

Abstract

This Diploma Thesis is focused on study of electrochemical behavior of 2,4,6-trinitrotoluene (TNT) and 2,4,6-trinitrophenol (picric acid) on finding the optimum conditions for their determination using direct current voltammetry (DCV) and differential pulse voltammetry (DPV) at a mercury meniscus modified silver solid amalgam electrode (m-AgSAE) in the solution of Britton-Robinson (BR) and on finding of the limit of quantification (L_Q) for these substances. Practical applicability of the newly developed methods was verified on direct determination of TNT and picric acid in model samples of drinking and river water. Moreover, the electrochemical behaviors of TNT and picric acid was studied using cyclic voltammetry (CV).

Optimum medium for the determination of TNT at m-AgSAE was: methanol-BR buffer pH 4.0 (1:9). Upon the DCV it is proper to apply regeneration potentials $E_{reg,1}= 0$ mV and $E_{reg,2}= -1100$ mV and upon the DPV was apply regeneration potentials $E_{reg,1}= 0$ mV and $E_{reg,2}= -600$ mV were applied. The concentration dependence of the peak current was found to be linear for both techniques over the concentration range of $1 \cdot 10^{-6}$ - $1 \cdot 10^{-4}$ mol/l with L_Q of $0.54 \mu\text{mol/l}$ (for DCV) and $0.46 \mu\text{mol/l}$ (for DPV). The method developed for the determination of TNT were verified on the model samples of drinking water with L_Q of $0.93 \mu\text{mol/l}$ (for DCV) and $1.0 \mu\text{mol/l}$ (for DPV) and on the model samples of river water with L_Q of $2.5 \mu\text{mol/l}$ (for DCV) and $0.92 \mu\text{mol/l}$ (for DPV)

For picric acid, the optimum conditions were found for both DCV and DPV at m-AgSAE in the medium of BR buffer pH 2.0. Upon the DCV and DPV it is proper to apply regeneration potentials $E_{reg,1}= 200$ mV a $E_{reg,2}= -950$ mV. The concentration dependences were measured in the range of $1 \cdot 10^{-7}$ - $1 \cdot 10^{-4}$ mol/l with L_Q of $0.11 \mu\text{mol/l}$ (for DCV) and $0.12 \mu\text{mol/l}$ (for DPV). The method developed for the determination of picric acid were verified on the model samples of drinking water with L_Q of $0.13 \mu\text{mol/l}$ (for DCV) and $0.10 \mu\text{mol/l}$ (for DPV) and on the model samples of river water with L_Q of $0.19 \mu\text{mol/l}$ (for DCV) and $0.14 \mu\text{mol/l}$ (for DPV).

Finally, a UV-VIS spectrophotometric determination of TNT in methanol was performed in the concentration range of $1 \cdot 10^{-6}$ - $1 \cdot 10^{-4}$ mol/l with L_Q of $0.56 \mu\text{mol/l}$. Picric acid was determinated in deionized water in the concentration range of $4 \cdot 10^{-7}$ - $1 \cdot 10^{-4}$ mol/l with L_Q of $0.073 \mu\text{mol/l}$.