Electronic tongue multisensor systems for marine toxins' detection

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Most of coastal countries are affected by out-of-control proliferation of microalgae – harmful algal blooms (HABs). Some of these microalgae species biosynthesize toxins that can be accumulated in the tissues of filter-feeding bivalves leading to the shellfish poisoning in humans upon consumption. Due to the unpredictability of the occurrence of HABs, routine surveillance of toxins in commercial bivalves is necessary.

Among marine toxins included in the monitoring program, our work focuses on detection of paralytic shellfish toxins (PSTs), which, through occurring infrequently, have hazardous effects on humans. This research is of particular relevance to the Aveiro region, which is one of most problematic areas with respect to the marine toxin contamination, though toxicity episodes related to PSTs were detected along all the Portuguese coast.

Our team is working on the development of such fast screening tools for the PST detection – electronic tongue based on potentiometric chemical sensors and biosensors and impedance assays. Our approach's novelty lies in the use of plasticized polymeric materials and enzymes as sensing elements, which affords low cost, robust and easily scalable sensors and biosensors. Use of electronic tongue approach – combination of partially selective sensors in the arrays and application of chemometrics to data processing, allows simultaneous quantification of several toxins with similar structure. The developed electronic tongue targets several of PSTs simultaneously comprising ones typical for the Portuguese coast and other world regions for which no alternative rapid tests are available.

Successful implementation of the proposed sensing tool will contribute to the more efficient management of bivalve harvest particularly at the start or end of a toxicity episodes with expected high economic, social, and environmental impacts.

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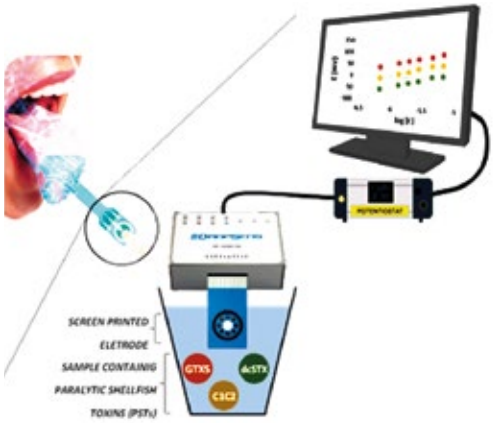

FIGURE 1
Concept of the electronic tongue: an array of partially selective (bio)sensors, chemometrics for data processing, simultaneous quantification of several PSTs.

FIGURE 2
Concept of the project: the project aims to replace the tedious laboratory analysis by portable microfluidic sensing platform, an enabling technology for rapid screening of toxins closer to the field.