ELECTROCHEMICAL SENSOR BASED ON MOLECULARLY IMPRINTED POLYMERS FOR PROTEIN DETECTION

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Proteins perform many important functions in living organisms. The selective detection of proteins is essential in clinical diagnostics, biomedicine, proteomics, etc. Conventional analytical methods, including enzyme-linked immunosorbent assay (ELISA), high-performance liquid chromatography–mass spectrometry (HPLC–MS), and fluorescence-based assays, offer high sensitivity but rely on costly instrumentation and complex sample preparation. These limitations have led to the development of biosensors, particularly electrochemical sensors, which offer rapid response and low cost [1]. Electrochemical sensors incorporating molecularly imprinted polymers (MIPs) have demonstrated potential for detecting a wide variety of analytes [2]. MIPs function as artificial receptors that mimic the molecular recognition behaviour of natural antibodies [3]. In this work, we report the development of an electrochemical sensor based on MIPs for selective protein recognition.

Molecularly imprinted polymers were electrochemically synthesised directly on the surface of screen-printed carbon electrodes (SPCE). Polymerisation of pyrrole was performed in the presence of bovine serum albumin (BSA), which was used as a model protein for system optimisation. During polymer formation, a conducting polymer, polypyrrole, was formed, and protein molecules were incorporated into its matrix. Following the removal of the template, complementary binding cavities were created within the polymer matrix. A non-imprinted polymer (NIP) was used as a control layer. The selective rebinding of BSA was assessed by monitoring the response using electrochemical impedance spectroscopy (EIS).

The MIP-modified electrochemical sensor showed a more pronounced impedance response to BSA than the non-imprinted polymer. The obtained results show the potential of MIP-based electrochemical sensors for the selective detection of proteins.

Acknowledgements

This project has received funding from the Research Council of Lithuania (LMTLT), agreement No. S-MIP-24-11.

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