Abstract

The main aim of this work was to use traditional mercury electrodes for the development of voltammetric methods of determination of organic xenobiotics and for the electrochemical study of the interaction between double-stranded deoxyribonucleic acid (DNA) and these compounds.

In relation to my previous research work (conducted in the framework of my diploma thesis), firstly, 4-nitrobiphenyl (4-NBP), the suspected carcinogen, was studied. Interaction of DNA with 4-NBP was studied using differential pulse voltammetry (DPV), cyclic voltammetry (CV), and chronocoulometry at a hanging mercury drop electrode (HMDE), and using CV and alternating current voltammetry at a DNA modified HMDE. Using CV, the reduction mechanism was investigated. The interaction of DNA with 4-aminobiphenyl (4-ABP), a metabolite of 4-NBP, and 4-NBP reduction intermediates was studied. It was found that the interaction of DNA with 4-NBP or 4-ABP results in a formation of a DNA aggregate with these analytes.

The second studied analyte was methyl violet 2B (MV). For determination of MV in a buffered solution were used: direct current tast polarography and differential pulse polarography at a dropping mercury electrode, and direct current voltammetry, DPV, and differential pulse adsorptive stripping voltammetry (DPAdSV) at HMDE. The lowest limit of quantification was reached using DPAdSV at HMDE, i.e., 13 nmol L^{-1}. The developed methods were used for determination of MV in model samples of drinking and river water.

Interaction of DNA with MV in buffered solution was studied using DPV, CV, chronocoulometry, and UV-Vis spectrophotometry. As same as for 4-NBP, the reduction mechanism of MV was studied using CV. It was found that the reduction of DNA with MV results in a formation of a DNA–MV complex. Moreover, based on the decrease of the MV peak current with an increasing concentration of DNA in the measured solution, the method of indirect determination of DNA was developed.