

Shellfish poisoning

P. Kaladharan and P. K. Asokan

Calicut Research Centre of CMFRI., WestHill PO, Kozhikode-673005

Certain dinoflagellates, diatoms and cyanobacteria produce biotoxins. These marine toxins are water soluble and heat stable. Shellfishes being filter feeders tend to accumulate these toxins. After consuming such bivalves ingested with toxin bearing planktons, human toxicity and mortality has been reported. While we aim for large scale mariculture of marine bivalve mollusks, the sanitary conditions in which they grow and their taste quality must be improved and protected. Mariculture sites should be protected from dumping anthropogenic wastes and regular monitoring of water quality is very much essential. Stray numbers of toxin bearing microalgae as normally found in seawater will not be harmful and it becomes when they outbreak and form blooms.

Algal blooms:

Dumping of anthropogenic wastes, runoff from agricultural lands and rivers, coastal upwelling are the major factors resulting in blooming of microalgae.

Diatom bloom- Species such as *Fragilaria oceanica*, *Hemidiscus hardmanniannus* etc form blooms during the monsoon season in west and east coasts of India and are not harmful.

Red tide: Species of *Trichodesmium* filamentous blue green algae start blooming during the premonsoon season along the Arabian sea and sometimes changes the colour of surface water to the characteristic red. During the declining phase levels of dissolved Ammonia shoots up in the red tide patches.

Dinoflagellate bloom: caused by members of Dinophyceae and most of the blooms are toxic and leads to poisoning if the bloom turns massive and prolonged for longer duration. The major species are *Noctiluca miliaris*, *Noctiluca scintillans*, *Gymnodinium breve*, *Gonyaulax* (= *Alexandrium*) spp, *Peridinium* spp, *Porocentrum* spp etc. Dinoflagellate blooms are harmful as they contain toxins and they are responsible for shellfish poisoning.

The quantity of toxins (poison) present in these microorganisms or those derived from the molluscan bivalves are represented in mouse units (MU). A MU is the minimum quantity of toxin that will kill a 20 gm mouse in 15 minutes when one ml of the extract at about pH 4.0 is injected intra-peritoneal.

Based on the characteristics of the toxins and the symptoms they cause to the consumers, these toxicities can be Paralytic (PSP), Neurotoxic (NSP), Amnesic (ASP) and Diarrhetic (DSP) shellfish poisoning. Based on the host organism from which the toxicity is derived can be venerupin shellfish poisoning (VSP).

1. Paralytic Shellfish Poisoning (PSP)

Paralytic shellfish poisoning (PSP) is the most commonly known and widely occurring shell fish poisoning which is caused by saxitoxin and its derivatives and the source of toxin is dinoflagellates. The toxin, remain even after the food has been cooked. The first symptom, a pins-and-needles sensation (tingling) around the mouth, begins 5 to 30 minutes after eating. Nausea, vomiting, and abdominal cramps develop next, followed by muscle weakness. Occasionally, the weakness progresses to paralysis of the arms and legs. Weakness of the muscles needed for breathing may even be severe enough to cause death. Those who survive usually recover completely.

Toxin profiles of clams and oysters involved in the outbreak of paralytic shellfish poisoning in India in 1983 were studied by a liquid chromatographic technique. Gonyautoxins 1, 2, 3, 4 and 8, and 11-epigonyautoxin 8 appeared to be the major toxins along with small amounts of saxitoxin, neosaxitoxin, decarbamoylsaxitoxin, decarbamoylgonyautoxins 2 and 3, C3 and C4. Toxin profile suggests the involvement of *Alexandrium* spp. in this outbreak.

In India, there have been at least three recorded outbreaks of PSP. In the first of these which occurred in Vayalur near Chengalpet Dist, Tamilnadu (east coast) during November 1981 after consuming oysters. The second one in Arikadu, Kumbala, near Mangalore (south west coast) during September 1983, one person died and several persons were hospitalized after consuming clams. Analysis of these clams revealed lethal doses of PSP1. In both these outbreaks, the causative algae could not be identified because by the time shellfish become toxic, blooms either collapsed or drifted away. Another outbreak occurred in Vizhijam, near Trivandrum during September 1998 in which at least five deaths were reported and over 500 people hospitalized due to consuming mussels. The toxin source was later identified from a dinoflagellate *Alexandrium polygramma*.

2. Amnesic Shellfish Poisoning (ASP)

ASP was first reported from Prince Edward Island, Canada in 1987 due to consumption of blue mussels which registered 3 deaths and more than 150 hospitalized. The toxin source was incriminated from a diatom and not dinoflagellate belonging to the genus *Pseudonitzschia* and species *P. pseudodelicatissima*, *P. multiseries* and *P. australis*. The symptoms include abdominal cramps, vomiting, disorientation and amnesia.

3. Diarrhetic Shellfish Poisoning (DSP)

DSP is the poisoning to the humans caused following the consumption of mussels and scallops was reported from Japan for the first time. This toxicity leads to diarrhea and other gastro intestinal disorder. Dinoflagellate species of the genus *Dinophysis* and *Prorocentrum* are identified as the source of toxin.

4. Neurotoxic Shellfish Poisoning(NSP)

NSP is reported only from the west coast of Florida, Gulf of Mexico following the consumption of oysters and hard clams harvested from red tide infested season. The red tide was due to the dinoflagellate *Gymnodinium breve* and the associated toxin is named as brevetoxin. No deaths have been attributed to NSP.

5. Venerupin Shellfish Poisoning (VSP)

VSP is also called oyster poisoning or *asari* poisoning which occurred in Japan followed by consuming short-neck clams (*Venerupis semidecussata*). The symptoms include gastrointestinal disorders followed by liver and kidney damage. Although the definite source of the toxin is not established, the dinoflagellate belonging to the genus *Prorocentrum* has been suspected.

Poisoning	Transvectors	Toxins	Toxin source	Symptoms	Casualty
PSP	Mussels, Clams	Saxitoxin Gonyautoxins	<i>Pyrodinium</i> , <i>Gonyaulax</i>	Numbness around lips, Nausea, headache, Prickly sensation to limbs, feeling of lightness, respiratory difficulty	Fatal Many deaths reported
ASP	Blue mussels		<i>Pseudonitzschia</i>	abdominal cramps, vomiting, disorientation and amnesia	Fatal
DSP	Mussels , Scallops		<i>Dinophysis</i> <i>Prorocentrum</i>	Abdominal pain, vomiting, diarrhea	Non fatal
NSP	Oysters , Hard clams	Brevetoxin	<i>Gymnodinium</i> <i>breve</i>	Numbness around mouth, nausea, vomiting	No deaths reported
VSP	Short-neck clams	Venerotoxin	<i>Prorocentrum</i>	Gastro- intestinal disorders, Liver and kidney damage	No deaths reported

Control measures

Untreated effluents should not be discharged near the mariculture site. Anthropogenic wastes should not be dumped anywhere near the mussel beds. Water quality and sediment quality should be monitored regularly for any contaminants and toxic algae, coliform bacteria etc. Bivalves should not be harvested from bloom infested areas.

Suggested readings

Gopinathan, C.P. and P.P.Pillai, 1976. Red tide and its deleterious effects on fisheries. *Seafood Exp.J.*, 8(12) : 1-5.

Karunasagar I, Gowda HSV, Subburaj M, Venugopal MN and Karunasagar I. 1984.

Outbreak of paralytic shellfish poisoning in Mangalore, West coast of India. *Curr. Sc.*,53(5), 247

Karunasagar I, Karunasagar I, Oshima Y, Yasumoto T. 1990. A toxin profile for shellfish involved in an outbreak of paralytic shellfish poisoning in India. *Toxicon*. 990;28(7):868-70.

Sammy M.Ray and K. Satyanarayan Rao, 1984. Manual on marine toxins in bivalve molluscs and general consideration of shellfish sanitation. CMFRI Spl Pubn 16: 100p