Innovating tools for monitoring pollutants in aquatic environments

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Abstract

Toxic substances such as heavy metals and environmental pollutants may contaminate the aquatic resources and portable water systems, posing serious threats to the humans, agriculture, livestock and wildlife. In the last decades, discharge of industrial effluents containing xenobiotic compounds such as pharmaceuticals, endocrine disruptors, surfactants, and industrial additives to water resources has become a point of major concern for the society. The worldwide different regulatory authorities has set the regulatory standards for these contaminants with very low permissible limits i.e. pg/L or ng/kg. In consideration of toxicity and ubiquity of these compounds, the development of fast, sensitive and reliable detection methods is highly needed. Conventional analytical methods are commonly used to insure the aquatic environment safety. However, analytical figures of merit such as relatively higher limited of detection, lack of portability and unsuitability for on-site analysis, elevated cost and requirement of highly trained professionals limit their real time applications [1, 2], and are therefore difficult to implement specially in the developing countries. To overcome the above limitation, researchers have focused to design novel screening methods to maintain water quality.

The current tendency has driven the development of biosensors as new analytical tools with potential to provide low cost, fast, reliable and sensitive measurements, while many of them are aimed for on-site analysis. Biosensors are defined as analytical devices incorporating a biological material, or biomimic, intimately associated with or integrated within a physicochemical transducer or transducing microsystem. The main advantages of biosensors include short analysis time, low cost per assay, possible portability, suitability for real-time/on-site measurements. Biosensors may not completely replace the official analytical methods, but can be used both by regulatory authorities and industry to add up the information for routine testing and screening of samples. These new technologies have been applied in quantitative analysis of various target analytes for diverse applications.

The present state of art suggests the evidence of several screening and biosensing methods for the detection of xenocompounds. In this context, the current activities and results of our research group will be discussed with particular focus on the advantages and drawbacks of each developed methodologies. It is anticipated that the future will see implementation of biosensing methods such as those based on the use of multiple array biosensors to monitor the emerging environmental contaminants.

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