Electrochemical oxidation of quercetin, an antioxidant agent, in mixed media using a glassy carbon electrode

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The oxidation mechanism of the quercetin (QCT) was studied using a glassy carbon electrode (GCE), a commercial saturated Ag/AgCl reference electrode, and a platinum counter electrode. Cyclic voltammograms (CVs) were recorded in a 1:1 (v/v) mixture of phosphate buffer (pH 7.4) and ethanol, which served as the supporting electrolyte [1]. All measurements were performed in the presence of 100 µM quercetin. The potential window ranged from –0.2 V to +0.5 V, with scan rates varying from 10 to 100 mV·s^{-1}. A single, well-defined anodic peak ($E_{\mathrm{ap},1}$) appeared in the range of 0.047–0.073 V across all scan rates. The slope of the $\log(I_{\mathrm{ap},1})\ vs\ \log(\nu)$ plot was greater than 0.5, indicating that the oxidation process is controlled by both diffusion and adsorption. A small cathodic peak ($E_{\mathrm{cp},1}$) was detected during the reverse scan. Furthermore, a broad anodic shoulder ($E_{\mathrm{ap},2}'$) was observed between 0.2 and 0.4 V. As the QCT concentration increased to the 300–700 µM range, the broad shoulder observed between 0.2 and 0.4 V evolved into a defined anodic peak at approximately 0.2 V($E_{\mathrm{ap},2}$), while a residual shoulder remained between 0.3 and 0.4 V($E_{\mathrm{ap},3}$). $E_{\mathrm{ap},1}$ remained at 0.056 V, and its peak current remained relatively constant in a 400 µM QCT solution as the temperature increased up to 50 °C and subsequently cooled to 25°C. A significant decrease in $I_{\mathrm{ap},1}$ and $I_{\mathrm{ap},2}$ was seen at higher temperatures (75–85 °C) [2] while $I_{\mathrm{ap},3}$ remained constant over this range. The similar decreasing patterns observed for $I_{\mathrm{ap},1}$ and $I_{\mathrm{ap},2}$ suggest that the process at $E_{\mathrm{ap},2}$ may depend on $E_{\mathrm{ap},1}$, since reductions in $I_{\mathrm{ap},1}$ consistently accompanied declines in $I_{\mathrm{ap},2}$.

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