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Abstract

Antimony Tin Oxide—Prussian Blue Screen-Printed Electrodes for Electrochemical Sensing of Potassium Ions †

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Abstract: In this work, the characterization and the electro-analytical applications of antimony tin oxide (ATO)–Prussian blue (PB) screen printed electrodes (SPE) are presented. The ATO conducting particles have been used recently in the development of screen-printed electrodes due to their excellent spectroelectrochemical properties. PB is a transition metal hexacyanoferrate with high electrocatalytic properties towards various biologically active compounds like hydrogen peroxide, besides its outstanding electrochromic properties. A combination of ATO and PB ingredients into a screen-printing paste provided a versatile and cost-effective way in the development of novel electrode materials for electrochemical sensing. The ATO-PB electrode material displayed good electrochemical properties demonstrated by means of cyclic voltammetry and electrochemical impedance measurements. In addition, the PB provided a high selectivity towards potassium ions in solution due to its zeolitic structures and excellent redox behavior. The cyclic voltammetric responses recorded at the ATO-PB-SPE device in the presence of potassium ions revealed a linear dependence of the cathodic peak current and cathodic peak potential of the Prussian blue/Everitt's salt redox system on the potassium concentrations ranging from 0.1 to 10 mM. This finding could be exploited in the development of an electrochemical sensor for electro-inactive chemical species. The potential application of the ATO-PB electrode in the electrochemical sensing of electro-active species like caffeic acid was also studied. An increase of the anodic peak current of the PB/ES redox wave in the presence of caffeic acid was observed. These results point out to the potential analytical applications of the ATO-PB electrode in the sensing of both electro-active and electro-inactive species.

Keywords: antimony tin oxide; Prussian blue; screen-printed electrodes; cyclic voltammetry; electrochemical impedance spectroscopy; electrochromic material; electrochemical sensing

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