ENVIRONMENTAL CONDITIONS FOR PATHOGENIC BACTERIAL GROWTH

Microorganism	Temperature range for growth	pH range for growth	Minimal water activity for growth	Growth (doubling time)	Death rate (90% reduction time)
1. Infective Microorganisms					
Yersinia enterocolitica	32° - 111°F 0° - 44°C	pH 4.6 - 9.0			0.24 - 0.96 min. @ 145°F, 62.8°C
Listeria monocytogenes	32° - 112°F 0° - 44°C	pH 4.5 - 9.5		7.5 days @ 32°F, 0°C 41 min. @ 95°F, 35°C	4.83 min @ 136°F, 57.8°C 2.85 min. @ 140°F, 60°C
Vibrio parahaemolyticus	41° - 109.4°F 5° - 43°C	pH 4.8 - 11.0	a_w 0.937		.08 - 48.2 min. @ 116°F, 47°C 1.7 min. @ 140°F, 60°C
Salmonella spp.	35.6° - 114°F 2.0° - 45.6°C	pH 4.1 - 9.0	a_w 0.92		5.3 - 48.3 min. @ 134.6°F, 57°C
Campylobacter jejuni	90° - 113°F 32° - 45°C	pH 4.9 - 8.0		50 min. @ 107.6°F, 42°C	12 - 21 sec. @ 137°F, 58.3°C
2. Toxin Producers or Spore-formers					
Clostridium botulinum, Type E and other non-proteolytic strains	38° - 113°F 3.3° - 45°C	pH 5.0 - 9.0	a_w 0.97		Spores: 0.49 - 0.74 min. @ 180°F, 82.2°C Toxin: 5 min. @ 185°F, 85°C
Staphylococcus aureus	43.8° - 122°F 6.5° - 50°C	pH 4.5 - 9.3	a_w 0.83		Vegetative cells: 5.25 - 7.82 min @ 140°F, 60°C
Toxin production	50° - 114.8°F 10° - 46°C	pH 5.15 - 9.0	a_w 0.86		Toxin: 134.2 min. @ 210°F, 98.9°C
Bacillus cereus	39.2° - 122°F 4.0° - 50°C	pH 4.35 - 9.3	a_w 0.912	29 min. @ 73.4°F, 23°C	Vegetative cells: 1 min. @ 140°F, 60°C Spores: 2.7 - 3.1 min. @ 212°F, 100°C Diarrheal toxin: 5 min. @ 133°F, 56.1°C Emetic toxin: Stable 90 min. at 258.8°F, 126°C
Clostridium botulinum, Type A and proteolytic B strains	50° - 118°F 10° - 47.8°C	pH 4.6 - 9.0	a_w 0.94	1.2 hours @ 68°F, 20°C	Spores: 0.14 - 0.23 min. @ 250°F, 121.1°C Toxin: 5 min. @ 185°F, 85°C
Clostridium perfringens	59° - 127.5°F 15° - 52.3°C	pH 5.0 - 8.3	a_w 0.95	7.2 min 105.8°F, 41°C	Vegetative cells: 7.2 min @ 138°F, 59°C Spores: 26 - 31.4 min. @ 210°F, 98.9°C

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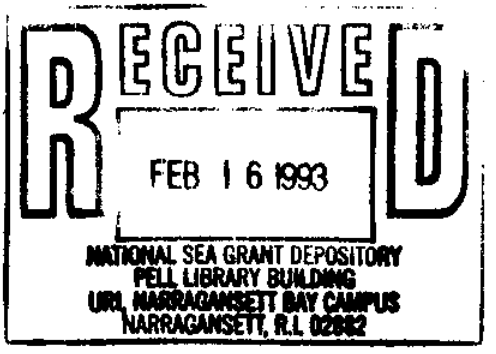
Robert J. Price, Ph.D., Extension Specialist, Seafood Products
Pamela D. Tom, M. Sc., Program Representative
Food Science & Technology, University of California, Davis, California 95616-8598



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