flow injection biosensor system for real time determination of heavy metal ions for water monitoring

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Background/Aim. Heavy metal ion pollution is a worldwide problem that causes irreparable damage to humans and other organisms. The traditional detection methods, while accurate, are expensive, complex, and slow, making them impractical for continuous real-time monitoring. Biosensors, however, offer a promising solution with their affordability, ease of use, sensitivity, portability, and on-site monitoring capabilities, effectively addressing heavy metal ion pollution challenges. **Methods.** The enzyme urease is immobilized to the gold electrode surfaces using a glutaraldehyde crosslinking method. As electrochemical transducers were used two pairs of planar thin-film interdigitated gold electrodes, were placed on a silicon wafer. A new flow injection analysis system was used for the operation of the biosensor. The system consists of a peristaltic pump, active valves to regulate solution flow, a flow cell with a biosensor, a measuring device, and a PC. **Results.** During the research, optimal conditions for biosensor operation were found. It was shown that the optimal flow rate for efficient operation of the system is 100–200 μL/min, the biosensors demonstrating high sensitivity and signal reproducibility during the continuous flow analysis. The main analytical characteristics: sensitivity, signal reproducibility, and storage stability of biosensor were studied and were compared with the stationary measurement system. The biosensor exhibited high sensitivity, operational stability, and reproducibility; the relative standard deviation was less than 6% during the workday. The biosensor's sensitivity to various concentrations of heavy metal ions ranging from 0.01 to 100 μM, was investigated. For most of the analyzed heavy metals, the detection limits were below foundational limits, indicating that the developed biosensor can potentially be used for the analysis of these heavy metals. The bioselective element reactivation with EDTA after inhibition for repeated analyses was also studied. **Conclusions.** A new flow injection biosensor system for real time determination of heavy metal ions for water monitoring was developed. Optimal parameters for continuous flow analysis were determined and its main analytical characteristics were investigated, including sensitivity, detection limit, signal reproducibility, and reactivation after inhibition. The developed biosensor system can potentially be used for the analysis of heavy metals in water. **Grants/Fundings**. This work is supported by CARA (the Council for At-Risk Academics). Furthermore, this study is part of a project that has received funding from the European Union's Horizon 2020 research and innovation program under the grant agreement No 958491, Project Waste2Fresh.

Keywords: electrochemical biosensor, heavy metal ions, enzyme inhibition, water monitoring.