Abstract

The studies presented in this Ph.D. dissertation were focused on two distinct issues. The first goal of the discussed series of publications was to develop electroanalytical assays for determining chosen electroactive compounds. The second was to evaluate the possible mechanisms of interactions between selected bioactive substances and DNA, using voltammetric techniques. Four different compounds were analyzed, i.e., sesamol, lamotrigine, lactofen, and metoxyfenozide.

To develop analytical methods for determination of the above-mentioned compounds, square wave voltammetry was used. The analyses were carried out using different working electrodes. In the first step, the optimization of the experimental conditions and parameters were made, afterwards, the linear relationship between the peak currents and concentration of each compound were found, and finally, the validation of the methods was carried out. The correctness of the proposed procedures was verified by the determination of selected compounds in various spiked samples. Additionally, to explain the nature of the processes taking place at the working electrodes, detailed studies were performed using the cyclic voltammetry technique. The obtained results clearly demonstrate the potential utility of voltammetric techniques for sensitive determination of selected compounds. Furthermore, the proposed methodologies are fast, have high precision, and can be employed for quantification of chosen compounds in various natural samples.

In the second part of the thesis, the characterization of the interaction mechanisms between analytes and DNA was presented. These interactions were studied by cyclic and square wave voltammetry. The observed differences in the electrochemical behavior of the analyzed compounds after the addition of DNA enabled the evaluation of binding constants, and allowed for an examination of the nature of the formed complexes. The obtained results show the usefulness of the voltammetric techniques for simple investigation of analyte-DNA interactions.