

## Important notes:

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### Title:

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

### Authors & affiliations:

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### Abstract:

The development of low-cost biosensors that enable a sensitive, selective and reliable determination of analytes has received considerable attention. In this context, electrochemistry represents a powerful tool for dealing with the detection of chemical species. Indeed, microelectrodes can be integrated using silicon-based technologies, and are compatible with the use of electrocatalytic conductive polymers. One of them, the poly(3,4-ethylenedioxythiophene) (PEDOT), was shown to exhibit optimized properties for bioanalysis: low oxidation potential, good stability, high electrical conductivity, good detection selectivity and biocompatibility. As a result, PEDOT was used for the determination of different molecules of biological interest such as antioxidant biomarkers. Among them, ascorbic (AA) and uric (UA) acids were widely studied since they are associated with oxidative stress and related pathologies.

In previous works, we demonstrated the integration of (Au – Pt – Ag/AgCl) electrochemical microcells (ElecCell) for the bioelectrochemical detection, as well as the catalytic behaviour of PEDOT towards the simultaneous determination of AA and UA acid in aqueous solutions and blood serum. This paper presents the integration of (Au/PEDOT – Pt – Ag/AgCl) ElecCell microdevices for the detection of antioxidant markers (fig. 1). First, it deals with the optimization of the PEDOT electrodeposition process on integrated gold microelectrodes. Then, more attention is brought to the dopamine (Dop) analysis, a well-known neurotransmitter coexisting usually with AA and UA in biological samples. Thus, using PEDOT-modified ElecCell microdevices, the selective determination of dopamine was achieved in presence of both ascorbic and uric acids (fig. 2). Excellent catalytic properties were thus evidenced for their simultaneous detection with high sensibilities (around 0.85, 3.0 and 1.65  $\text{pA}\cdot\text{cm}^{-2}\cdot\mu\text{M}^{-1}$  for AA, UA and Dop respectively) and low detection limits ( $< 500$  nM) (fig. 3 and 4). Such results intend to demonstrate that silicon-based, PEDOT-modified electrochemical microsensors are convenient probes for the practical determination of antioxidant biochemical markers in biological samples.

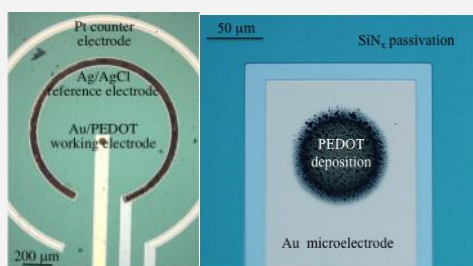


Fig. 1: Details of the (Au/PEDOT – Pt – Ag/AgCl) ElecCell microdevice

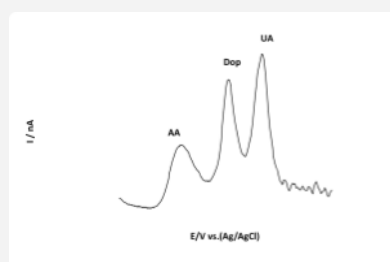


Fig. 2: Differential pulse voltammogram of an equimolar solution (1 mM) of AA, UA and Dop

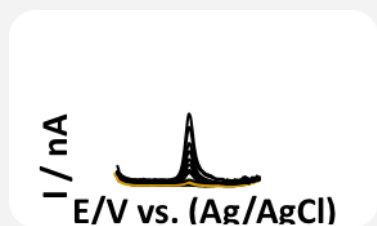


Fig. 3: Differential pulse voltammograms for different concentrations of dopamine (0.1 - 300  $\mu\text{M}$ )

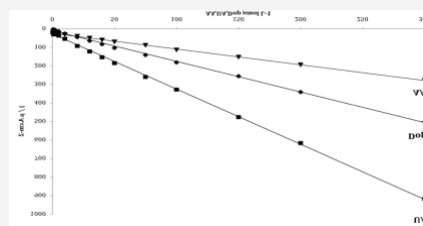


Fig. 4: Calibration curves of AA, UA and Dop

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