

## Abstract

In this work, the application of boron-doped diamond electrodes with various surface pre-treatment were tested on selected oxidizable and reducible model compounds, specifically *para* and *ortho* cresols and 2'-deoxycytidine and 7-deazaadenosine labeled by 4-nitrophenyl triazole. The aim of the study was the investigation of electrochemical and adsorptive processes with respect to the development of electroanalytical methods of detection of the selected compounds, or utilization of boron-doped diamond electrodes as detectors in liquid-flow systems.

Cresols were used as the model oxidizable compound. On O-terminated and polished boron-doped diamond electrodes, cresols provide oxidation signal owing to their oxidation to methylphenoxy radical at comparable potentials as on other carbon-based electrodes used as a reference in this work, *i.e.*, glassy carbon electrode, pyrolytic graphite electrode, and carbon paste electrode. These carbon electrode materials show relatively high propensity to adsorption of reaction products, while such adsorption is minimal on boron-doped diamond. *In situ* anodic activation allows for a rapid regeneration of boron-doped diamond surface prior to each scan. A differential pulse voltammetric method that was developed with a detection limit of  $0.61 \mu\text{mol}\cdot\text{l}^{-1}$  to  $2.97 \mu\text{mol}\cdot\text{l}^{-1}$  and was also tested on model samples of river water, thus presents a fast and cheap alternative for the detection of cresols, as long as they are not present in a mixture. For an analysis of a mixture of cresols and other phenolic pollutants, the need for a separation step arises. In a proposed HPLC with electrochemical detection method it was confirmed that boron-doped diamond is a suitable material for liquid-flow analyses, even for analytes known to severely passivate electrodes during batch voltammetric measurements (such as phenolic compound).

An ever-increasing interest is apparent in utilization of boron-doped diamond electrodes for reduction processes, as presented in this work with 2'-deoxycytidine and 7-deazaadenosine labeled by 4-nitrophenyl triazole. These complex molecules and products of their voltammetric reactions (*i.e.*, corresponding nitroso and hydroxylamino derivatives) strongly adsorb on polished boron-doped diamond electrode surface. Therefore, these electrodes can be used for transfer techniques as shown in this work on an example of squarewave voltammetric detection of  $\text{dA}^{\text{TRNO}2}$ . The adsorbed product of the reduction, an hydroxylamine, is subsequently oxidized giving rise to a nitroso group, and the signal of a quasi-reversible pair  $\text{NO}/\text{NHOH}$  can be used for its quantification. Moreover,  $\text{dA}^{\text{TR}}$ , *i.e.*, a derivative of 2'-deoxycytosine, is also strongly adsorbed on boron-doped diamond surface. A decline in the intensity of the voltammetric signal of simple nitro group-containing organic

molecules (2-nitronaphtalene a 4-nitrophenyl acetylene), that is diffusion controlled, was observed in the presence of  $\text{dA}^{\text{TR}}$ .