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Extended Abstract

Electrochemical Study of Ferulic Acid at a Pencil Graphite Electrode †

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Ferulic acid (FA), a hydroxycinnamic acid naturally found in fruits, vegetables and alcoholic beverages, has antioxidant, antiaging, antiviral and antibacterial activity being used in the medicine, food and pharmaceutical industries [1]. Therefore, there is a huge need for the rapid sensitive and selective determination of FA in various complex matrices. FA electroactivity is due to the phenolic group contained in its molecule. Thus, electroanalytical methods using proper electrodes [2] are often the best choice for FA investigation and quantification. A sensitive, cheap, eco- and user-friendly electrode is the pencil graphite electrode (PGE), which is commercially available and has also good electrochemical characteristics [3]. The present work describes the electrochemical behavior of FA at PGE and based on this, a method for its voltammetric quantification.

Working solutions were obtained from the daily prepared 10-2 M FA ethanolic stock solution by successive dilutions with the supporting electrolyte. A three-electrode cell (working electrode: PGE [4]) and a Autolab PGSTAT 12 system connected to a PC running GPES 4.9 software were used for cyclic (CV) and differential pulse voltammetric (DPV) measurements.

DPV recorded for FA in acetate buffer pH 4.00 at different working electrodes (Pt, glassy carbon and PGE with graphite leads of different hardness) showed an oxidation signal at ~ 0.50 V, the highest sensitivity (0.386 A×L/mol×cm^2) being obtained at the non-electro activated H type PGE. FA CVs recorded at different pH values presented in the first scan a well-defined oxidation peak and a reduction signal. In the second and third scans the reduction peak remained almost unchanged but in the anodic scan a supplementary oxidation signal appeared at less positive potentials in comparison to the main one. All signals were pH dependent and their Ep=f(pH) equations emphasized that the processes involved an equal number of electrons and protons. The highest CV and DPV oxidation signals were recorded in Britton Robinson Buffer at pH 3.00, this electrolyte being used for further investigations. The different relations between the peak currents obtained by CV at various scan rates indicated that the FA main oxidation signal is governed by a controlled diffusion process, whereas the reduction signal is generated by an adsorption controlled one. Instrumental parameters (modulation amplitude and time, step potential, interval time) were optimized for FA DPV quantification.

CVs studies emphasized that FA presents a complex voltammetric behavior at PGE. The main oxidation signal can be exploited for its quantitative determination by DPV.

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