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Abstract

Development of a Novel Voltamperometric Sensor Based on Carbon Nanofibers and Cobalt Phthalocyanine for the Detection of P-Coumaric Acid †

Alexandra Virginia Bounegru * and Constantin Apetrei *

University of Galati, Faculty of Sciences and Environment, 111 Domneasca Street, 800201, Galați, Romania

* Correspondence: alexandra.meresescu@yahoo.com (A.V.B.); apetreic@ugal.ro (C.A.)

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Abstract: p-Coumaric acid is a hydroxy derivative of cinnamic acid, the hydroxyl group being in para position in the phenyl group. PCA has antioxidant [1], antibacterial [2], [3], and anti-inflammatory [4], [5] properties and it could be a precursor for the production of flavors and fragrances used in foods or chemicals. This compound has a large number of important applications in the nutraceutical, pharmaceutical, materials and chemical industry. The present study aims to develop a novel electrochemical sensor based on carbon nanofibers and cobalt phthalocyanine deposited onto screen-printed electrode (CNF-CoPc/SPE) useful for the detection of p-coumaric acid in various fitoproducts. The deposition of CNF and CoPc was carried out by casting technique in two stages. The sensor surface was initially analyzed by FTIR technique being observed the change of the functional group present on the surface after successive modification. The electrochemical behavior of CNF-CoPc/SPE was studied in aqueous solutions of p-coumaric acid using as electrolyte a phosphate buffer solution of pH 5.0. Cyclic voltammetry and square wave voltammetry were used as detection techniques. In the voltammograms are observed two peaks pairs related to the redox processes of p-coumaric acid from the solution and to CoPc immobilized into the carbonaceous matrix. In order to study the influence of the scan rate on the voltammetric response, the cyclic voltammograms of CNF-CoPc/SPE were recorded at different scan rates between 0.1 and 1.0 V·s-1. It was obtained a linear dependence between Ia and v½, which demonstrates that the redox process of p-coumaric acid is controlled by the diffusion process. The CNF-CoPc/SPE was further used to perform a calibration curve using p-coumaric acid solutions in the concentration range 0.1-202.5 mM. Low value of LOD equal of 9.29´10-7M was obtained. Furthermore, the sensor has been shown to have good sensitivity, selectivity and reproducibility for the detection of p-coumaric acid. The p-coumaric acid from three fitoproducts was qualitatively and quantitatively determined using CNF-CoPc/SPE sensor with good sensitivity. The results were validated by FTIR method and compared with the values provided by the producers obtaining good correlations. The sensor developed in this study could be used in the fitoproduct quality control.

Keywords: sensors; p-coumaric acid; cyclic voltammetry; square wave voltammetry

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