

## Abstract

Presented dissertation thesis is focused on the development of electrochemical methods for the determination of three important tumour biomarkers, namely homovanillic acid (HVA), vanillylmandelic acid (VMA), and 5-hydroxyindole-3-acetic acid (5-HIAA).

First part of the study is focused on electrochemical behaviour of these analytes in batch arrangement using differential pulse voltammetry (DPV) at screen-printed carbon electrodes (SPCEs). It has been proved that presented method is sufficiently sensitive for monitoring above mentioned analytes. Moreover, it can be used for determination of HVA and VMA in mixture. Obtained limits of detection (*LODs*) were  $0.24 \mu\text{mol}\cdot\text{L}^{-1}$  for HVA,  $0.06 \mu\text{mol}\cdot\text{L}^{-1}$  for VMA, and  $0.12 \mu\text{mol}\cdot\text{L}^{-1}$  for 5-HIAA.

The requirements to speed up the analysis and at the same time to reduce its price initialized our study of the determination of tested biomarkers in flow systems. Firstly, flow injection analysis with amperometric detection was investigated for the determination of all three biomarkers at the same SPCE, and then an analogous determination of structural more similar pair, HVA and VMA, was performed at a boron doped diamond electrode (BDDE). Obtained *LODs* of optimized methods were as follows: at SPCE  $0.07 \mu\text{mol}\cdot\text{L}^{-1}$  for HVA,  $0.05 \mu\text{mol}\cdot\text{L}^{-1}$  for VMA, and  $0.03 \mu\text{mol}\cdot\text{L}^{-1}$  for 5-HIAA, respectively; at BDDE  $0.44 \mu\text{mol}\cdot\text{L}^{-1}$  for HVA and  $0.34 \mu\text{mol}\cdot\text{L}^{-1}$  for VMA, respectively.

Furthermore, the determination of monitored biomarkers in human urine by HPLC with amperometric detection at a glassy carbon electrode was studied. After its optimization and the development of a simple urine samples pre-treatment procedure, a rapid determination of all three analytes in one chromatographic run of the urine sample was successfully performed with *LODs*  $11.0 \mu\text{mol}\cdot\text{L}^{-1}$  for HVA,  $5.0 \mu\text{mol}\cdot\text{L}^{-1}$  for VMA, and  $8.3 \mu\text{mol}\cdot\text{L}^{-1}$  for 5-HIAA, respectively.