Optimization of SERS-substrates based on nonwoven material and the “silver mirror” reaction

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Currently, biosensors are a rapidly developing field, which is primarily driven by the needs of medicine. Biosensors can be used in both clinical and home settings. The latter is designed for individual analysis, which allows people with certain conditions to carry out express diagnostics outside of specialized laboratories. Therefore, the search for new methods and materials that can be applied in creating biosensors remains relevant.

One promising material that can be used to create biosensors is SERS substrates. Surface-enhanced Raman scattering (SERS) is an effective and fast method for detecting low-concentration analytes in samples.

In this work, a non-woven material made of polyacrylonitrile (PAN) obtained by electrospinning was used as a matrix for the developed sensor structures. The choice of nonwoven material as a substrate is due to its following advantages: flexibility, wettability, small weight and thickness, high porosity. Modification of the PAN surface with AgNP particles was carried out by chemical reduction of Ag^+ ions with L-ascorbic acid. This reaction is also known as the "silver mirror" reaction. It is a simple and inexpensive way to modify SERS substrates. In the course of the work, four different approaches to functionalization were studied in order to identify the most optimal conditions for enhancing the Raman signal. An ethanol solution of 4-mercaptobenzoic acid was chosen as the analyte at concentrations from 10^{-2} to 10^{-4} M. For comparison, the intensity of the bands of the lowest concentration of the analyte was used.

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