Embelin - a Natural Powerful Antioxidant and Calcium Transporter

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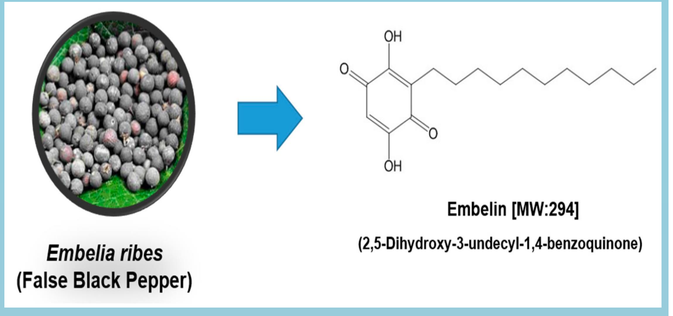
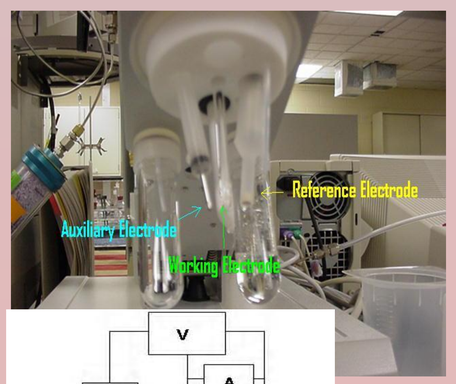


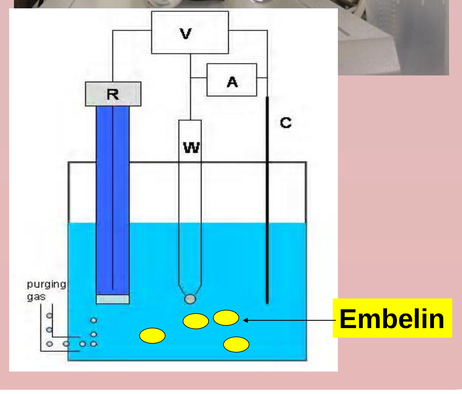
Introduction

In the recent years, there have been high demands about finding natural hydroxyl derivatives of coenzyme Q that are potential antioxidants and metal-ion transporters. The unique properties of such systems towards the cell physiological activity are described in the recent works of Gulaboski et al [1-4]. Embelin (from Embelia ribes) is a natural 2,5-dihydroxy benzoquinone that contains also a long-chained alkyl substituent in its structure. It is hardly soluble in water, but dissolves nicely in water-alcohol mixture. It nicely dissolves in lipophilic organic solvents. It is a natural herbal product that possesses unique properties to scavenging free radicals ranging from superoxide to hydroxyl radicals. We show in this work its antioxidative abilities with the help of electrochemical technique. Alongside, in the experiments with the so-called "three-phase electrode", we show that Embelin can bind and transfer Ca^{2+} ions across biomimetic membranes. These features make Embelin a potential antioxidant and ion-transporter important for many cells physiological functioning.

Methods & Materials

We used Cyclic voltammetry as a working technique.





Results

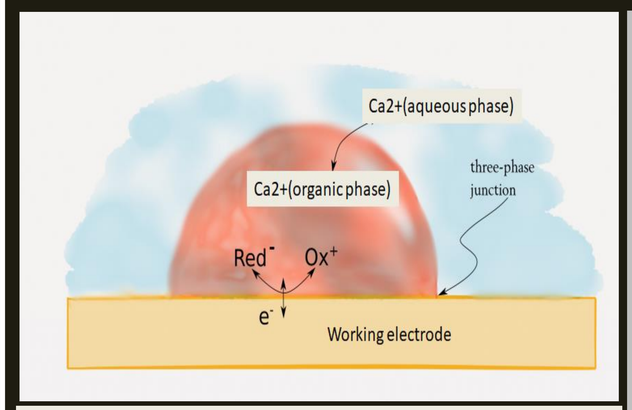


Figure 1.
Embelin dissolved in 1,2-dichlor ethane (DCE) was
studied in the Three-phase electrode scenario.
A droplet (1μL) of Embelin was attached to the surface of the working electrode.
Such modified, the working electrode was thereafter
sumberged in water solution in presence and absence of Ca^{2+} ions and cylcic voltammogramms
were recorded.
(OX-RED are Oxidized and Reduced forms of Embelin)

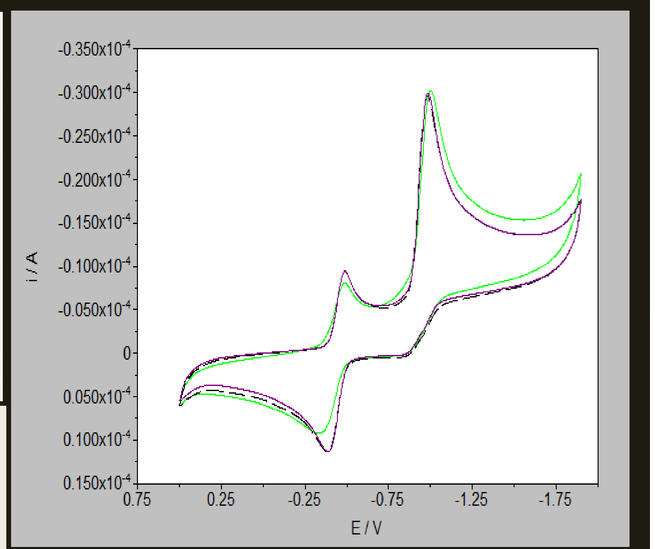


Figure 2.
In absence of Ca2+ ions in aqueous phase,
0.5 mM Embelin dissolved in 1,2-dichlor ethane (DCE)
showed two pairs of quasireversible signals

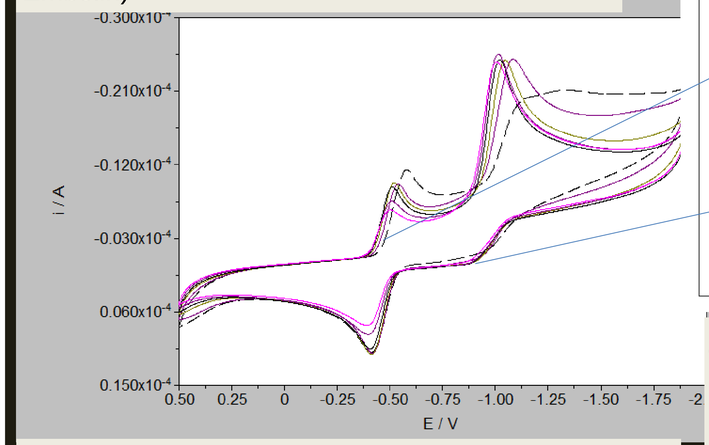


Figure 3.
In presence of Ca2+ ions in aqueous phase,
0.5 mM Embelin dissolved in 1,2-dichlor ethane (DCE) showed two pairs of quasireversible signals, whose position was sensitive to Ca2+ ions concentration present in aqueous phase

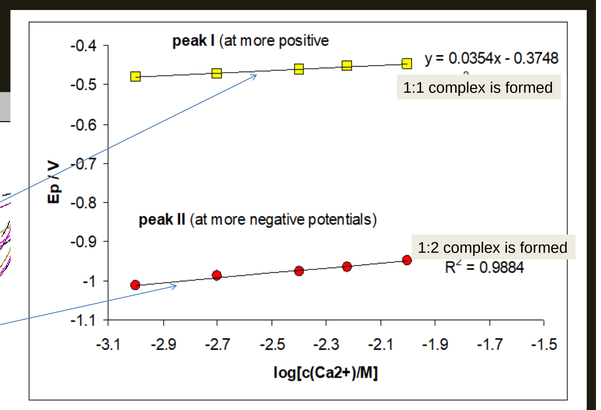


Figure 4.
In presence of Ca2+ ions in aqueous phase, the „mid-peak potentials" of the two signals of 0.5 mM Embelin dissolved in 1,2-dichlor ethane (DCE) recorded in cyclic voltammetry shifted to more positive values with different slopes, indicating 1:1 and 1:2 complexes of Embelin with Ca2+ ions

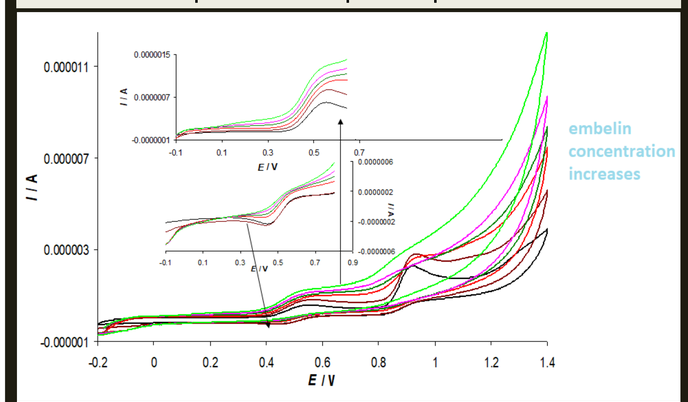


Figure 5.
Antioxidative abilities of Embelin was tested in Experiments with ABTS (redox standard).
In presence of Embelin, an increase of the limiting currents of ABTS voltammograms was
Observed by increasing Embelin concentration
From 0 to 10 mM.

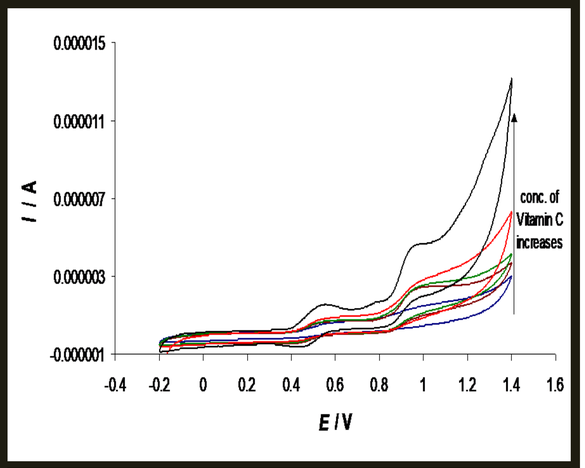


Figure 6.
Antioxidative potential of Embelin is comparable to that of Vitamin C (these experiments are for
comparison)

Conclusions

In a set of voltammetric experiments, we showed for the first time that the natural product Embelin, has abilities to bind Ca2+ ions, while forming two different complexes with 1:1 and 1:2 stochiometry.

Besides, we showed that this natural remedy shows strong antioxidative abilities comparable to those of Vitamin C.

References

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Acknowledgements

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