Chapter 15: *Listeria monocytogenes*

Potential Food Safety Hazard

The genus *Listeria* includes 6 different species (*L. monocytogenes*, *L. ivanovii*, *L. innocua*, *L. welshimeri*, *L. seeligeri*, and *L. grayi*). Both *L. ivanovii* and *L. monocytogenes* are pathogenic for mice, but only *L. monocytogenes* is consistently associated with human illness (Hitchins, 1998). *L. monocytogenes* is widespread in nature and has been isolated from soil, vegetation, marine sediments and water. In the early 1900s, *L. monocytogenes* was recognized as a bacterium that caused illness in farm animals. More recently, it has been identified as the cause of listeriosis in humans. Most healthy individuals are either unaffected by *L. monocytogenes* or experience only mild flu-like symptoms. Victims of severe listeriosis are usually immunocompromised. Those at highest risk include cancer patients, individuals taking drugs that affect the body's immune system, alcoholics, pregnant women, persons with low stomach acidity and individuals with AIDS. Severe listeriosis can cause meningitis, abortions, septicemia and a number of other maladies, some of which may lead to death.
The greatest threat of listeriosis is from ready-to-eat products that do not require further cooking at home. *L. monocytogenes* in raw food that will be cooked before consumption is less of a concern to the food industry since the bacteria are killed during cooking. *L. monocytogenes* has been isolated from raw fish, cooked crabs, raw and cooked shrimp, raw lobster, surimi and smoked fish (Ward et al., 1997).

**Control Measures**

Hazards from *L. monocytogenes* can be prevented by thoroughly cooking seafood and by preventing cross-contamination once the seafood is cooked. Since the infective dose of *L. monocytogenes* is thought to be small, time/ temperature abuse of food products may not be necessary to result in illness (Ward et al., 1997).

**Guidelines**

**FDA Guidelines**

**FDA & EPA safety levels in regulations and guidance.**

**Canadian Food Inspection Agency Bacteriological Guidelines for Fish and Fish Products**

**Growth**

**Table A-1.** Limiting conditions for pathogen growth.

**Heat Resistance**

**Heat resistance of *L. monocytogenes*.**

<table>
<thead>
<tr>
<th>Temp. (°C)</th>
<th>D-Value (°F)</th>
<th>Medium</th>
<th>Reference</th>
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<tr>
<td>50</td>
<td>122</td>
<td>34.48</td>
<td>Blue crabmeat</td>
</tr>
<tr>
<td>50</td>
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<td>40.43</td>
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<tr>
<td>51.6</td>
<td>125</td>
<td>97.0</td>
<td>Lobster</td>
</tr>
<tr>
<td>54.4</td>
<td>130</td>
<td>55.0</td>
<td>Lobster</td>
</tr>
<tr>
<td>55</td>
<td>131</td>
<td>9.18</td>
<td>Blue crabmeat</td>
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<td>55</td>
<td>131</td>
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<td>Blue crabmeat</td>
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<td>55</td>
<td>131</td>
<td>10.23</td>
<td>Crawfish tail meat</td>
</tr>
<tr>
<td>56</td>
<td>132.8</td>
<td>48.09</td>
<td>Mussels, brine soaked</td>
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<tr>
<td>57.2</td>
<td>135</td>
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<tr>
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<td>--------------</td>
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<tr>
<td>58</td>
<td>136.4</td>
<td>16.25</td>
<td>Mussels, brine soaked</td>
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<tr>
<td>58</td>
<td>136.4</td>
<td>10.73</td>
<td>Salmon</td>
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<tr>
<td>58</td>
<td>136.4</td>
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<td>Cod</td>
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<tr>
<td>59</td>
<td>138.2</td>
<td>9.45</td>
<td>Mussels, brine soaked</td>
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<td>60</td>
<td>140</td>
<td>2.39</td>
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<td>1.31</td>
<td>Blue crabmeat</td>
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<td>2.61</td>
<td>Blue crabmeat</td>
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<tr>
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<td>140</td>
<td>1.98</td>
<td>Crawfish tail meat</td>
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<tr>
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<td>5.49</td>
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<tr>
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<td>4.48</td>
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<tr>
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<td>140</td>
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<td>62</td>
<td>143.6</td>
<td>1.85</td>
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<td>145</td>
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<td>65</td>
<td>149</td>
<td>0.87</td>
<td>Salmon</td>
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<tr>
<td>65</td>
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<tr>
<td>68</td>
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<td>0.15</td>
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<tr>
<td>70</td>
<td>158</td>
<td>0.03</td>
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</table>

Z-values: lobster meat 5.0ºc, blue crabmeat 8.40ºc in trypticase soy agar, crawfish tail meat 5.5ºc, mussels 4.25ºc, salmon 5.6ºc, cod 5.7ºc.

**Analytical Procedures**

**BAM: Detection and enumeration of *L. monocytogenes* (US FDA)**

**Food sampling and preparation of sample homogenate (US FDA)**

**Serodiagnosis of *Listeria monocytogenes* (US FDA)**

**Summary of Methods to detect the presence of *Listeria spp.* and *Listeria monocytogenes* (HC)**

**Other analytical methods**
- *Listeria monocytogenes* in Milk and Dairy Products: Selective Enrichment and Isolation Method (AOAC, 1995a)
- *Listeria* Species: Biochemical Identification Method (Vitek GPI and GNI) (AOAC, 1995b)
- *Listeria* Species: Biochemical Identification Method (MICRO-ID Listeria) (AOAC, 1995f)

### Commercial Test Products

**Commercial test products for *L. monocytogenes***.

<table>
<thead>
<tr>
<th>Test</th>
<th>Analytical Technique</th>
<th>Approx. Total Test Time</th>
<th>Supplier</th>
</tr>
</thead>
<tbody>
<tr>
<td>AccuPROBE® <em>Listeria</em> monocytogenes Culture Identification Test</td>
<td>Nucleic acid hybridization</td>
<td>18-48 h</td>
<td>Gen-Probe Web: <a href="http://www.gen-probe.com">www.gen-probe.com</a></td>
</tr>
<tr>
<td>API <em>LISTERIA</em> [Used to identify <em>Listeria</em> spp.]</td>
<td>Biochemical reactions</td>
<td>18-24 h</td>
<td>bioMérieux Inc. Web: <a href="http://www.biomerieux.com">www.biomerieux.com</a></td>
</tr>
<tr>
<td>Assurance <em>Listeria</em> EIA² [Used to identify <em>Listeria</em> spp. including <em>L. monocytogenes</em>]</td>
<td>Enzyme immunoassay</td>
<td>50 h</td>
<td>BioControl Systems, Inc. Contact: Robin Forgey 12822 SE 32nd St. Bellevue, WA 98005 Phone: 800/245-0113; 425/603-1123 E-mail: <a href="mailto:info@rapidmethods.com">info@rapidmethods.com</a> Web: <a href="http://www.rapidmethods.com">www.rapidmethods.com</a></td>
</tr>
<tr>
<td>BAX® for Genus <em>Listeria</em></td>
<td>Polymerase chain reaction</td>
<td>45 h</td>
<td>Qualicon, Inc. P.O. Box 80357 Wilmington, DE 19880-0357 Phone: 800/863-6842; 302/695-9400 E-mail: <a href="mailto:info@qualicon.com">info@qualicon.com</a> Web: <a href="http://www.qualicon.com">www.qualicon.com</a></td>
</tr>
<tr>
<td>BAX® for Screening/<em>L. monocytogenes</em></td>
<td>Polymerase chain reaction</td>
<td>45 h</td>
<td>Qualicon, Inc. P.O. Box 80357 Wilmington, DE 19880-0357 Phone: 800/863-6842; 302/695-9400 E-mail: <a href="mailto:info@qualicon.com">info@qualicon.com</a> Web: <a href="http://www.qualicon.com">www.qualicon.com</a></td>
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<tr>
<td>Method</td>
<td>Duration</td>
<td>Company</td>
<td>Contact Information</td>
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<tr>
<td>---------------------------------------------</td>
<td>----------</td>
<td>----------------------------------</td>
<td>-----------------------------------------------------------------------------------------------------------------------------------------------------</td>
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</tbody>
</table>
| Chromogenic Listeria                       | 42-66 h  | Biomedix                         | Contact: Claver Bundac  
1105 #F North Golden Springs Dr.  
Diamond Bar, CA 91765  
Phone: 800/674-8648 #4282;  
909/396-0244  
E-mail: cb4biomedx@aol.com |
| Dynabeads anti-Listeria                    | 48 h     | Dynal Inc.                       | Contact: Technical Service  
5 Delaware Dr.  
Lake Success, NY 1042  
Phone: 516/326-3270  
E-mail: techserv@dynalusa.attmail.com  
Web: www.dynal.no/ |
| EIAFoss Listeria                           | 48 h     | Foss North America, Inc. 7682 Executive Dr.  
Eden Prairie, MN 55344  
Phone: 612/974-9892  
E-mail: sales@fossnorthamerica.com  
Web: www.fossnorthamerica.com |
| GENE-TRAK Listeria monocytogenes Assay      | 48 h     | Neogen Corporation 620 Lesher Pl. Lansing, MI 48912  
Phone: 517/372-9200  
E-mail: NeogenCorp@aol.com  
Web: www.neogen.com/genetrakback.htm |
| GENE-TRAK Listeria Species Assay²          | 48 h     | Neogen Corporation 620 Lesher Pl. Lansing, MI 48912  
Phone: 517/372-9200  
E-mail: NeogenCorp@aol.com  
Web: www.neogen.com/genetrakback.htm |
| ISO-GRID Method for Listeria spp.          | 24 h     | Neogen Corporation 620 Lesher Pl. Lansing, MI 48912  
Phone: 517/372-9200  
E-mail: NeogenCorp@aol.com  
Web: www.neogen.com/isogridgen.htm |
| Listeria Culture                           | 24 h     | Contamination Sciences LLC  
Contact: Robert Steinhauser  
4230 East Towne Blvd., Suite 191 Madison, WI 53704  
Phone: 608/825-6125  
E-mail: bsteinha@contam-sci.com  
Web: www.contam-sci.com |
| Listeria Rapid EIA                         | 42 h     | Oxoid, Inc.                      |                                                                                                                                                     |
| Test² | [Used to identify *Listeria* spp. including *L. monocytogenes*] | Contact: Jim Bell  
217 Colonnade Rd.  
Nepean, Ontario K2E 7K3  
Canada  
Phone: 613/226-1318  
E-mail: jbell@oxoid.ca |
|---|---|---|
| *Listeria*-Tek™² | ELISA | 48 h  
Organon Teknika Corp.  
100 Akzo Ave.  
Durham, NC 27712  
Phone: 800/654-0331; 919/620-2000  
E-mail: casey@orgtek.com |
| ListerTest™² | Immunomagnetic separation | 24 h  
Vicam, L.P.  
Contact: Brian Kraus  
313 Pleasant St.  
Watertown, MA 02472  
Phone: 800/338-4381  
E-mail: vicam@vicam.com  
Web: www.vicam.com |
| Microbact 12L² | Biochemical identification system | 4-24 h  
BioControl Systems, Inc.  
Contact: Robin Forgey  
12822 SE 32nd St.  
Bellevue, WA 98005  
Phone: 800/245-0113; 425/603-1123  
E-mail: info@rapidmethods.com  
Web: www.rapidmethods.com |
| MICRO-ID Listeria² | Latex agglutination | 24 h  
Remel  
Contact: Customer Service  
12076 Santa Fe Dr.  
Lenexa, KS 66206  
Phone: 800/255-6730; 913/888-0939  
E-mail: remel@remelinc.com  
Web: www.remelinc.com |
| Probelia PCR System | Polymerase chain reaction | 30 h  
BioControl Systems, Inc.  
Contact: Robin Forgey  
12822 SE 32nd St.  
Bellevue, WA 98005  
Phone: 800/245-0113; 425/603-1123  
E-mail: info@rapidmethods.com  
Web: www.rapidmethods.com |
| Reveal® for *Listeria*² | Sandwich ELISA | 48 h  
Neogen Corporation  
620 Lesher Pl.  
Lansing, MI 48912  
Phone: 517/372-9200  
E-mail: NeogenCorp@aol.com  
Web: www.neogen.com |
| TECRA Listeria Visual Immuno Assay² | ELISA | 48 h  
International BioProducts  
Contact: Bob Ward  
14780 NE 95th St. |
<table>
<thead>
<tr>
<th>Test Name</th>
<th>Assay Type</th>
<th>Incubation Time</th>
<th>Manufacturer</th>
<th>Contact Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transia Plate Listeria</td>
<td>ELISA</td>
<td>48 h</td>
<td>Diffchamb AB</td>
<td>FO Petersons Gata 32 SE-421 31 Västra Frölunda, Sweden Phone: +46 -31-742 33 50 E-mail: <a href="mailto:market.dept@diffchamb.se">market.dept@diffchamb.se</a> Web: <a href="http://www.diffchamb.se">www.diffchamb.se</a></td>
</tr>
<tr>
<td>Transia Plate Listeria</td>
<td>ELISA</td>
<td>45 h</td>
<td>Diffchamb AB</td>
<td>FO Petersons Gata 32 SE-421 31 Västra Frölunda, Sweden Phone: +46 -31-742 33 50 E-mail: <a href="mailto:market.dept@diffchamb.se">market.dept@diffchamb.se</a> Web: <a href="http://www.diffchamb.se">www.diffchamb.se</a></td>
</tr>
<tr>
<td>Vidas LIS²</td>
<td>Enzyme linked fluorescent assay</td>
<td>48 h</td>
<td>bioMérieux Inc.</td>
<td>Web: <a href="http://www.biomerieux.com">www.biomerieux.com</a></td>
</tr>
<tr>
<td>Vidas LMO</td>
<td>Enzyme linked fluorescent assay</td>
<td>48 h</td>
<td>bioMérieux Inc.</td>
<td>Web: <a href="http://www.biomerieux.com">www.biomerieux.com</a></td>
</tr>
<tr>
<td>VIP for Listeria²</td>
<td>Visual immunoprecipitate</td>
<td>48 h</td>
<td>BioControl Systems, Inc.</td>
<td>Contact: Robin Forgey 12822 SE 32nd St. Bellevue, WA 98005 Phone: 425/603-1123 E-mail: <a href="mailto:info@rapidmethods.com">info@rapidmethods.com</a> Web: <a href="http://www.rapidmethods.com">www.rapidmethods.com</a></td>
</tr>
</tbody>
</table>

1 Includes enrichment
2 AOAC Approved

References


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