PEDOT-modified electrochemical microsensors: a versatile probe for the detection of antioxidant biomarkers
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PEDOT-modified electrochemical microsensors: a versatile probe for the detection of antioxidant biomarkers

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Introduction

During the last two decades, the area of electrochemical sensors has greatly benefited from the development on nanotechnology in term of sensors design, fabrication and performances. This is particularly true in electrochemical analysis and biosensing thanks to the advantages of microelectrodes such as high sensitivity, fast response, easy integration, mass fabrication and low production cost. In this context, electrochemical sensors present an interesting alternative for the detection of ascorbic acid, dopamine and uric acid which are considered as important biochemical markers in different pathologies. This explains the numerous methods developed for their detection. Thus, our attention has been focused on the electrosynthesis of poly(3,4-ethyleneoxythiophene) PEDOT on (Au-Pt-Ag/AuCl) microdevices for the simultaneous assay of ascorbic acid, dopamine and uric acid in biological samples.

Fabrication of integrated electrochemical microcells (ElecCell)

Thermal oxidation of the silicon substrate

Differential pulse voltammograms (DPV) of (Au/PEDOT – Pt - Ag/AuCl) (black line) and (Pt/PEDOT – Pt - Ag/AuCl) (blue line) ElecCell in 0.1 M PBS pH 7.0 solution containing an equimolar AA/Dop/UA (1 mmol.L−1) PEDOT electrodeposited in acetonitrile solution (black line) or in aqueous solution (blue line)

IV. Analytical performances

Differential pulse voltammograms (DPV) of (Au/PEDOT – Pt - Ag/AuCl) ElecCell in 0.1 M PBS pH = 7.0 containing different concentrations of AA,Dop,UA and corresponding calibration curves

Conclusion

Electrosynthesis conditions determine the structure and catalytic properties of the resulting PEDOT polymer(5):

- The morphology of PEDOT depends on the electrode materials and the solvent of the electrolytic medium
- PEDOT upon gold electrode is more homogeneous than over platinum electrode(2)
- Regular polymer network improve both the cohesion and the conductivity of the polymer (6)
- Electropolymerization of PEDOT in aqueous solution has deleterious consequences on the polymerization reactions(6)
- and the conjugation length and the conductivity of the polymer (6)

Peaks potential (mV/SCE) Sensitivity (µA.µM−1. cm2) Limit of detection (µM) Linear range (µM)

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References