CYCLIC VOLTAMMETRIC ANALYSIS OF 2-STYRYLCHROMONES

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2-Styrylchromones (2-SC) are a chemical family of heterocyclic compounds, vinylogues of flavones (2-phenylchromones), whose occurrence in nature has been reported. Recently, several 2-SC derivatives were demonstrated to entail antioxidant properties, namely, xanthine oxidase inhibition, hepatoprotection against pro-oxidant agents in cellular and non cellular systems, and scavenging activity against reactive oxygen and reactive nitrogen species (ROS and RNS).

Cyclic voltammetry is a widely used electroanalytic technique that allows determining the redox properties of molecules in a solution. This technique has previously been used to study the electrochemical oxidation mechanisms of flavonoid compounds. In the present work, the electrochemical behaviour of several 2-SC was studied by cyclic voltammetry, together with a number of flavonoids with well known antioxidant activities, and the results correlated to their ability to scavenge ROS and RNS.

The results obtained showed that 2-SC with a catecholic B-ring have a low oxidation peak corresponding to the oxidation of the 3',4'-OH (catechol) moiety. A detailed analysis of this peak indicated a reversible redox process with a coupled chemical reaction. The compounds with a phenolic B-ring have a common peak, with oxidation potential values of about +0.4/+0.5 V vs. Ag/AgCl, corresponding to the oxidation of the 4'-OH. The oxidation of the hydroxyl substituents in the A-ring generated peaks of higher potentials (+0.7/+0.8 V vs. Ag/AgCl).

The results from the cyclic voltammetry assays were in agreement with those from scavenging activity assays, i.e., lower values of oxidation potentials corresponded to higher scavenging effects. The oxidation potentials obtained by cyclic voltammetry seem to be applicable as a general indicator of radical scavenging activity.
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RESULTS AND DISCUSSION

Cyclic voltammograms of 2-SC from group 1 (1A-1D) showed the permanent presence of a low potential oxidation peak, with a correspondent reduction peak being detected in the reverse scan, and a second oxidation peak at higher potentials.

An oxidation peak with oxidation potential (E\text{pa}) values between +0.4 and +0.5 V vs. Ag/AgCl was visible in the cyclic voltammograms of the compounds from group 2 (2A-2D). It was observed a second oxidation peak at higher potentials for the compound 2A. The compounds 3A-3C originated an oxidation peak with E\text{pa} values comparable to those of the second peak of compounds 1A-1C and 2A. These oxidation peaks appear to correspond to irreversible processes, since no current was observed in the reverse scan. For compound 3D there were no detectable peaks.

The cyclic voltammogram of luteolin presented one oxidation peak and a correspondent reduction peak. The flavones chrysins, 5-OH flavone, and 7-OH flavones revealed a common oxidation peak which appeared at potentials around +0.8 V vs. Ag/AgCl. Apigenin showed two possible oxidation peaks, although barely defined, not allowing the determination of the E\text{pa} values.

Correlations between the E\text{pa} of the first peak and the scavenging activity against ROS and RNS were analyzed by using the Pearson correlation test. Significant correlations were found for H\textsubscript{2}O\textsubscript{2}, hypochlorous acid (HOCI), singlet oxygen (\textsuperscript{1}\text{O}\textsubscript{2}), and peroxynitrite, indicating that the scavenging mechanism against these reactive species is based on redox reactions. No significant correlation was found for supersoxide radical (\textsuperscript{2}\text{O}\textsubscript{2}•).