Development of a novel voltamperometric sensor based on carbon nanofibers and cobalt phthalocyanine for the detection of p-coumaric acid

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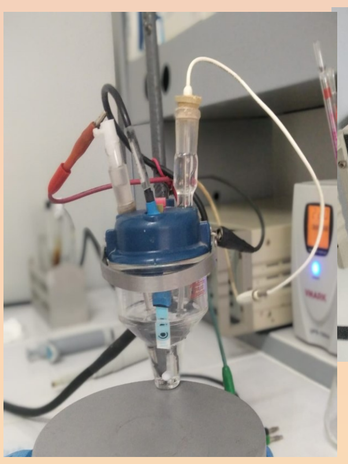
Introduction

p-Cumaric acid (PCA) has a large number of important applications in the nutraceutical, pharmaceutical, materials and chemical industry, due to its antioxidant, antibacterial and anti-inflammatory properties.

Objectives

- **Development of new sensor based on screen-printed electrodes from carbon nanofibers modified with cobalt phthalocyanine (CNF-CoPc/SPE)**
- **Study of the electrochemical properties of the sensor towards PBS 0.1 M and PCA 10^{-3}M solution.**
- **Study of the influence of the scanning rate on the electrochemical behavior of the biosensors in the solution of PCA 10^{-3}M.**
- **Performing a calibration curve using solutions with different PCA concentrations.**
- **Cuantification of PCA from fitoproducts using CNF-CoPc/SPE.**

Experimental setup, materials and methods



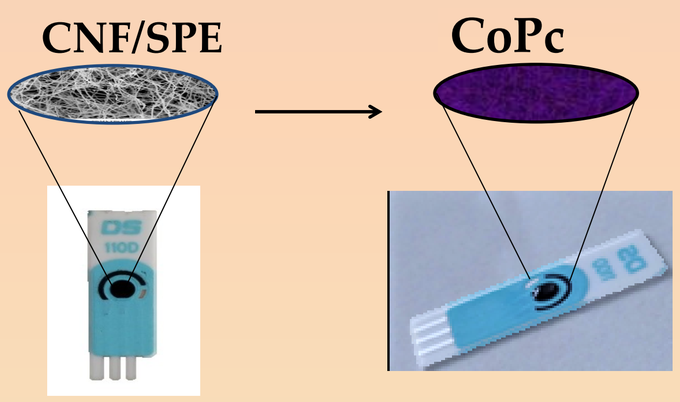
Cyclic voltammetry

Square wave voltammetry

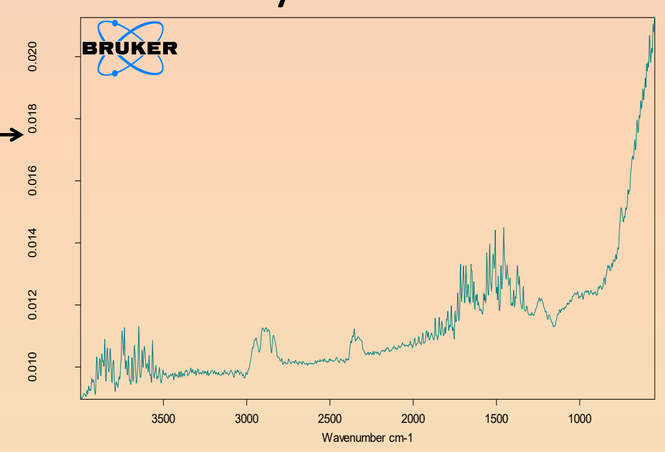
FTIR

Results

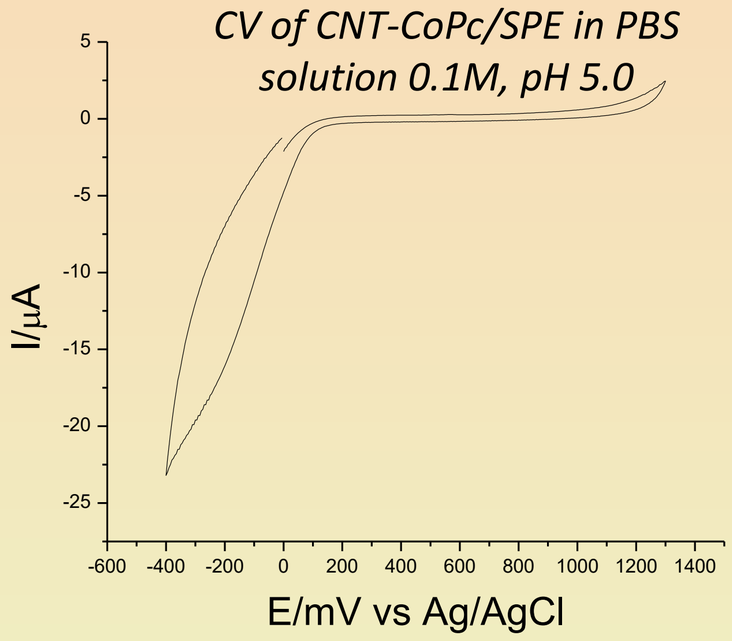
Sensor preparation



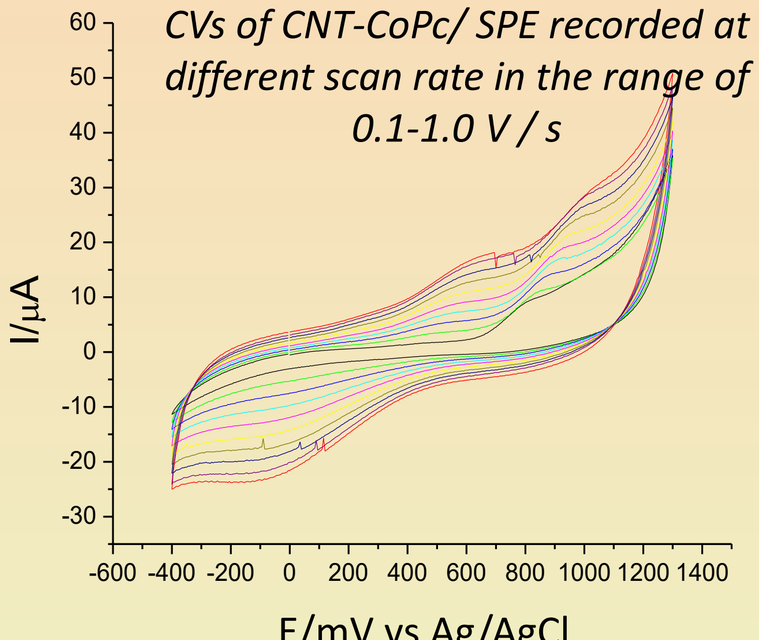
FTIR analysis of the sensor



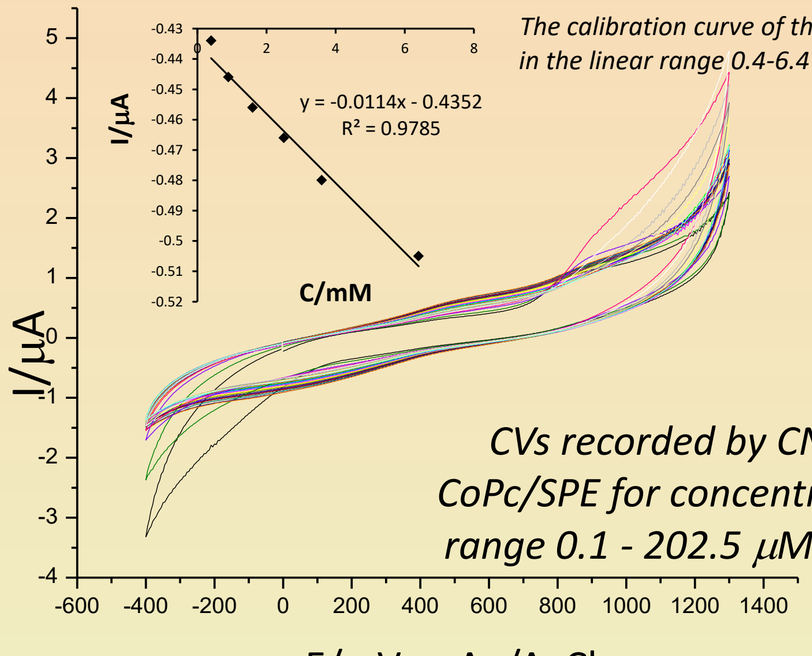
CV of CNT-CoPc/SPE in PBS solution 0.1M, pH 5.0



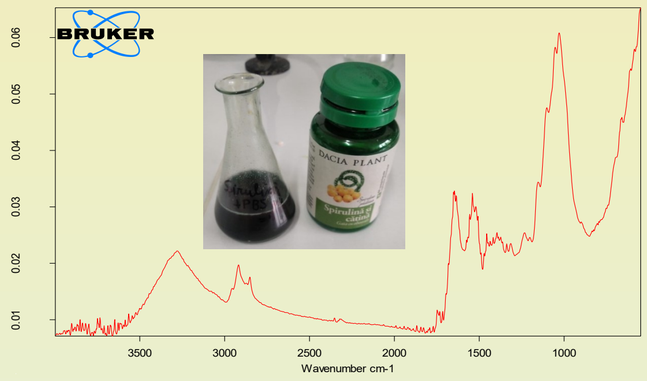
CVs of CNT-CoPc/ SPE recorded at different scan rate in the range of 0.1-1.0 V / s

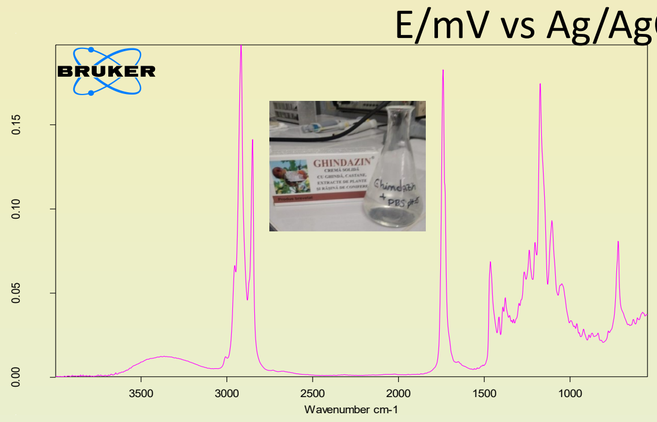


The calibration curve of the sensor in the linear range 0.4-6.4 μM PCA



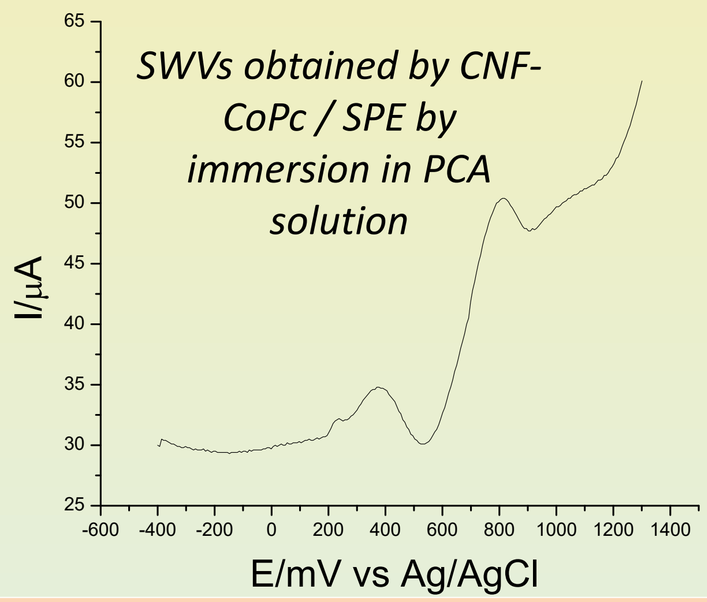
CVs recorded by CNF-CoPc/SPE for concentration range 0.1 - 202.5 μM PCA.





LOQ (M)	LOD (M)
3.1×10^{-6}	9.29×10^{-7}

SWVs obtained by CNF-CoPc / SPE by immersion in PCA solution



Conclusion

- **The sensor has been shown to have good sensitivity, selectivity and reproducibility for the detection of PCA.**
- **The sensor developed in this study could be used in the fitoproduct quality control.**

Results and Discussions

In the CVs are observed two peaks pairs related to the redox processes of PCA from the solution and to CoPc immobilized into the carbonaceous matrix.

It was obtained a linear dependence between I_a and v½, which demonstrates that the redox process of PCA is controlled by the diffusion process.

The PCA from three fitoproducts was qualitatively and quantitatively determined using CNF-CoPc/SPE sensor with good sensitivity.

The results were validated by FTIR method and compared with the values provided by the producers obtaining good correlations.