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REGULATION OF NEAR-ELECTRODE PROCESSES BY INCLUSION POLYELECTROLYTE STRUCTURES INTO SENSOR SYSTEMS

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Electrochemical sensors are characterized by the simplicity of the device, low cost and high stability of a signal, and the possibility of their miniaturization. The high sensitivity is reached due to use as an electrode of the nanostructured surface, which will provide an increase in a surface area of an electrode. Another task is the selectivity of the electrochemical sensor in relation to a particular analyte in biological liquids of the complex structure. The selectivity of the sensing platform in relation to defined substances will be reached by the use of specific reagents (e.g. antibodies or aptamers) in the case of the definition of viruses and bacteria.

Recently, the need for the rapid fabrication of new systems for detecting viral and bacterial diseases has demonstrated the lack of a universal approach to their development. This is primarily concerned with the problem to remain the activity of immobilized antibodies or antigens on a substrate as part of test systems. There are fundamental scientific studies that propose to use sequentially adsorbed layers of polyelectrolytes as a method for immobilizing biological sensitive molecules on the substrate surface. The use of polyelectrolyte nanoarchitecture for the immobilization of antibodies, antigens, and enzymes demonstrates the possibility of increasing the number of immobilized sensitive molecules, which in turn leads to an increase in the sensitivity of test systems.

Hydrophilic properties suppress nonspecific adsorption and simplify the surface blocking process, thereby increasing the selectivity and specificity of the sensor.
Our work is demonstrated that polyelectrolytes increase the adsorption of primary antibodies on the substrate, thereby increasing the sensitivity of the assay. It was shown that polyelectrolytes are possible to simplify the process of creating electrodes in comparison with the covalent crosslinking antibodies in other techniques.

The developed tick-borne encephalitis virus sensors showed high sensitivity and specificity, a linear range of determining concentrations of 10^3–10^9 particles/ml, and a low detection limit of $1.6 * 10^1$ particles/ml. The technique of “sandwich" immunoassay is demonstrated.
The developed sensor for the analysis of St. Aureus showed high sensitivity and a clinically significant linear range of 10^3–10^8 CFU/ ml. The technique of direct analysis of antigens has been demonstrated.

An electrochemical immunosensor developed with a simple functionalization protocol can then be used to detect other clinically relevant biomarkers.

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