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## *Dairy Foods Science Notes*

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### ***Listeria monocytogenes* in the Dairy Environment**

#### **What is *Listeria monocytogenes*?**

*Listeria monocytogenes* is a bacterium common in the environment that is capable of causing serious human disease. Listeriosis, the general name given to a variety of illnesses caused by *L. monocytogenes*, is almost always caused by consumption of food contaminated with this organism. While most healthy people do not get severe forms of listeriosis, certain populations are at risk for serious illness. Groups at risk include fetuses of pregnant women, newborns, the elderly, and people with weakened immune systems due to chronic illnesses or treatment of illnesses, such as AIDS or cancer. Less severe cases of listeriosis may result in flu-like symptoms that can include fever, muscle aches, and occasionally gastrointestinal symptoms such as nausea or diarrhea. More severe forms of listeriosis result from the organism infecting the blood (septicemia) and ultimately the nervous tissue or brain (meningitis and encephalitis). Ensuing symptoms include headache, stiff neck, confusion, loss of balance or convulsions and possibly death in high-risk individuals. While a *Listeria* infection during pregnancy may be asymptomatic or only cause flu-like symptoms in the mother, it can lead to severe infection of the newborn, premature delivery, spontaneous abortion or stillbirth. Illness can begin 2-8 weeks after consuming contaminated food, which makes it difficult to trace to the source.

#### **Why has *Listeria monocytogenes* become so important to the food and dairy industry?**

In the United States, an estimated 2,500 persons become seriously ill with listeriosis each year, with a fatality rate of approximately 20-30%. The fact that this foodborne bacterial infection has such a high mortality rate makes it an important concern of the food industry. Since the early 1980's, *L. monocytogenes* has been implicated in several major foodborne outbreaks in North America. In 1981, coleslaw was implicated in a Canadian outbreak resulting in 41 cases and 11 deaths. In 1983, pasteurized milk was the probable vehicle for an outbreak in Massachusetts, with 49 confirmed cases and 14 deaths. A third major outbreak associated with a Mexican-style soft cheese occurred in 1985 in California, with 142 cases and 48 deaths. In response to these outbreaks, the USDA and FDA established a "zero" tolerance policy for *L. monocytogenes* in ready-to-eat products, meaning that *L. monocytogenes* is not allowed at detectable levels in foods that will be consumed without cooking. The combined regulatory and industry response appears to have reduced the frequency of major foodborne outbreaks of listeriosis. However, a listeriosis outbreak linked to hot dogs and deli meats occurred in 1998-99 (approx. 100 cases with 21 deaths) and additional subsequent outbreaks have reemphasized the importance of *L. monocytogenes* as a foodborne pathogen. In particular, recent listeriosis outbreaks linked to dairy products (Hispanic-style cheese and pasteurized milk in Massachusetts in Fall 2007) serve as a reminder of the importance of controlling this pathogen in the dairy industry.

#### **Where is *Listeria monocytogenes* found?**

*L. monocytogenes* is widespread in the environment and has been isolated from water, soil, dust, plants, animal feed, feces and sewage and has been associated with mammals, birds and possibly fish. Many animals, including dairy cows, can carry the organism in their intestinal tract without becoming sick. Raw foods from which *L. monocytogenes* has been isolated include unpasteurized (raw) milk or foods made from unpasteurized milk, red meats, poultry, seafood, vegetables, and fruits. *Listeria* can be a common contaminant in the dairy environment, both on the farm and in the processing plant. On the farm, important sources include manure and improperly fermented silage. Though rare, the bacterium is also a cause of mastitis. Various studies have found from 2-6% of the raw milk samples tested contained *Listeria monocytogenes*. In the dairy plant, *Listeria* has been isolated from a variety of sites, although it is most frequently found in moist environments or areas with condensed or standing water or milk, including drains, floors, coolers, conveyors and case washing areas.

## Does *Listeria monocytogenes* survive pasteurization?

Pasteurization of milk is effective in destroying *L. monocytogenes*. However, post-pasteurization contamination can occur within the processing plant. *Listeria monocytogenes* is capable of growing at refrigeration temperatures. Therefore, even very low numbers of *L. monocytogenes* in processed dairy products can multiply to dangerous levels, despite proper refrigeration. The dairy industry's trend toward production of refrigerated products with longer shelf lives further exacerbates this problem.

## How can contamination with *Listeria monocytogenes* be prevented?

The Pasteurized Milk Ordinance and other food regulations are designed to protect the safety and quality of dairy products, so adherence to these regulations is critical. Dairy processors should focus attention on preventing *Listeria monocytogenes* contamination in the processing environment. Processors should:

- Segregate raw milk handling areas and equipment (e.g., brushes, gaskets, fittings, piping, tanks) from areas and equipment used for pasteurized product; i.e., prevent cross-contamination of raw to pasteurized milk. **On-farm processors** must enforce restrictions and procedures that prevent cross-contact of the dairy farm environment with the processing environment (e.g., different workers; shower & change of clothes/boots, controlled traffic).
- Restrict unauthorized persons from the processing area, including truck drivers, receivers and raw product handlers. Milk haulers and others who have been on the farm should not be allowed in the processing area as they are likely to carry contaminants on their boots and clothing.
- Ensure that separators/clarifiers are properly cleaned and maintained and that they desludge directly to a drain. Somatic cells concentrated in separator/clarifier sludge can contain large numbers of *Listeria*.
- Develop an environmental cleaning, sanitizing and monitoring program that includes plant and cooler floors, drains, milk case handling areas and equipment and piping exteriors. Monitoring programs should include regular testing of environmental samples for *L. monocytogenes* or *Listeria* spp. with a clear plan of follow-up actions that will occur if samples test positive for *L. monocytogenes* or *Listeria* spp.
- Keep all brushes and equipment used for environmental cleaning separate from food contact brushes and equipment. Mark or color code equipment and brushes (e.g., red for raw, blue for pasteurized, purple for environmental, black for drains). Brushes used for drains should be used only for that purpose.
- Prevent water or milk from becoming stagnant on plant floors. All floors should slope to nearby drains. All drains should be free-flowing and cleaned and sanitized on a routine basis. Repair floors where cracked.
- Avoid the creation of aerosols during processing, especially in the milk storage and packaging areas. Aerosols can carry harmful bacteria that can contaminate pasteurized product. Do not use high-pressure to clean drains.
- Validate daily that cleaning, sanitizing and maintenance of milk processing, storage and packaging equipment is effective and performed in a manner that prevents post-processing contamination.
- Avoid hand contact with milk contact surfaces that have been cleaned and sanitized. If it is necessary to disassemble equipment during processing, clean and re-sanitize before it is reassembled and put back to use.
- Provide adequate training and guidance for all workers in personal health and hygiene, Good Manufacturing Practices (GMP's) and plant sanitation procedures. Cleaning and sanitizing procedures are important activities that should not be delegated to any employee without proper training.
- Develop a HACCP-based program integrating prevention, validation, and an action plan for possible program deviations including well defined procedures for product recalls.

## Should you test for *Listeria* in your dairy plant?

Environmental testing to validate environmental cleaning programs is highly recommended. Testing of finished dairy products should be conducted when required by clients or to validate a new process. *Listeria* testing should be done by an outside or off-sight laboratory to avoid potential propagation in the plant environment.

## More information:

If you have questions about listeriosis, *L. monocytogenes*, environmental sampling programs or how to prevent *Listeria* contamination, please contact Martin Wiedmann ([mw16@cornell.edu](mailto:mw16@cornell.edu) or 607-254-2838).

**References:** CDC Listeriosis – General: <http://www.cdc.gov/nczved/divisions/dfbmd/>  
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