Development of a Molecularly Imprinted Polymer Immunosensor for the Serological Detection of SARS-CoV-2 Protein

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The current global health challenges, prompted by SARS-CoV-2, highlight the requirement for new diagnostic tools. The quick mutations of the virus underline the need for advanced analytical techniques to identify it precisely. Researchers have extensively explored the virus, including its protein structures, genome, and interactions with medications. However, traditional methods like reverse transcription polymerase chain reaction (RT-PCR) and enzyme-linked immunosorbent assay (ELISA) come with inherent limitations. Molecularly imprinted polymers (MIPs) are an attractive alternative to other detection techniques [1].

This study presents the development and characterisation of an immunosensor designed for the serological detection of the SARS-CoV-2 protein. The immunosensor employs a molecularly imprinted polymer (MIP) and integrates a self-assembled monolayer (SAM) on the gold interface. Electrochemical impedance spectroscopy (EIS) and square wave voltammetry (SWV) were utilised for the electrochemical characterisation of gold electrodes modified with MIP and non-imprinted polymer (NIP) layers. The use of screen-printed electrodes and electrochemical techniques ensures a cost-effective and reliable platform for developing of this biosensing technology [2].

The removal of the protein template from the MIP layer increase in the electron transfer rate and decreased the impedance. The MIP-based immunosensor exhibited higher sensitivity compared to the NIP counterpart, demonstrating its potential for selective protein detection. The limit of detection values obtained through SWV and EIS underscored the sensors capability to detect low concentrations of the target protein. Specificity tests confirmed minimal nonspecific binding, showing the reliability of the novel immunosensor. The findings highlight the potential of molecularly imprinted polymers for the creation of effective, sensitive, and selective biosensors, contributing to advances in the field of diagnostic technology for infectious diseases.

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[2] M. Drobysh, et al. "Determination of rSpike protein by specific antibodies with screen-printed carbon electrode modified by electrodeposited gold nanostructures." Biosensors 12.8 (2022): 593.