Determination of quercetin by carbon nanotube-modified electrodes and metal complexation

Guang-Ri Xu, Sunghyun Kim*
Department of Chemistry and Bio/Molecular Informatics Center
Konku University, Seoul, 143-701, Korea
TEL: +82-2-450-3764, FAX: +82-2-3437-6106

Abstract

Quercetin oxidation was favorable in acidic conditions and current gradually decreased as the solution pH increased. No oxidation was observed when two -OH groups in a catechol moiety were fully deprotonated. These electrodes enabled selective determination of quercetin in the presence of interfering species such as ascorbic acid in a large excess. A linear response was obtained over a concentration range of $5.0 \times 10^{-8} \sim 3.0 \times 10^{-6}$ M. The complexation effect with zinc ion has also been studied by UV/visible and X-ray absorption spectroscopy. In acidic conditions, quercetin does not form a Cu-complex because all the -OH groups are protonated. As pH increases, Cu^{2+}ion begins to bind to quercetin. Upon Cu-binding, absorption maximum position shifts to lower wavelength. From XAS and Job's plot one quercetin molecule can bind two copper ions. In strongly alkaline solutions, most quercetin molecules exist as a dimer. The rate constant was calculated to be ca. 3 min-1. A gold electrode modified with quercetin were evaluated as a highly sensitive voltammetric sensor for Cu^{2+}. The quercetin-based electrode showed an attractive ability to efficiently preconcentrate trace of Cu^{2+} from solution, allowing a very simple and reproduciblemethod for copper determination. The quercetin modified electrode presented a linear response range between 1.010^{-9} and 1.010^{-5} M for Copper(II) with a detection limit of 1.010^{-9} M by cyclic voltammetric method.

References

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