

Work Package 5: Shellfish Toxins

Paralytic shellfish phycotoxins

The increased occurrence of phycotoxins in coastal seawaters is a public concern, since they can pose a serious threat to human health, cause severe economic losses to aquaculture and have a major environmental impact.

The proliferation of plankton algae (so-called "algal blooms" or "red tides" if they discolour the surface of the sea), as shown in figure 1. This is a natural phenomenon that has occurred throughout recorded history. In the past two decades these events have increased in frequency, intensity and geographical distribution. Some phytoplankton species have the capacity to produce potent toxins that accumulate in aquatic animals, which are then used as food for human consumption, (e.g. filter-feeding molluscs such as mussels).



Figure 1: Red Tide Image

PSP (paralytic shellfish poisoning) toxins are a group of shellfish phycotoxins produced by microalgae, such as those shown in figure 2. They affect the nervous system of mammals by blocking voltage-gated sodium channels of excitable cells (such as nerve cells). Symptoms induced by PSP intoxication include headache, dizziness, nausea, vomiting, numbness around the lips, muscular paralysis and, in extreme cases, death by cardio-respiratory failure.

Therefore, the monitoring and control of the presence of PSPs in food is essential. Currently, according to the 91/492/CEE regulation, total PSP content in shellfish

destined for human consumption must not exceed 80 µg per 100 g of mollusc flesh, and the validated method for their detection is the mouse bioassay. This method, however, has serious limitations due to its low specificity and reproducibility. Moreover, it also raises ethical problems associated with the sacrifice of large numbers of animals.



Figure 2: PSP toxic microalgae –*Alexandrium catenella* (top right); *Gymnodinium catenatum* (left) and *Pyrodinium bahamense* var. *compressum* (right)

Optical biosensor method

BioCop will address the lack of in vitro tests that are suitable for PSP detection by developing an optical biosensor assay intended for routine use in PSP determination in shellfish.

The optical biosensor is based on the phenomenon of Surface Plasmon Resonance (SPR) (see figure 3, below). SPR biosensors are capable of detecting a specific interaction between two molecules, e.g. between a toxin and its receptor, in real time, without the need for fluorescence or radioactive labelling of any molecule. Assay development requires specific PSP binders (antibodies and/or receptors) and pure PSP toxins to be used as reagents, antigens and standards.



Figure 3: SPR-based biosensor. Biacore Q



WP5 work includes the purification and determination of individual PSP toxins (there are more than twenty different toxins described) from contaminated material or seawater plankton and the development of a new optical biosensor assay. This will use the sensor chip surfaces created by WP3 (Sensors) and the specific binders provided by WP4 (Binders). Finally, prototype sensor kits will be distributed for validation studies and for widespread demonstration, training and dissemination activities.

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