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BIOTOXMARIN

Development of novel analytic tools for the detection of marine biotoxins

The Challenge

The contamination of seafood with algal toxins can cause severe neurological and gastrointestinal disorders and allergies in humans. Sporadic outbreaks of poisoning by ingestion of shellfish which has accumulated marine biotoxins have become a global problem and the production of marine biotoxins during algal blooms can have significant economic consequences.

There are four forms of poisoning caused by consumption of contaminated seafood, which differ in symptoms and duration:

- Paralytic shellfish poisoning (PSP),
- Neurotoxic shellfish poisoning (NSP),
- Amnesic shellfish poisoning (ASP)
- Diarrhetic shellfish poisoning (DSP).

ASP can be a life-threatening syndrome. It is characterized by gastrointestinal symptoms such as nausea, vomiting, abdominal cramps and diarrhoea as well as neurological symptoms. DSP is not fatal and causes gastrointestinal symptoms only. NSP causes an intoxication syndrome with both neurological and gastrointestinal symptoms. NSP toxins can also cause respiratory asthma-like symptoms. PSP is a life-threatening syndrome; the symptoms are purely neurological with rapid onset.

Toxins causing ASP, DSP and PSP may be present in European waters, while NSP toxins could be found in imported shellfish. The chemical structures underlying the ASP, DSP, NSP and PSP toxins are well known. The toxic dinoflagellates producing them can be isolated from both natural and anthropogenic algal blooms.

Project Objective

- To develop new assays for marine Biotoxins which allow rapid detection of biotoxins.
- To develop new antibodies against certain marine biotoxins and new assay-methods, ELISA and lateral-flow assays. These developments can be combined to support the establishment of guidelines for food safety.
- To isolate marine biotoxins and to chemically characterise them.

Key Points

- Production of high-affinity antibodies against selected marine biotoxins associated with algal blooms and which are harmful to

EATiP Thematic Area of Relevance

TA1: Product Quality, Consumer Safety and Health

TA2: Technology and Systems

TA3: Managing the Biological Lifecycle

TA4: Sustainable Feed Production

TA5: Integration with the Environment

TA6: Knowledge Management

TA7: Aquatic Animal Health and Welfare

TA8: Socio-Economics and Management

Key Words

Marine, biotoxins, algal blooms, shellfish poisoning

Project Information

Contract number:

513967

Contract type:

Specific Targeted Innovation Project

Research area:

FOOD-2003-T5.3 Development of cost-effective tools for risk management and traceability systems for zoonotic agents and marine biotoxins in seafood

Duration:

36 months (01/01/2005 – 31/12/2007)

Coordinator:

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human health. A sensitive immunoassay based on infrared-fluorescence imaging system will also be developed.

- Parallel development of Instruction/receptor phases for the isolation, identification and binding of marine biotoxins.
- User-friendly chip (POCT Chip, dip-stick/card test) assay methods for the fast and sensitive detection and quantification of marine biotoxins based (a) on the antibodies and (b) on the synthetic polymeric receptors will also be developed.
- Development of highly sensitive sensor chips applying the Integrated Optical Grating Coupler (IOGC) sensor technology for the detection and quantification of marine biotoxins. Both an immunosensor based on antibodies and a sensor based on Instruction/receptor phases will be developed.
- Development of a colorimetric microtitre-plate based phosphoprotein phosphatase 2A (PP2A) inhibition assay (determination of okadaic acid)
- Development of a bioassay based on activation/phosphorylation of MAP kinases.

Output Highlights

Analytical methods

Developed fast, simple and cost-effective marine biotoxin detection methods for seafood and patient sera. Detection was based on the application of high-affinity capture antibodies and novel artificial receptor mimics against the toxins.

Safety concerns

Successfully raised antibodies against okadaic acid, a diarrhetic shellfish poisoning (DSP) toxin. New tools developed in this project allow for the quantification of marine biotoxins. Prototype kits will be manufactured by the companies involved in the project.

The Full Report:

For a comprehensive description of the research project, visit www.biotoxmarin.de

Next Steps – Suggested Actions/Follow On



RTD

- Identification strategies need to be extended to other groups of relevant toxins causing PSP, NSP and ASP. More research into the further development of detection methods is needed
- The sensitivity of the methods developed during this project requires further investigation. The developed technologies will be compared with existing techniques for evidence of improved efficiency and accuracy.
- An assessment of the sensitivity of the new analytical methods requires further investigation.

Related Publications/Projects

A full list of publications emanating from the project can be found on the website www.biotoxmarin.de