Dairy Food Safety

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25 Note

Listeria monocytogenes – Management in Dairy Factories

This Note provides a background on why *Listeria monocytogenes* is a concern for dairy manufacturers, and offers practical measures to prevent product contaminations, or manage them should they occur.

What is the risk?

There are six known *Listeria* species, however only *Listeria monocytogenes* has been confirmed as pathogenic (disease-causing). The detection of any *Listeria* species in either the plant environment or a dairy product may be considered a warning, as *L. monocytogenes* is often found following earlier detections of other *Listeria* species.

Consumers of product containing *L. monocytogenes* may contract listeriosis, a disease that can have varying effects, depending on the level of bacteria present, the quantity of product consumed and the susceptibility of the consumer. Listeriosis is rare, but the consequences of infection can be severe. For individuals categorised as "high risk", (infants, pregnant women, the elderly, and those immuno-compromised), it is estimated that up to 30% will die if they contract the illness [(1)].

In Australia in 2006, eight *Listeria* infections identified in pregnant women resulted in two infant deaths, and 51 *Listeria* infections in elderly or immuno-compromised individuals resulted in 7 deaths [(2)]. Although these illnesses were not linked to dairy foods, it demonstrates the serious effects the disease can have on susceptible consumers.

How do I prevent contamination?

Although regular product testing results may show an excellent history with respect to coliforms, Enterobacteriaceae or staphylococci, testing for these organisms will usually provide no indication that *Listeria* may be present in the plant or product. *Listeria* species often live and breed in different environments to these other contaminants. They are widespread in the general environment in soil and water, and can be carried by animals. They are most commonly found in moist damp environments, and are hardy survivors.

There are various strategies that can be adopted to help prevent *Listeria* contaminations occurring. These include:

- implementing an environmental monitoring program
- designing the manufacturing plant to reduce the risk of contamination
- improving operational aspects or processes within production.

An Environmental Monitoring Program

Evidence shows that a basic environmental monitoring program can be cost-effective when compared to the costs incurred in a *L. monocytogenes* detection in product [(3)]. Environmental monitoring will usually provide a forewarning as to whether *Listeria* is present within the manufacturing site before it can contaminate product.

The ANZDAC *Listeria Manual* contains useful information on how to implement an environmental monitoring program [(4)].

Premises design

Flaws in a premise's design or construction may favour the growth of *Listeria.* In such cases, where it is impractical to fix these faults, extra vigilance will be required to monitor hot spots and maintain these areas in a sanitary condition.

The following references provide practical detail in design and construction aspects, which have proven successful over time:

- The *Australian Code of Practice for Dairy Factories (1986)* [(5)]
- NZFSA *Operational Guideline: Design and Construction of Dairy Premises and Equipment* [(6)]

Plans for any new premises must be approved by DFSV[(7)].

Operational aspects

Staff training is an important aspect of managing the risks associated with *L. monocytogenes* contamination. Each staff member must be adequately trained in hygienic practice related to their job. Having the best of systems and equipment in place does not eliminate the risk of contamination if there is inadequate understanding of how contamination can occur. Resources such as external training bodies or information from DFSV can be utilised. In-house training sessions, or

mentoring of inexperienced staff should also be considered.

Restricting the entry of personnel into high-risk production areas will assist in reducing the risk of contamination. Reinforcing the reasons why access is limited can also aid in reinforcing operator understanding of the impact of contamination. Tanker drivers, maintenance, laboratory and administration staff, as well as visitors, are all capable of unknowingly transferring *Listeria* into a clean facility.

Similarly, equipment can also transfer *Listeria* into production areas. Trolleys, fork lifts, pallets, containers (particularly cardboard) are all possible contamination sources[8].

The Production process

Products or ingredients that are introduced into the production process without an adequate microbial kill step may result in a *Listeria* contamination. Raw milk may contain *L. monocytogenes* or other pathogens. Ensure segregation of raw and processed products to prevent any possible cross-contamination.

All ingredients that are not heat-treated, or are added after pasteurisation, should be purchased from approved suppliers, who should provide an assurance that they are free of *Listeria*. Also be aware of the handling process associated with ingredients, with the potential for contamination coming from the packaging.

Be wary of purchasing “discounted” ingredients e.g. cheese to be used for shredding, or similar processes. Examples have been recorded of cheese known to be contaminated with *Listeria* being sold to an unsuspecting manufacturer, resulting in their plant and products becoming contaminated,

Possible sources of contamination

Like other pathogens, *L. monocytogenes* is destroyed by pasteurisation, therefore contamination in product will have occurred post-pasteurisation. Based on a combination of research and experience, some examples are listed below of how and where *Listeria* can colonise a factory environment.

Drains: *Listeria* is regularly found in external drains. To ensure these microorganisms do not enter the manufacturing area, drainage flow should be checked that it does not pass back through production areas. Open drains should be contained within each specific manufacturing section, not running under dividing walls, or to outside the premises. Never wash drains with water using high pressure, particularly while product or clean processing equipment is exposed, as the aerosols (tiny moisture droplets) created can disperse bacteria extraordinary distances. Include drains in your cleaning and sanitising program. Drain cleaning needs to be done carefully, and not while production is still running, with appropriate attention paid to minimising the potential for contamination of the boots and clothing of the person doing the cleaning. Brushes used to clean drains should be clearly identified and only used for that purpose.

Floors: Effective floor sealing is essential, particularly where equipment is or has been mounted on the floor. Any damage must be repaired promptly in order to prevent bacterial colonisation.

Walls: Dangers exist when walls are in direct contact with the floor in wet environments. Solid ‘dwarf’ or ‘nib’ walls incorporated into the flooring are recommended to raise panel walls above floor level. If damaged, particularly in production areas where product can fall, splash or be washed in, walls can become contaminated with *Listeria*, and will continually seed the environment until replaced and properly sealed.

Footbaths or shoe change areas: Where provided, these facilities must be used by *all* who enter restricted production areas. Footbaths must be regularly emptied and cleaned, and adequate sanitiser strengths maintained.

Traffic: If possible eliminate wheeled devices such as fork lifts, pallet jacks or trolleys from entering high risk production areas. Consider un-powered conveyor systems instead.

Trolley wheels: Often overlooked in cleaning, trolley wheels can combine product, grease, moisture and soil, becoming a breeding ground for *Listeria*. Do not use high pressure water if cleaning them in production areas, as aerosols will be produced.

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Second-hand or refurbished equipment: Be aware that second-hand/refurbished equipment could contain contaminants, so ensure it has been thoroughly cleaned before installation.

Jacketed vats: Jacketed vats can be damaged or pitted on internal surfaces and holes may not be visible to the naked eye. Leak detection dyes are useful in such cases. External corrosion of vats can also allow contamination with product and organisms, which may be difficult to trace and remove.

Enclosed support frames & other hollow equipment: When damaged or ineffectively sealed, enclosed support frames can become impossible to clean if internally contaminated. They have been known to cause on-going intermittent contamination through leakage onto exposed product. Avoid this tube structure where possible. Alternatively, ensure it is totally sealed, or can be effectively cleaned and drained. Any other equipment that is of hollow construction can similarly be a potential site for microbial contamination, such as conveyor rollers, agitator shafts and manual equipment with hollow handles.

"Out of sight" product build-up: Get a floor-upward and ceiling-down perspective of the production area. Product and bacterial accumulation on the under surfaces of equipment has the potential to fall or come into contact with objects that may contaminate product. Uncleaned areas above production can allow contaminants to fall directly into product, or onto product contact surfaces, or be circulated through the environment by air currents such as air conditioning or opening/closing doors. A regular inspection will highlight areas of concern.

Powered conveyors*:* In wet areas, particularly where product can come into contact with them, powered conveyors can be problematic for cleaning and sanitising due to access difficulties. Sanitiser sprays or passing the belt through sanitiser solution is often used as a preventative measure.

Mechanical seals: Seals can wear or become damaged, and on equipment such as reciprocating pneumatic devices, or on other locations that are not regularly subject to cleaning, can become a problem. Routine maintenance should prevent this occurring, and careful manual cleaning may be required in hard to access areas. Over-lubrication may also contribute to contamination from inside the stem housing.

Air line moisture traps: *Listeria* has been isolated from air line moisture traps. Once inside, distribution can become widespread. These sites should be included in an environmental monitoring program.

Control panels: Perished or damaged seals in wet production areas can support *Listeria* growth, either in the seal, or inside the panel. Inspect routinely.

Ventilation/refrigeration: Vents and air-conditioning units can gather dust in some production circumstances. Condensate collection must be managed effectively. Regular inspection is recommended.

Exposed product: Take extra care in how product post-pasteurisation is stored prior to packaging, particularly when left in cool or maturing rooms. Exposed product can become contaminated through the air currents of the recirculation systems. *Listeria* is an organism that can continue to multiply slowly at refrigeration temperatures.

Cleaning and sanitising: Review the program efficacy, and ensure adequate contact with all surfaces is occurring. *Listeria* species have the ability to form biofilms which are difficult to remove once they attach to a surface. Consult with chemical and equipment suppliers to assist with this.

Personnel: Direct product contamination by personnel is far more likely with *E. coli* or *Staphylococcus aureus* than with *Listeria*. However, failure to follow basic Good Manufacturing Practices (GMP) may cause a *Listeria* contamination.

What if there is a product contamination?

Detailed information is provided in the *Listeria* Manual of steps to take when *Listeria* is detected in product [4]. This includes the requirement to undertake a clearance program.

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If the contaminant is identified as *L. monocytogenes*, then the additional procedures mandated in the Manual need to be implemented.

Part of the clearance program will involve environmental testing to try to trace the source of the contamination. Initial environmental testing may pinpoint locations that may appear to be the obvious cause, however experience has shown that there may be multiple sites that are not immediately detected. This can result in intermittent positive detections in product even after a clearance program has concluded. In such cases, additional environmental swabbing, line surveys or plant dismantling and inspection are suggested to trace the root source and cause of the contamination. Sometimes even extensive testing can fail to identify the source, which then places greater emphasis on the need to have an effective system of controls in place to prevent further contaminations, and to control affected product should a contamination occur.

Summary

There are numerous ways that *Listeria monocytogenes* can colonise a factory environment and potentially cause product contamination. Careful consideration of factory design, construction, cleaning and maintenance will minimise the risk of contamination occurring. Staff training, ingredient control, and effective processing will further reduce this risk. Implementing an environmental monitoring program is perhaps the best strategy available to alert a manufacturer of potential dangers before product contamination with *Listeria monocytogenes* can occur.

References

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Further information

Other Dairy Food Safety Notes are available from www.dairysafe.vic.gov.au

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