Metal nanoparticles-based electrochemical immunosensors for sensitive detection of protein biomarkers

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Currently, immunosensors have taken a lot of attention for their rapid responses, low-cost, simple, and most important integrable on point-of-care technology for detecting proteins [1-3]. Hence, an electrochemical immunosensor has been developed for simultaneous determination of selected protein biomarkers with clinical significance. For this immunoassay, the sandwich arrangement of immunocomplex formation has been preferred, which is composed of immunosorbent and bioconjugate. The immunosorbent consists of magnetic beads immobilized with primary antibodies, helped to concentrate protein, reduce purification steps, and nonspecific sorption. Whereas the bioconjugate include secondary antibodies, labelled with electroactive metal nanoparticles, and combined with mesoporous silica nanoparticles.

Nanoparticles are tiny materials classified depending on their properties. Owing to increased surface area enabling the conjugation with ligands, e.g., specific antibodies, together with metal nanomaterials, the nanoparticles are able to interact with corresponding proteins to be determined [4]. Selection of proper combination of several metal nanoparticles was the key step of developed immunosensor. These nanoparticles are electrochemically readable and were chosen with different oxidation in order to get simultaneous electrochemical detection, without overlapping, thus making this assay more practice and accurate. The outcome signals are measured electrochemically, using square wave voltammetry, which is known for trace analysis with low detection (10^{-12} M).

The selection of specific antibodies of high quality, ensuring the functionality of the system, has been another key step of developed immunosensor. Using the immunochemical dot-blot assay, suitable antibodies for each protein were found. SDS-PAGE was used for evaluation of the binding efficiency in immunosorbent and bioconjugate preparation.

References

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