

Review Article

Hydroxycinnamic Acid Antioxidants: An Electrochemical Overview

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Received 30 April 2013; Accepted 18 June 2013

Academic Editor: Kent M. Reed

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Hydroxycinnamic acids (such as ferulic, caffeic, sinapic, and *p*-coumaric acids) are a group of compounds highly abundant in food that may account for about one-third of the phenolic compounds in our diet. Hydroxycinnamic acids have gained an increasing interest in health because they are known to be potent antioxidants. These compounds have been described as chain-breaking antioxidants acting through radical scavenging activity; that is related to their hydrogen or electron donating capacity and to the ability to delocalize/stabilize the resulting phenoxyl radical within their structure. The free radical scavenger ability of antioxidants can be predicted from standard one-electron potentials. Thus, voltammetric methods have often been applied to characterize a diversity of natural and synthetic antioxidants essentially to get an insight into their mechanism and also as an important tool for the rational design of new and potent antioxidants. The structure-property-activity relationships (SPARs) correlations already established for this type of compounds suggest that redox potentials could be considered a good measure of antioxidant activity and an accurate guideline on the drug discovery and development process. Due to its magnitude in the antioxidant field, the electrochemistry of hydroxycinnamic acid-based antioxidants is reviewed highlighting the structure-property-activity relationships (SPARs) obtained so far.

1. Introduction

In the last decade, dietary polyphenols, which are the most abundant antioxidants present in a human diet, have received increasing interest from researchers, food manufacturers, and also consumers as one of the most promising groups of dietary preventive agents. They constitute a heterogeneous family of chemical compounds comprising phenolic acids, flavonoids, tannins, stilbenes, coumarins and lignans, among others.

Phenolic acids are usually divided into two main groups: benzoic acids, containing seven carbon atoms (C6-C1), and cinnamic acids, comprising nine carbon atoms (C6-C3). These compounds exist predominantly as hydroxybenzoic and hydroxycinnamic acids and may occur either in their free or conjugated forms.

Cinnamic acids have been categorized as structural and functional constituents of plant cell walls and also as bioactive

ingredients of the diet [1, 2]. Recent data support their beneficial application as preventive and/or therapeutic agents in several oxidative stress related diseases, such as atherosclerosis, inflammatory injury, and cancer [3, 4]. Data found in the literature shows that hydroxycinnamic acids antioxidant efficacy is strongly dependent on their structural features and intrinsically related to the presence of hydroxyl function(s) in the aromatic structure [4, 5].

2. Hydroxycinnamic Acids: Classification and Occurrence

Hydroxycinnamic acids (HCAs) possess a simple chemical backbone consisting of a phenylpropanoid C6-C3 structure and are the major subgroup of phenolic acids with ubiquitous distribution in the plant kingdoms. They are abundantly found

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