Smartphone-based electrochemical immunosensor for ciguatoxins detection

Introduction

- Ciguatoxins (CTXs) are potent lipophilic marine toxins responsible for Ciguatera Fish Poisoning (CFP), the most common non-bacterial seafood-borne diseases worldwide.
- The importance of CTXs in seafood safety and their emerging occurrence in locations far away from the (sub)tropical areas where they were considered endemic, highlight the need for rapid, simple and cost-effective analytical methods.
- A portable electrochemical immunosensor for the detection of CTXs is presented. A sandwich configuration is adopted: on the one side, two different capture antibodies able to recognise the left wing of CTX1B and 54-deoxyCTX1B and the left wing of CTX3C and 51-hydroxyCTX3C are immobilised on multi-walled carbon nanotube (MWCNT)-modified electrodes. On the other side, a biotinylated antibody which binds to the right side of these four congeners is used as a detector antibody. PolyHRP-streptavidin is used as an enzymatic label for signal amplification and detection.
- Amperometric measurements are recorded with a small and ready-to-go potentiostat inserted in a smartphone, providing in situ measurements.

Smartphone-based electrochemical

Analysis of naturally contaminated fish samples

In progress...

Results will be compared with those obtained by cell-based assay (CBA) and liquid chromatography coupled to mass spectrometry (LC/MS).

Conclusions

- A portable electrochemical biosensor for the detection of CTXs has been developed, allowing the detection of CTX1B at levels below the 0.01 µg/kg guidance level proposed by the US Food and Drug Administration (FDA).
- The use of carboxyl-functionalised MWCNT-modified electrodes allows the covalent immobilisation of the two capture antibodies on the electrode, providing an enhanced active area and improving electron transfer.
- The immunosensor is being applied to the analysis of naturally contaminated fish samples. The use of two different capture antibodies in the sandwich configuration will allow the detection of at least four CTX congeners. Results will be compared with other analytical methods. The different recognition principles between analytical techniques should be considered when comparing the results.
- This alternative low-cost, easy-to-use, rapid and portable analytical tool can clearly contribute to address the significant challenges faced for the reliable and accurate detection of CTXs at the point of need.

Acknowledgements

The authors acknowledge financial support from the Ministerio de Economía, Industria y Competitividad, the Agencia Estatal de Investigación (AEI) and the Fondo Europeo de Desarrollo Regional (FEDER) through the CIGUASENSING project (BIO2017-87046-C2-2-R) and from the European Food Safety Authority through the EuroCigua Project (GPIEF/SAIF/05/2015/03). The authors also acknowledge support from CERCA Programme/Generalitat de Catalunya.