



Cheese in oil – the risk of botulism

Artisan dairy products with inclusions such as garlic, chives, parsley or rosemary sprigs that are submerged in olive or other oils, are becoming increasingly popular. However plant material, particularly herbs and spices, may contain spores of the bacterium *Clostridium botulinum*. In the oxygen-free environment created by the oil, and under other favourable conditions, this bacterium can grow and produce a potentially deadly toxin.

What is botulism?

Botulism is a severe form of food intoxication caused by a toxin produced by *C. botulinum*. Foodborne botulism occurs after ingestion of the pre-formed toxin in a food. It can result in long lasting muscle paralysis and potentially death.

Outbreaks are commonly attributed to low acid (pH >4.6) plant products that have been inadequately processed during home bottling or canning e.g. peas, beans, mushrooms. However food products stored in oil have also been linked to illness.

Clostridium botulinum

C. botulinum is a spore-forming bacterium naturally present in soil and prevalent in agricultural environments. Spores are a resistant form of the organism, and are capable of surviving extreme conditions. Food derived from plant and animal material can become contaminated with *C. botulinum*.

An important characteristic of *C. botulinum* is its inability to grow in the presence of oxygen. Processes such as canning, bottling, or storing under oil result in an oxygen depleted environment and can provide conditions suitable for growth and toxin production. It is essential that dairy manufacturers are aware of the possible consequences of changing the environment for products to an anaerobic (oxygen-free) state without controls to prevent growth of *C. botulinum*.

Due to their resistant nature, spores can persist in foods that are incorrectly or minimally processed. In the case of dairy products, pasteurisation will destroy vegetative cells present in raw milk, however the spores will survive. Unless further control measures are in place, there is potential for *C. botulinum* to grow and produce toxin in foods stored anaerobically, for example, submerging cheese in oil eliminates oxygen and provides conditions under which *C. botulinum* may grow.

Despite the ability of spores to survive pasteurisation, *C. botulinum* outbreaks attributed to dairy products are relatively rare due to cold chain management, combined with the absence of a strictly anaerobic environment in many products.

Controlling *C. botulinum*

Heat treatment

Commercial processes designed to destroy spores in low acid foods require a heat treatment of 121°C for at least three minutes or equivalent. In products subjected to milder heat treatments (such as pasteurisation), other controls are required to prevent outgrowth and toxin production in anaerobically stored products. These controls include refrigeration, and/ or product formulation to ensure that it will not support the growth of *C. botulinum*.

Refrigeration

Growth and toxin production by *C. botulinum* is restricted at refrigeration temperatures, although some rare strains can grow at temperatures as low as 3°C. If temperature is used as a control measure to prevent *C. botulinum* growth, refrigeration conditions must be strictly maintained and monitored.

As manufacturers cannot control product storage temperatures along the entire distribution chain, until the point of consumption, refrigeration should not be relied upon as the sole hurdle to prevent growth of this organism.



Product formulation

Manipulation of the physicochemical properties of a product presents another strategy to prevent the outgrowth of spores, particularly where the product is unrefrigerated. This can be achieved by ensuring that the product has a pH, water activity, salt content, or added preservatives, that will restrict the growth of *C. botulinum*.

C. botulinum will not grow below pH 4.6, or at a water activity of less than 0.94. Reducing the pH is one of the most common means of preventing growth of this bacteria and can be achieved by adding organic acids (such as lactic, citric, or acetic acid). The addition of salt, sugar or other solutes to reduce the water activity to less than 0.94 is another control measure.

Manufacturers of canned processed cheese have used the preservative nisin at levels known to inhibit the outgrowth of *C. botulinum* spores, often in combination with sub-inhibitory levels of pH, salt and emulsifying agents.

Where the risk of *C. botulinum* contamination is due to the use of organic inclusions (such as herbs commonly added to cheese stored in oil), treatment of these additions with sanitisers such as peracetic acid has been shown to be effective in inactivating spores of clostridia.

The management of actions designed to effectively control the risk presented by *C. botulinum* is crucial. Focus on carefully identifying and monitoring critical control points, and objectively determine a safe shelf-life.

Key points to consider

- Inclusions such as herbs and spices may introduce *C. botulinum* into dairy products.
- Although the risk is low, some dairy products may support the growth of *C. botulinum*.
- Packaging of dairy products in oil can be potentially dangerous, especially when plant inclusions are present.
- Acidify inclusions to a pH below 4.6 prior to their addition to cheese contained in oil.

Further information

Further food safety technical information is available at www.dairysafe.vic.gov.au

Or contact Dairy Food Safety Victoria on (03) 9810 5900 or info@dairysafe.vic.gov.au

© Copyright State of Victoria 2018