

An electrochemical sensor based on molecularly imprinted Polymers for the detection of acetaminophen

UAB

Universitat Autònoma de Barcelona

Mingyue Wang, Xavier Cetó Alsedà, Manel del Valle†

Sensors and Biosensors Group, Department of Chemistry,

Universitat Autònoma de Barcelona, 08193, Bellaterra, Barcelona, Spain

E-mail: mingyue.wang@e-compus.uab.cat

GSB GRUP DE SENSORS I BIOSENSORS

Introduction

As an analgesic and antipyretic drug, acetaminophen (AP) is widely employed in the treatment of cold, fever and relief of pain. However, AP could lead to the accumulation of its toxic metabolites in the cases of overdose that has fatal hepato- and nephro-toxic effects on health. Although there are some protocols for the detection of AP, such as, high performance liquid chromatography, spectrophotometry and titrimetry, the processes are time-consuming, laborious. Herein, we synthesized an electropolymerized molecularly imprinted polymer film on the surface of graphite epoxy composite electrode to determine AP by electrochemical methods. The electrochemical sensor exhibited superb sensitivity, selectivity, and a wide detection range in the detection of acetaminophen.

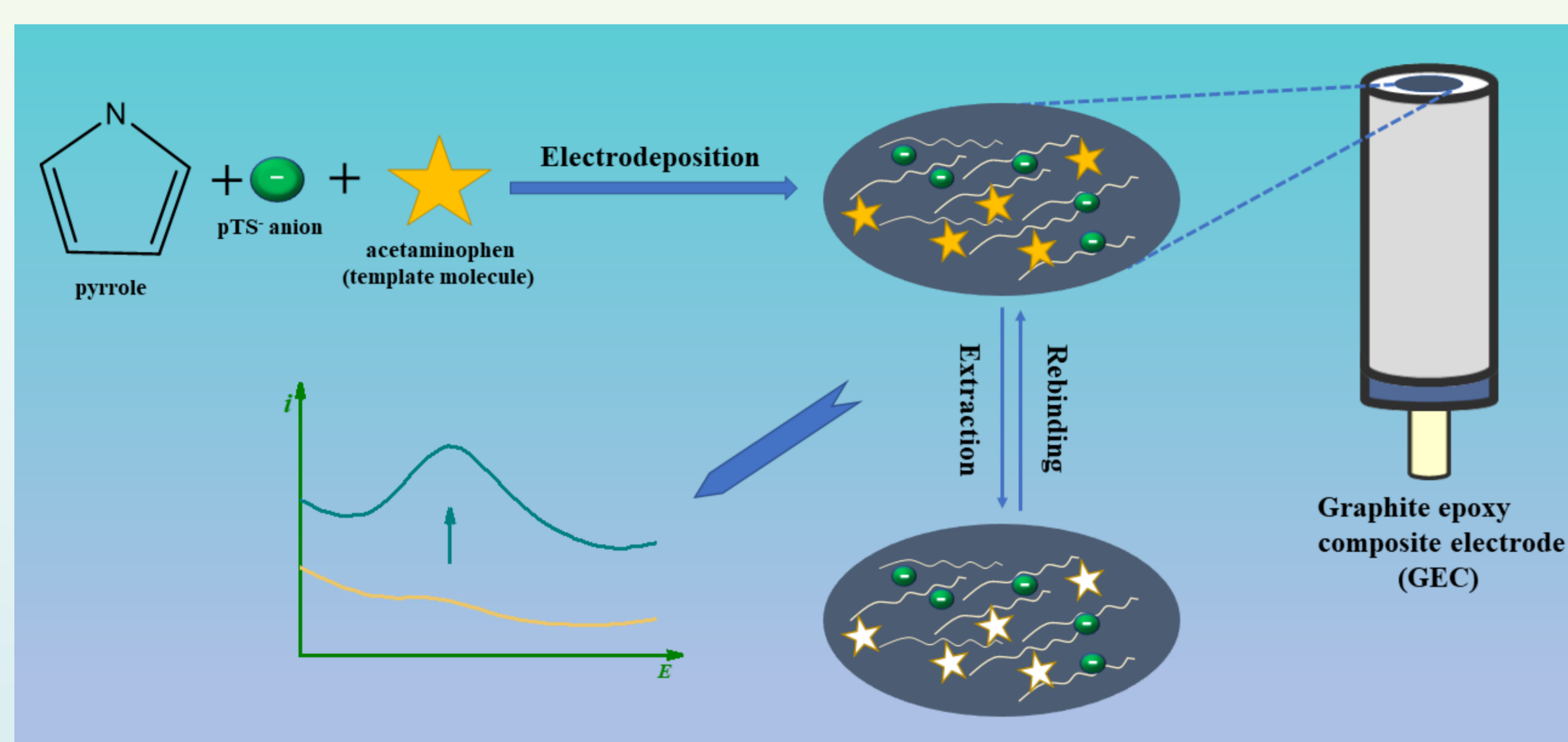


Fig.1 Scheme of the fabrication process and working principle of pTS-/PPy MIPs sensor.

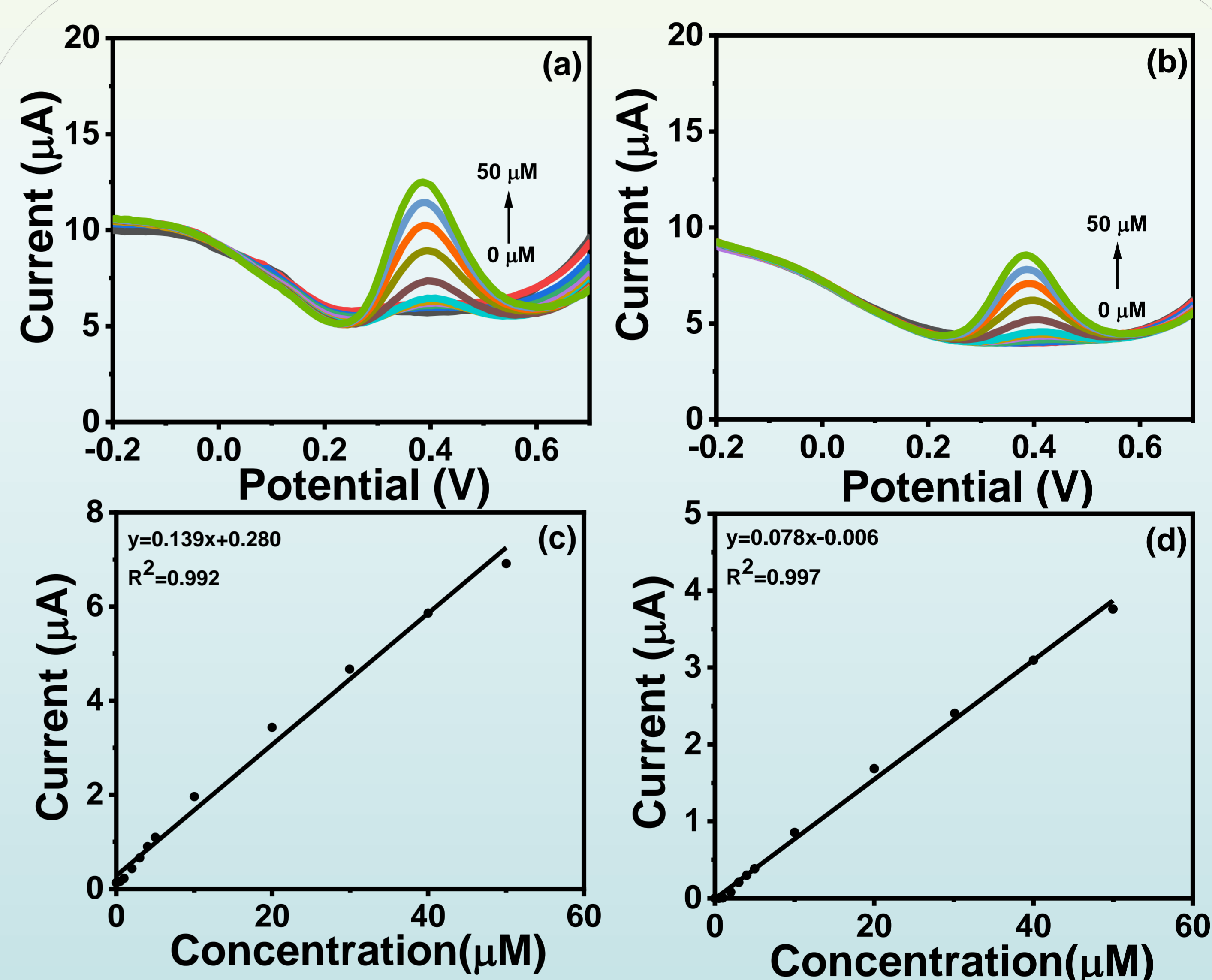


Fig.4 DPV curves of the pTS-/PPy MIP(AP) (a) and NIP (b) responding towards acetaminophen in PBS. Calibration plotting of the PPy/pTS- MIPs (c) and NIPs (d) responding towards acetaminophen

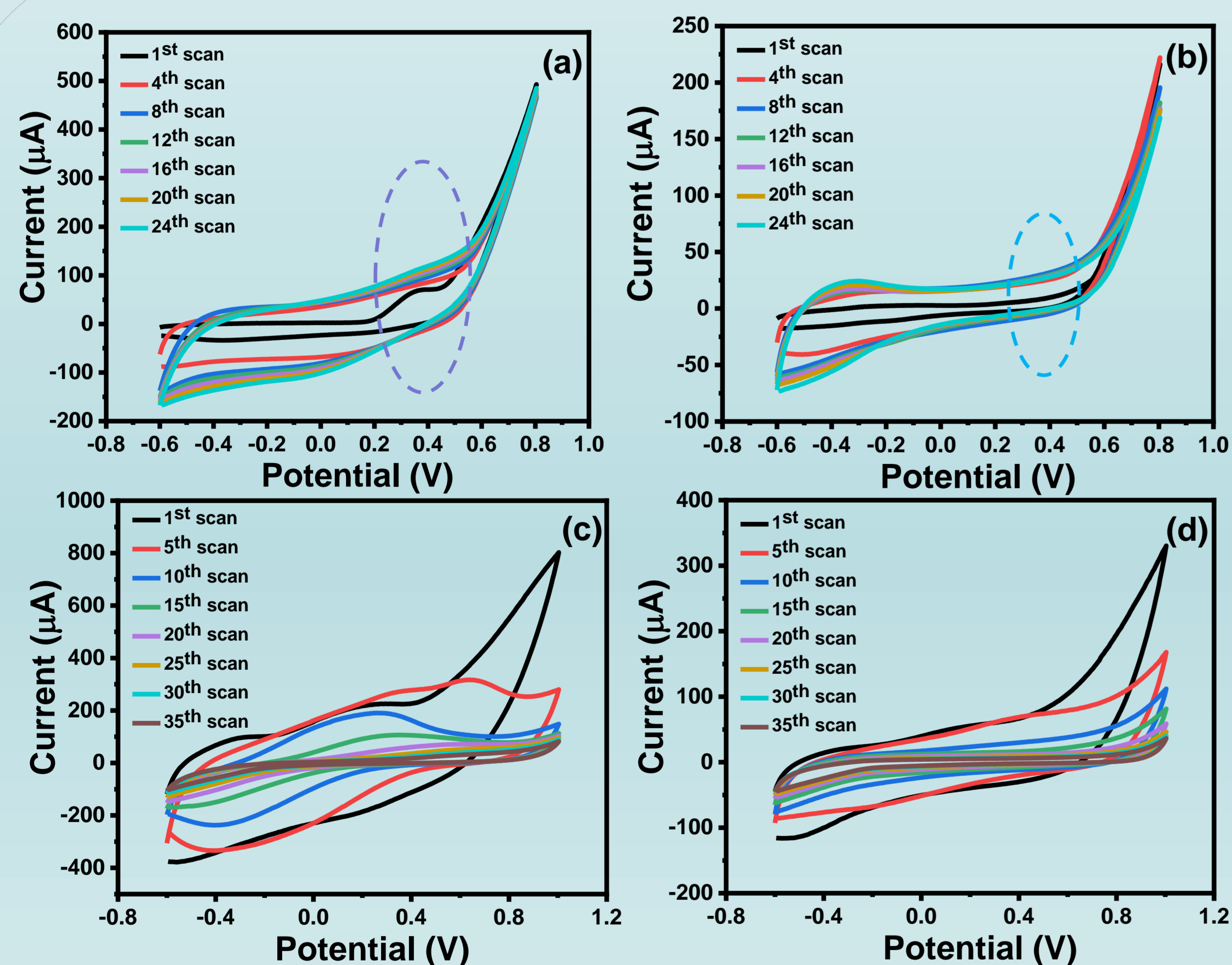


Fig.2 Cyclic voltammograms taken place during the electropolymerization (a) with and (b) without acetaminophen on GEC, Cyclic voltammograms taken place during the extraction of (c) pTS-/PPy MIP(AP) and (d) pTS-/PPy NIP.

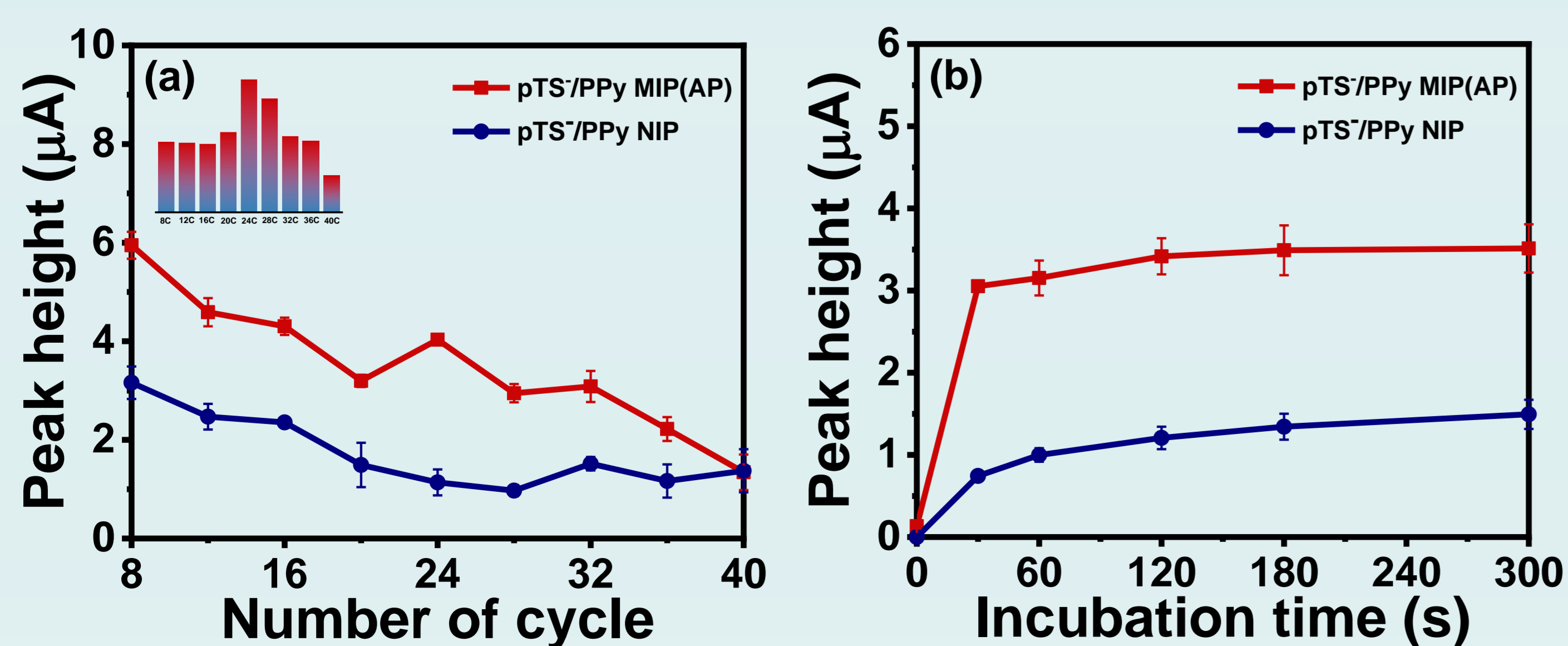


Fig.3 Effects of (a) the number of cycles and (b) the incubation time on pTS-/PPy MIP and NIP modified GEC electrodes responding towards a 30µM AP solution in PBS.

Conclusions

In summary, a facile method for the in-situ electropolymerization of pTS-/PPy MIP(AP) and NIP films onto the surface of GEC electrodes was proposed. Moreover, in the response to acetaminophen, pTS-/PPy MIP(AP) was proven to be more effective than pTS-/PPy NIP. The proposal paves the way for the further applications in the real pharmaceutical sample analysis.

References

- [1] Rijun Gui, Hui Jin, Huijun Guo and Zonghua Wang, Recent advances and future prospects in molecularly imprinted polymers-based electrochemical biosensors, *Biosensors and Bioelectronics* 100 (2018) 56-70.
- [2] Xavier Cetó, Christopher P. Saint, Christopher W.K. Chow, Nicolas H. Voelcker, Beatriz Prieto-Simón, Electrochemical detection of N-nitrosodimethylamine using a molecularly imprinted polymer, *Sensors and Actuators B* 237 (2016) 613-620.
- [3] L. Ozcan, Y. Sahin, Determination of paracetamol based on electropolymerized-molecularly imprinted polypyrrole modified pencil graphite electrode, *Sensors and Actuators B* 127 (2007) 362-369.

Acknowledgements

Financial support for this work was provided by the Spanish Ministry of Science and Innovation (MCINN) through the project PID2019-107102RB-C21C. Manel del Valle thanks the support from *Generalitat de Catalunya* through the program ICREA Academia.