

CHARACTERIZATION OF ANTIOXIDANTS ACTIVITY IN A MICROFLUIDIC CHANNEL

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Antioxidant is the common designation for substances that have a potential action in the prevention of oxidative stress. The characterization of the reactivity of these substances has attracted the attention of many researchers, with the aim to establish correlations between the intake of antioxidants and health maintenance or to detect early stages of diseases associated with oxidative stress. The measurement of antioxidant capacity of physiological fluids (blood serum, saliva or urine) or foodstuff is currently performed by means of different methods, mostly based on spectrophotometric detection.

Voltammetry has gained popularity in this context.^[1] Whereas peak potentials are used to characterize the reactivity of the antioxidant, the peak currents (or the area under voltammograms) are used for the antioxidant capacity evaluation. Although voltammetric methods constitute one of the most effective means to monitor the antioxidant electron-transfer reactions, quantitative information is not directly obtained from voltammograms of antioxidants mixtures. The antioxidant capacity is usually evaluated by relative parameters defined towards a reference substance. The significance of this result is limited and cannot be translated in the effective protection degree provided by the antioxidant.

In a recent work, we have proposed an analytical method for the evaluation of the reducing antioxidant capacity of antioxidants evaluated by electrolysis (RACE).^[2] The oxidation of antioxidants is analyzed in large scale controlled potential electrolysis and its consumption is monitored at the anode by the current decrease. The monitored charge for the complete oxidation of active antioxidants provides a quantitative measure of their ability to eliminate a given reactive oxygen species, according to the selected potential used in the electrolysis. In order to transfer the RACE methodology to a sensor design, electrochemical microfluidic devices were built and tested. Experimental variables such as device geometry and flow rate were optimised in order to achieve a thin-layer regime in mass transport^[3]. The chronoamperometric response of antioxidants was analyzed to evaluate its reducing power at selected potentials, according to the nature of the reactive oxygen species whose action is simulated. These results demonstrated the validity of the concept.

References

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