Abstract

The concentration of bile acids is an important parameter in hepatobiliary tract diseases. This work deals with the electrochemical oxidation of the chenodeoxycholic (CDCA) and cholic acid (CA) at boron dopped diamond (BDD) electrode in comparison with the oxidation at glassy carbon (GCE) and platinum electrode (PtE), in a mixed environment of acetonitrile and water (0.26 % from 0.1 $mol \cdot l^{-1}$ $HClO_4$, supporting electrolyte). The measurement was carried out in an electrochemical cell with salt bridge containing 0.5 $mol \cdot l^{-1}$ $NaClO_4$ separating the working and the Pleskov´s reference electrode (0.01 $mol \cdot l^{-1}$ $AgNO_3$ and 1 $mol \cdot l^{-1}$ $NaClO_4$ in acetonitrile). Cyclic voltammetry (CV) characterization of BDD electrode by a redox pair $[Fe(CN)_6]^{4-/3-}$ (c = 0.1 $mmol \cdot l^{-1}$) in 1 $mol \cdot l^{-1}$ KCl was performed. Quasi-reversible behaviour was observed and the difference of the anodic and the cathodic peak potential ranged from 80 to 200 mV, depending on the scan rate. Alumina polishing (4 min) of the BDD electrode was identified as the most appropriate method of activating the surface and it was applied between consecutive voltammetric scans in the presence of CA and CDCA. Irreversible anodic peaks of CDCA and CA in acetonitrile-water (0.26 %) were observed at the relatively high potentials of about +1100 ± 100 mV, depending on the scan rate and used voltammetric technique. This observation was noted only in CA and CDCA, both of which contain 7-α-hydroxy group, not for the other teste bile acids (deoxycholic, lithocholic acid). According to the linear dependency of peak current to square root of the scan rate, it can be seen that the oxidation process is controlled by diffusion. The calibration dependences were measured at a concentrations range of 1 - 900 $\mu mol \cdot l^{-1}$ CDCA and CA 1 - 90 $\mu mol \cdot l^{-1}$, they are linear and reach higher sensitivity at BDD in comparison to GC and Pt electrodes. Further studies will be devoted to the oxidation mechanism and the possibility of its use for selective detection of these bile acids.

Key words

cyclic voltammetry, differential pulse voltammetry, electrochemical oxidation, boron doped diamond electrode, glassy carbon electrode, platinum electrode, chenodeoxycholic acid, cholic acid