Abstract

Presented Diploma Thesis is focused on electroanalytical determination of genotoxic 4-nitroindane, one of the nitrated polycyclic aromatic hydrocarbons (NPAHs). A hydrocarbon indane (a component of petrol) is a precursor of 4-nitroindane. NPAHs are produced all above by combustion processes in gasoline and diesel engines. It has been shown that NPAHs can be many times more mutagenic or carcinogenic than their parent PAHs, so the analysis of these dangerous pollutants becomes important for modern environmental analytical chemistry.

Optimal conditions for determination of 4-nitroindane have been investigated in buffered water-methanolic solutions and electrochemical transformations of 4-nitroindane have been studied by DC voltammetry (DCV), differential pulse voltammetry (DPV) and cyclic voltammetry at a hanging mercury drop electrode (HMDE) and at a mercury meniscus modified silver solid amalgam electrode (m-AgSAE). For voltammetric determination of 4-nitroindane, the following techniques were used: DCV (limit of quantification (L_Q) ~ $7 \cdot 10^{-8}$ mol·l^{-1}), DPV (L_Q ~ $1 \cdot 10^{-7}$ mol·l^{-1}) and adsorptive stripping voltammetry (AdSV; L_Q ~ $7 \cdot 10^{-9}$ mol·l^{-1}) at HMDE, and DCV (L_Q ~ $1 \cdot 10^{-7}$ mol·l^{-1}) and DPV (L_Q ~ $1 \cdot 10^{-7}$ mol l^{-1}) at m-AgSAE.

The applicability of the newly developed polarographic/voltammetric methods of determination of 4-nitroindane has been verified on model samples of drinking and river water.

As an optimization pre-step for future development of the method for determination of 4-nitroindane in a mixture with environmental NPAH markers (2-nitrofluorene, 3-nitrofluoranthene, 1-nitropyrene) using high performance liquid chromatography (HPLC) with electrochemical detection, a non-time consuming method was developed for the determination of model mixture of these selected NPAHs using HPLC with UV-VIS detection. For 4-nitroindane, the attained L_Q was $5 \cdot 10^{-7}$ mol·l^{-1} (evaluated from peak height) and $4 \cdot 10^{-7}$ mol·l^{-1} (evaluated from peak area).