

Amnesic Shellfish Poisoning

Bivalve molluscs are one of the only foods normally delivered to the consumer alive. This, and the fact that bivalve molluscs can selectively retain contaminants that are harmful to human health, means controls are in place to mitigate against potential contamination.

A good understanding of the controls and how the animals respond to various handling regimes can lead to safer seafood being delivered to market.

To ensure best practice guidelines are followed Seafish has produced a series of industry guidance notes for fishers and shellfish farmers. These cover:

- **Paralytic Shellfish Poisoning (PSP)**
- **Amnesic Shellfish Poisoning (ASP)**
- **Diarrhetic Shellfish Poisoning (DSP)**

This fact sheet details:

- What is ASP?
- The symptoms of ASP
- Algal toxins
- The legislative framework
- Controls in place
- How the samples are tested
- What harvesters should be doing
- Sources of further information

What is ASP?

Amnesic Shellfish Poisoning (ASP) is a serious illness that can cause permanent short term memory loss, and in the worst case scenario, death. It can be induced by consuming fish, bivalve molluscs, crustacea or gastropods that contain the algal toxin, Domoic Acids.

We are unaware of any recorded outbreaks of ASP in the UK. This may indicate that the controls in place do work. However, the serious nature of any potential future outbreak is sufficient to imbue a responsible approach to the sourcing and handling of any batches of bivalves, whether from the UK or other nation's coastal waters.

The symptoms and treatment of ASP

The symptoms of ASP can include:

1. Vomiting, diarrhoea and abdominal cramps
2. Disorientation and memory loss
3. Seizures
4. Renal failure
5. Coma (in a small number of cases death may follow due to a combination of the above).

There is no known antidote for this toxin and palliative care appears to be the norm.

Algal toxins

Algal toxins sometimes referred to as 'biotoxins' are produced by naturally occurring phytoplankton sometimes found in UK coastal waters. The number of phytoplankton occurring at any one time can be very small and local in size, or can be so vast that they can create 'blooms' in UK waters of more than 1,000 square miles in size. The term 'algal bloom' is sometimes used to denote such an event.

Bivalve molluscs in particular have the ability to accumulate any toxins present in the locality, and retain them for significant periods of time.

Amnesic Shellfish Poisoning (ASP) is caused by consumption of shellfish that have accumulated domoic acid, a neurotoxin produced by some strains of phytoplankton, called *Pseudonitzschia*.

Pseudonitzschia is a form of microscopic algae, or tiny plant, which lives in the sea and obtains energy from sunlight during the day.

The legislative framework

It is a criminal offence to place any food on the market that is unsafe.

The health standards for live bivalve molluscs are contained in EC Regulation 853/2004. This lays down the specific hygiene rules. Bivalve molluscs, both live and processed, placed on the market for human consumption must not contain marine biotoxins in total quantities (measured in the whole body or any part edible separately). The limit applies to domoic acid which must not exceed 20 milligrams per kilogram for ASP. This is also represented as 20 micrograms/100 grams. Any bivalves found

to contain more than this prescribed limit would be deemed unsafe. **See:** <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2004:139:0055:0205:EN:PDF>

The sampling regime suggested for live bivalve molluscs is contained in EC Regulation 854/2004. This details the official controls necessary to check for compliance with the criteria and targets laid down in Community legislation. This highlights the need to target relaying and production areas which must be periodically monitored to check for the presence of toxin-producing plankton and biotoxins in live bivalve molluscs.

The sampling frequency for toxin analysis in molluscs is, as a general rule, weekly during the periods at which harvesting is allowed. This frequency may be reduced in specific areas, or for specific types of molluscs, if a very low risk of toxic episodes is indicated. It may be increased where an appropriate assessment suggests that weekly sampling would not be sufficient. <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2004:139:0206:0320:EN:PDF>

Official controls on pectinidae (scallops) harvested outside classified production areas are carried out in fish auctions, dispatch centres and processing establishments.

Controls in place

Food business operators are responsible for ensuring that product standards are maintained and must determine what controls they are going to put in place to prevent contaminated product being consumed.

There are a number of different control options:

- **End Product Testing (EPT)**

This normally involves establishing a programme of sampling and testing statistically significant batches of products to be sold, namely End Product Testing (EPT). Products chosen should be based on likely risk of ASP contamination and be linked back to Hazard and Critical Control Point plans (HACCP). Some businesses may wish to rely on the statutory monitoring programme to supplement their own HACCP plan.

- **Monitoring harvesting grounds**

In general, the best method of controlling the risk is by monitoring the harvesting grounds for the presence of domoic acid in the mollusc flesh, and establishing if the trend is for increasing, or decreasing amounts of toxin.

It is especially important to monitor those areas where a *Pseudonitzschia* bloom of algal toxins has previously occurred, as reoccurrence in the same location is not uncommon.

- **Occurrence of blooms**

There is little consensus on what causes a bloom to appear, grow and die off. At least one study appears to have demonstrated an evident cause and effect relationship between nutrient inflows originating from agricultural activities in the watershed and the development of a potential Harmful Algal Bloom (HAB). However other naturally occurring factors may be responsible for the multiplication of this species of phytoplankton.

- **Registration Document**

A vital industry role is to ensure that accurate information about where bivalves are harvested is recorded on a 'Registration Document' for each and every batch. All bivalves must be sold through a licensed dispatch or purification centre or approved processing establishment. For wild caught scallops alternative controls may exist. Always check with your local EHO for specific advice.

How the samples are tested

Bivalve molluscs do not accumulate and retain biotoxins at a uniform rate given similar environmental parameters and availability of toxins.

Different species harvested from the same locality can be expected to have differing levels of contamination. Different individuals of the same species can also be expected to have markedly different levels of contamination and even individual shellfish, can and do have, different levels of toxin in different body parts such as adductor muscle, gonads and viscera.

- **Determining batch size for testing**

Difficulties can exist for harvesters and food businesses in determining an appropriate batch size for carrying out EPT for domoic acid. A batch can be a bag, box or bin of shellfish or two days fishing harvest. The decision as to what constitutes a batch can only be taken by the business placing the shellfish on the market in the light of their own risk assessment.

If a tested batch exceeds the regulatory limit set, the whole batch becomes a 'Category 1 waste' and is no longer fit for human

consumption. So under the conditions of the Animal By products Regulation, it must be disposed of at the food businesses expense. This must include incineration or rendering under pressure and burial in an appropriate authorised landfill site. This may be very expensive.

<http://www.defra.gov.uk/foodfarm/byproducts/wastefood/index.htm>

(The other option is to reduce the size of a batch and hence reduce the risk and cost of non-compliance, but this would increase the sampling costs. A large batch size means the toxin sampling costs are lower, but conversely the potential costs should a non-compliance occur is much higher than for a small batch.)

- **Effects of cooking or processing**

Cooking, processing or heating batches of shellfish contaminated with domoic acid will not reduce the toxin load.

Testing methods

1. Mouse Bioassay (MBA)

If the toxins levels are extremely high, the mouse bioassay may be used following the official control method for PSP (the mouse bioassay).

2. High Performance Liquid Chromatography (HPLC)

This method is officially approved in the EU for the detection of domoic acid.

The HPLC method can detect domoic acid well below the regulatory limit of 20 milligrams per kilogram of domoic acid in shellfish meat and has been validated to international standards

3. Enzyme-linked immunosorbent assay (ELISA)

A method based on enzyme-linked immunosorbent assay (ELISA) can be used for screening of domoic acid in bivalve molluscs. This method has been subject to an international collaborative validation study. It is officially approved by the AOAC® International as First Action Official MethodSM number 2006.02.

This method is officially allowed to be used in the EU for screening purposes. It can be a valuable tool for rapid and selective determination of domoic acid and its isomers in crude extracts.

<http://www.biosense.com/docs/A31300401-sheet.pdf>

4. End Product Testing kits

Test kits are very useful, as they are quick and easy to use and may be used in the field or on board vessels to test for the presence of toxins in harvested products. We are currently aware of one test kit available for ASP.

The Jellett Rapid Test for ASP is a quick field test kit. <http://www.jellett.ca/>

Biosense Laboratories may also provide test kits for the detection of ASP.

<http://www.biosense.com/>

All test kits have some limitations and unlike ELISA these kits are not quantitative.

Harvesters should satisfy themselves as to the most appropriate kit for their needs. The commercial market is always changing and we recommend you carry out your own search for an appropriate product as the need arises.

Guidance for harvesters

- Monitor the harvesting grounds for the presence of domoic acid in the mollusc flesh. Establish if the trend is for increasing or decreasing toxin levels.
- Be aware of the sampling regime suggested for live bivalve molluscs.
- For King Scallops it is possible to reduce the likely risk of human ingestion of domoic acid and other biotoxins through consumption of the product by effective shucking. Separation of the adductor muscle and roe from the viscera, followed by washing in clean running water for five minutes helps to reduce the risk. This activity will not completely remove domoic acid, but is still recommended.
- Bivalves fed toxic algae and subsequently held in filtered seawater for 24 hours or more almost never showed growth of harmful algae in fecal material after re-immersion. So this practice, to immerse in filtered seawater, may be considered when formulating biosecurity plans for transfer of stock from one site to another.

Thanks to the Food Standards Agency and Cowan Higgins (Agri-Food and BioSciences Institute Northern Ireland) for their valuable corrections and comments.

- Prior to delivery to market EPT is crucial as the ultimate reassurance to operators that their product is safe.

For further information

EC Regulation 853/2004 laying down specific hygiene rules on the hygiene of foodstuffs. <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2004:139:0055:0205:EN:PDF>

EC Regulation 854/2004 laying down specific rules for the organisation of official controls on products of animal origin intended for human consumption. <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2004:139:0206:0320:EN:PDF>

Seafish Good manufacturing practice guidelines - Live bivalves workbook. A step-by-step guide to good live bivalve preparation for the market. See Appendix 2 and 3 for EPT standards.

http://www.seafish.org/media/Publications/GMPG_Bivalves_downloadable.pdf

Animal By-products Regulation on Disposal options

<http://www.seafish.org/processors/legislation/waste-legislation/by-products-usage-and-disposal>

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See:

<http://www.seafish.org/aquaculture/information-for-culturists/delivering-safer-seafood>

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