

First study of electrochemical behavior of herbicide pethoxamid and its voltammetric determination in river water

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Pethoxamid (POA) is relatively new herbicide and it belongs to group of chloroacetamides. It inhibits the germination of target weeds in corn, soybeans, peas and beans, tobacco and other crops and it can affect on herbicide-resistant weeds. There are no many research records about this, in the future quite applicable, herbicide. Bearing in mind that pethoxamid is high soluble in water, with almost no sorption in soils [1], the leaching and runoff of this compound in ground and surface water is a real threat. Pethoxamid residues in soil, water food and feed of plant origin usually were determined by using liquid chromatography with tandem mass spectrometry (LC-MS/MS) [2] while some other analytical methods were used for determination of pesticides [3].

The electroanalytical methods are noted as fast and cost-effective analytical methods for determination of many analytes of environmental interest. As far as we know, this is a first report about electrochemical behavior of herbicide pethoxamid and its electroanalytical determination. This method is based on the electrochemical oxidation of pethoxamid in Britton-Robinson buffer solution at pH 4 at a boron-doped diamond electrode. This type of carbon electrode is almost resistant to contamination of surface with various chemical species, easy to maintain and has a very wide working potential window which could provide insight into the electrochemical oxidation of pethoxamid at high anodic potentials.

All electrochemical measurements (cyclic and square-wave voltammetry) were performed on PalmSens 3 potentiostat/galvanostat/impedance analyzer with PSTrace software (PalmSens BV, Netherlands). Three-electrode system in the electrochemical cell was consisted from Ag/AgCl (1M KCl) reference electrode and platinum wire counter electrode, while working electrode was boron-doped diamond electrode. BDD electrode was electrochemically prepared as it was written before [4]. Cyclic voltammetry provided a well defined oxidation peak at +1.35 V, and this peak was used as a peak of quantification at a optimal pH value 4 (Figure 1 a). The square-wave voltammetry was chosen as suitable technique for analytical determination of pethoxamid with an established optimal working conditions (pulse amplitude of 60 mV and frequency of 10 Hz).

The voltammograms obtained for standard solutions from 1 to 100 μM and corresponding calibration curve were shown on Figure 1 b.

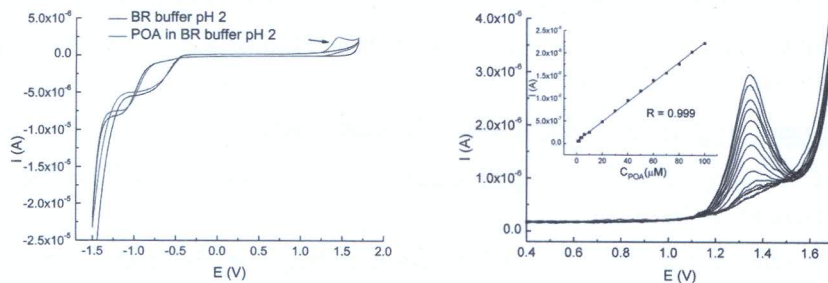


Figure 1. a) Cyclic voltammograms of BR buffer pH 2 with and without 100 μM of pethoxamid; b) SW voltammograms of different concentrations of pethoxamid at optimized working conditions in BR buffer, pH 4, at BDDE. Inserted figure: corresponding calibration curve

The method was applied for selective quantification of pethoxamid from spiked river water samples with good recovery of 92.0 to 104.6% for standard solutions of POA and good agreement with comparative HPLC method (97.6-98.1%). The results of this research indicate successful, fast, simple, reliable and cheap estimation of pethoxamid content in the surface water samples with no electrode surface modification and time-consuming sample preparation.

References

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