IR-BIOSENSOR FOR *IN SITU* DETECTION OF TOXIC ALGAE *ALEXANDRIUM MINUTUM*

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Abstract: Toxic algal blooms are a public health issue and constitute a menace for coastal areas. The potentiality of a chalcogenide optical fibre biosensor, operating in the mid-infrared (MIR) spectral domain, is studied. In order to monitor blooms of toxic algae, more specifically *Alexandrium minutum* specie, two ways are explored: immuno-biosensing and DNA identification.

Keywords: IR-Biosensor, FEWS, Toxic algae

The evaluation of the marine environment quality requires continuous monitoring of coastal waters. Indeed, toxic algal blooms affecting coastal areas represent both a public health issue and an economic stake.

Current microscopy detection methods are expensive, time-consuming and require human expertise for species identification. A fast and a sensitive detection of toxic phytoplanktons would be a major improvement for *in situ* toxicity monitoring.

In this context, the development and the use of biosensors is well-adapted for the monitoring of coastal areas specially threatened by blooms of *Alexandrium minutum (Alex.min.)*. This algae belongs to the dinoflagellate family and produces toxins leading to the syndrome of paralytic shellfish poisoning (PSP) among contaminated shellfish consumers [1,2].

The biorecognition process between a receptor and a ligand is a key issue for biosensor development. Two main ways are studied for the detection of *Alex. min.* cells: the immunological way, based on antibody-antigen interaction and a second using DNA identification [3]. This second way consists in surface immobilisation of specific probes that target DNA sequences of the algae.

The use of infrared fibre optics as biosensor brings two advantages: (i) collecting absorption measurements by remote, *in situ* and real-time spectroscopy, (ii) transparency window in the MIR range, between 800 cm^{-1} and 4000 cm^{-1}, allowing access to most of biomolecules fingerprint. The IR fibre is made from a glass which belongs to the chalcogenide family and has been already qualified for biomedical applications [4].

The detection is based on the principle of fibre evanescent wave spectroscopy (FEWS) [5,6]. To improve the detection of such a sensor, the fibre is locally tappered [7]. The experimental set-up consists in a Fourier Transform Infrared (FTIR) spectrometer coupled with the fibre and a Mercury-Cadmium-Telluride (MCT) detector. The evanescent wave penetration depth allows probing the very first microns of the sample [5].

First of all, the infrared biosensor is tested with the well-known avidin/biotin system, chosen as a model of biological interaction. MIR spectra are recorded by a mere contact between a solution of biomolecules and the surface of the fibre. Through this contact, spectral differences are identified and assigned. Surface immobilisation studies by immunological and DNA ways and IR characterisation (IR microscopy, PM-IRRAS, ATR) of chalcogenide glass disk surface are lead prior to fibres configuration assessments.

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