

Abstract

Submitted Ph.D. Thesis is focused on the electrochemical characterization and testing of recently developed working electrodes made from pure gold or graphitic carbon particles and electrochemical arrangements. These electrodes are suitable for large screening measurements of various organic compounds. The development of new sensitive voltammetric methods for determination of oxidisable biologically active organic compounds is another aim of this work.

To verify its applicability, the array of carbon composite film electrodes integrated in measuring cell system was selected for the development of voltammetric methods for determination of homovanillic acid, vanillylmandelic acid, and indoxyl sulphate. These analytes, which belong to the group of biomarkers of human diseases, were selected for increasing interest in their determination in medical laboratories. Moreover, determination of indoxyl sulphate was coupled to its solid phase extraction from human urine prior to voltammetric determination. Obtained results were compared with measurements of standards with well-established carbon paste electrode.

Sputtered (physical vapour deposition method) gold nanostructured film electrodes on treated PTFE substrates and gold nanostructured film electrodes modified with various functional groups on the surface were selected for testing and electrochemical characterization as an interesting analytical tool with promising use as disposable sensors for *in-situ* measurements with microvolumes of the sample. Electrochemical characterization was carried out by examination of the electrode reaction (reversibility, repeatability) of standard redox probes (ferrocyanide/ferricyanide, hydroquinone/benzoquinone) in different types of supporting electrolytes, by evaluation of the parameters of calibration curves of probes, by calculations of their real surface areas from Randles-Sevcik equation, and by observation of blocking of modified electrode surfaces by grafted functional groups. The whole study was complemented by critical evaluation and suggestion of possibilities for improvements of tested electrodes and arrangements. Obtained results were again compared to measurements with conventional bulk gold electrode or pristine gold nanostructured electrode sputtered on glass substrate.