ABSTRACT

This Diploma Thesis is focused on investigation of the voltammetric behavior of the explosive penthrite (pentaerythritol tetranitrate) (PETN) and on searching for optimum conditions for its determination using differential pulse voltammetry (DPV) at a hanging mercury drop electrode (HMDE) (this part of the Diploma Thesis follows the topic investigated in the author's Bachelor Thesis; in this Diploma Thesis, the results of the Bachelor thesis are applied to the determination of PETN in environmental matrices) and at a mercury meniscus modified silver solid amalgam electrode (m-AgSAE) and on investigation of voltammetric behavior in real samples (deionized, drinking, and river water).

For investigating the behavior of PETN in aqueous-methanolic media on the m-AgSAE, mixtures of Britton-Robinson buffers (BR-buffers) and methanol in various volume ratios were used. In non-aqueous media, methanolic solutions of tetramethylammonium bromide (TMAB), tetrabutylammonium iodide (TBAI), and tetrabutylammonium chloride (TBAC) were used as supporting electrolytes.

Firstly, the influence of pH (in the range of 2 - 13) and methanol content (10 – 90 vol. %) on voltammetric responses of PETN was studied. The best response was obtained at each of those pH values at the volume ratio of BR-buffer – methanol of 1:9 or at 100% content of methanol. At the measurements in a 100% methanolic medium, TMAB, TBAI, and TBAC were used as supporting electrolyte salts, and TMAB (c = 0,01 mol·dm^{-3}) was chosen as the optimum one.

For investigating the behavior of PETN in real environments (deionized, drinking, and river water) at the HMDE, mixtures of phosphate buffer (or borate buffer, respectively, at pH 9) and deionized, drinking, or river water, respectively, were employed. The optimum media found in the Bachelor Thesis (pH = 2, 6, and 9) were used for this purpose.

Concentration dependences were measured in nine different media on the HMDE (in the concentration range of 0,1-10 μmol·dm^{-3} of PETN), and the reached limits of quantification (L_Qs) were in all cases in submicromolar concentrations. On the m-AgSAE, concentration dependences were measured in two different media (in the concentration range of 1-100 μmol·dm^{-3} of PETN), with the L_Qs attained in micromolar concentrations.