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Research Article

New Electrodes Based on Garlic for the Inhibition of the Free Radicals Effects

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Abstract

A new electrode based on garlic is prepared to inhibit the effect of oxidative stress, often linked to the presence of an excess of free radicals. The electrode paste was prepared as a mixture of finely powdered of garlic together with graphite powder. The influence of variables such as the garlic loading and free radicals concentration was tested by Square Wave Voltammetry (SWV), Cyclic Voltammetry (CV) and Electrochemical Impedance Spectroscopy (EIS). The obtained results were found in good correlation with garlic reputation.

Keywords: CV; EIS; Garlic; Modified electrodes; Oxidative stress; SWV

Introduction

Oxidative stress is defined as an imbalance between the production of free radicals and the ability of the body to counteract or detoxify their harmful effects through neutralization by antioxidants. Free radicals play an essential role in the biochemical processes of living beings. They are continuously produced by the body's normal use of oxygen such as respiration and some cell mediated immune function. At high concentrations, free radicals generate oxidative stress, a deleterious process that can damage all cell structures [1-8].

Oxidative stress can develop of chronic and degenerative diseases such as cancer, arthritis, aging, autoimmune disorders, cardiovascular and neurodegenerative diseases. Antioxidant compounds in food are found to have a health protecting factor. Primary sources of naturally occurring antioxidants are whole grains, fruits and vegetables. Garlic (*Allium Sativum*) is an herb. It is best known as a flavoring for food [9]. But over the years, garlic has been used as a medicine to prevent or treat a wide range of diseases and conditions. Garlic consists of more than 250 genera and 3700 species. The potential antioxidant properties of garlic are related to its phenolic and flavonoid fractions [10].

Several amperometric biosensors have already been proposed for antioxidant capacity determination [11-14]. Most of them are based on the amperometric detection of H2O2, resulting from the catalyzed Dismutation of superoxide radicals (O2-.) in presence of superoxide dismutase. In this work, we prepared and characterized the garlic modified carbon-paste electrode, which successfully exploits the favorable mechanical and electrochemical properties of carbon-paste electrodes. Our work develops the electrochemical technology of the inhibition of effects of free radicals.

Experimental

Instrumentation and Software

Square-wave voltammetry was performed with a voltalab potentiostat (model PGSTAT 100, Eco Chemie B.V., Utrecht, The Netherlands) driven by the general purpose electrochemical systems data processing software (voltalab master 4 software) connected to Pentium III computer run under Windows 98. The electrochemical cell contains.

A HAp-modified carbon paste working electrode, a platinum counter electrode and a Saturated Calomel Reference Electrode (SCE). The pH-meter (Radiometer Copenhagen, PHM210, Tacus-

sel, and French) was used for adjusting pH values.

Preparation of The Modified Electrode Garlic-CPE

Garlic-modified carbon-paste electrode was prepared according the following procedure [15]. The modified carbon-paste electrode was prepared by mixing the graphite powder with the garlic to give an appropriate ratio Garlic/CP. The mixture was grinding in amortar agate and then a portion of the resulting composite material was housed in PTFE cylinder. The geometric surface area of the working electrode was 0.1256 cm2. A bare of carbon vitreous inserted into carbon paste provided the electrical contact.

Results and Discussion

The effect of the carbon paste composition in the voltammetric response of the electrode modified with Garlic was evaluated by cyclic voltammetry in 0.10 mol L^{-1} NaCl media (Figure 1). The anodic peak current increased with the amount of garlic in the paste up to 30% (w/w). Beyond the anodic peak current decreased significantly, this probably occurs due to a decrease in the conductive area at the electrode surface (Figure 2). According by these results a carbon-paste composition of 30% (w/w) by weights was used in further experiments.