

Chapter 10: *Bacillus Cereus*

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Potential Food Safety Hazard

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Food poisoning caused by *Bacillus cereus* may occur when foods are prepared and held without adequate refrigeration for several h before serving. *B. cereus* is an aerobic spore forming bacterium that is commonly found in soil, on vegetables, and in many raw and processed foods. Consumption of foods that contain $\geq 10^6$ *B. cereus*/g may result in food poisoning. Foods incriminated in past outbreaks include cooked meat and vegetables, boiled or fried rice, vanilla sauce, custards, soups, and raw vegetable sprouts. Two types of illness have been attributed to the consumption of foods contaminated with *B. cereus*. The first and better known is characterized by abdominal pain and diarrhea; it has an incubation period of 4-16 h and symptoms that last for 12-24 h. The second, which is characterized by an acute attack of nausea and vomiting, occurs within 1-5 h after consumption of contaminated food; diarrhea is not a common feature in this type of illness (Rhodehamel and Harmon, 1998).

Control Measures

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B. cereus is a common food contaminant. Effective control measures depend on destruction by a heat process and temperature control to prevent spore germination and multiplication of vegetative cells in cooked, ready-to-eat foods. Measures to reduce or eliminate the threat of food poisoning by *B. cereus* include: 1) Avoid preparing food too far in advance of planned service, 2) Avoid holding cooked foods at room temperature, 3) Use quick chill methods to cool foods below 7.2 °C (45°F) within 4 h of preparation; store in shallow pans/small quantities with the food less than 4 inches (10.2 cm) deep; if food is especially thick (e.g., refried beans), store no

more than 3 inches [7.6 cm] deep). Hold/store hot foods above 60°C (140°F) until served, and 5) Reheat foods rapidly to 74°C (165°F) or above (Kramer and Gilbert, 1989; Reed, 1994).

FDA Guidelines

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FDA to assess situations on a case by case basis.

Growth

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[Table A-1. Limiting conditions for pathogen growth.](#)

Heat Resistance

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***B. cereus* spore heat resistance.**

Temperature		D-Values (min.)	Medium	References
(°C)	(°F)			
90	194	21-137	Water	Gilbert et al., 1974
95	203	5-36	Water	Gilbert et al., 1974
100	212	6.7-8.3	Water	Gilbert et al., 1974

Analytical Procedures

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[Food sampling and preparation of sample homogenate](#) (USFDA)

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[Definition of Terms](#) (HC Appendix A); [Collection of samples](#) (HC Appendix B);

[Supplement to All Methods in the HC Compendium: General Microbiological Guidance](#) (HC Appendix I) [General Microbiological guidance on Pre-warming of Broths in All Qualitative Methods in the \[HC\] Compendium](#) (HC Supplement to

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[Bacillus cereus](#) (USFDA)

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[Isolation and enumeration of *Bacillus cereus* in foods](#) (HC MFLP-42)

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[Bacillus cereus diarrheal enterotoxin](#) (USFDA)

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Other analytical procedures

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- *Bacillus cereus* in foods: Enumeration and confirmation microbiological methods (AOAC, 1995a).
- Differentiation of members of *Bacillus cereus* group: Microbiological method (AOAC, 1995b).

Commercial Test Products

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Commercial test products for *B. cereus*.

Test Kit	Analytical Technique	Approx. Total Test Time ¹	Supplier
<i>Bacillus cereus</i> Test [A presumptive test for <i>Bacillus cereus</i> .]	Uses prepared traditional media	24 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
BCET-RPLA TD950 [Used to identify <i>B. cereus</i> diarrheal enterotoxin]	Reversed passive latex agglutination	24 h (food) 48 h (bacterial culture)	Oxoid, Inc. Contact: Jim Bell 217 Colonnade Rd. Nepean, Ontario K2E 7K3 Canada Phone: 613/226-1318 E-mail: jbelle@oxoid.ca
CRA Bacillus diarrheal Enterotoxin VIA [Used to detect GDE toxin and <i>Bacillus</i> spp. capable of producing enterotoxin]	ELISA	4-24 h	InternationalBioProducts Contact: Mike Yeager 14780 NE 95th St. Redmond, WA 98052 Phone: 425/861-4918 E-mail: myeager@intlbioproducts.com Web: intlbioproducts.com

¹Includes enrichment

References

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