Chapter 9: Aerobic Plate Count

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Potential Food Safety Hazard

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The aerobic plate count (APC) indicates the level of microorganisms in a product (Maturin and Peeler, 1998). Aerobic plate counts on fish and fishery products generally do not relate to food safety hazards, but sometimes can be useful to indicate quality, shelf life and post heat-processing contamination. Fresh fish and fishery products often have an APC of 10^4-10^5/g, although there are examples of seafoods with an APC of 10^6-10^8/g without objectionable quality changes (Nickelson and Finne, 1992).

The plating medium (nutrient source) used in an APC can affect the number and types of bacteria isolated because of differences in nutrient and salt requirements of the various microorganisms. For many fish and fishery products, a plate incubation temperature of 25ºC (77ºF) produces

significantly higher numbers of bacteria than incubation at 35ºC (95ºF) (Nickelson and Finne, 1992).

FDA Guidelines

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FDA Compliance Policy Guides

Product	Guideline	Reference
Raw breaded shrimp	Aerobic plate counts (35ºC [95ºF]) – The mean log of 16 units of finished product breaded shrimp collected prior to freezing is greater than 5.00 (i.e., geometric mean greater than 100,000/g) and exceeds the mean log of 16 units of stock shrimp by more than twice the standard error of their difference (2 SED)	FDA, 1996a

Table #A-5. **FDA & EPA safety levels in regulations and guidance.**

State Guidelines

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State APC Guidelines.

State	Product	Maximum APC
Alabama	Oysters, fresh or frozen	5×10^5/g
Alaska	Oysters, clams, and mussels	5×10^5/g
	Oysters, clams, and mussels: in shell or shucked, but not eviscerated	5×10^5/g
	Oysters, clams, and mussels: eviscerated	1×10^5/g
Arizona	Clams, mussels, and oysters	5×10^5/g
Arkansas	-	
California	Oysters, clams, and mussels	5×10^5/g
Colorado	Oysters, clams, mussels, and scallops	5×10^5/g
Connecticut	Oysters, clams, and mussels	5×10^5/g
Delaware	Clams, mussels, or other mollusks, fresh or frozen	5×10^5/g
Florida	Blue crab	10^5/g
	Shellfish	5×10^5/g
Georgia	Clams, mussels, and	5×10^5/g

	oysters - fresh or frozen	
	Fried clams, frozen	10^4/g
	Scallops, fried, frozen	10^4/g
	Scallops, breaded, frozen	10^4/g
	Crabmeat, fresh cooked	10^4/g
	Deviled crab, frozen, cooked	10^4/g
	Deviled crab, fresh, uncooked	10^6/g
	Shrimp, peeled, cooked	10^5/g
	Shrimp, breaded, frozen, raw	10^6/g
	Fish, frozen, breaded, fried	2.5×10^4/g
	Fish, frozen, breaded, raw	10^5/g
	Fried fish cakes, frozen	10^4/g
Hawaii	Oysters, clams, mussels, fresh or frozen	5×10^5/g
Idaho	-	-
Illinois	-	-
Indiana	-	-
Iowa	-	-
Kansas	-	-
Kentucky	Oysters, clams, scallops, shrimp, fresh or frozen	5×10^5/g
Louisiana	-	-
Maine	-	-
Maryland	Fresh crabmeat	10^5/g
	Pasteurized crabmeat	2.5×10^4/g
	Oysters, clams, mussels, fresh or frozen	5×10^5/g
Massachusetts	Oysters, clams, mussels, fresh or frozen	5×10^5/ml
Michigan	-	-
Minnesota	-	-
Mississippi	Oysters, clams, mussels, fresh or frozen	5×10^5/g
Missouri	Oysters, clams, mussels, fresh or frozen	5×10^5/100ml
	Foods	1.5×10^6/g
Montana	-	-
Nebraska	Oysters, clams, mussels, fresh or frozen	5×10^5/g
	Deli foods (shrimp salad, etc.)	10^5/g
Nevada	-	-

New Hampshire	Oysters, softshell clams, fresh or frozen	5×10^5/g
New Jersey	Oysters, clams, mussels, fresh or frozen	5×10^5/g
	"Potentially hazardous" (tuna, shrimp salad)	10^4/g
New Mexico	-	-
New York	-	-
North Carolina	Shellfish	5×10^5/g
	Crustacea, fresh	10^4/g
	Crustacea, pasteurized	3×10^3/g
North Dakota	-	-
Ohio	-	-
Oklahoma	-	-
Oregon	Oysters, clams, mussels, fresh or frozen	5×10^5/100g
Pennsylvania	-	-
Rhode Island	Oysters, clams, mussels, fresh or frozen	5×10^5/g
	Fresh seafood	10^6/g
	Smoked fish	10^5/g
South Carolina	Fresh cooked blue crabmeat	10^5/g
	Pasteurized blue crabmeat	2.5×10^4/g
	Oysters, clams, mussels, fresh or frozen	5×10^5/g
South Dakota	-	-
Tennessee	-	-
Texas	Crabmeat	10^5/g
	Oysters, clams, mussels, fresh or frozen	5×10^5/g
Utah	-	-
Vermont	-	-
Virginia	Fresh blue crabmeat	10^5/g
	Pasteurized blue crabmeat	3×10^3/g
	Shellfish - shucked or in the shell	5×10^5/g
Washington	Molluscan shellfish (Oysters, clams, mussels, fresh or frozen)	5×10^5/g
West Virginia	-	-
Wisconsin	-	-
Wyoming	-	-

(AFDO, 1998)

Recommended Microbiological Limits

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ICMSF

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Recommended microbiological limits for fish and fishery products (ICMSF, 1986).

Product	n[1]</font	c[2]</font	Bacteria/g or cm^2	
			m[3]	*M*[4]
Fresh and frozen fish and cold-smoked fish	**5**	**3**	**5 x 10^5**	**10^7**
Precooked breaded fish	**5**	**2**	**5 x 10^5**	**10^7**
Frozen raw crustaceans	**5**	**3**	**10^6**	**10^7**
Frozen cooked crustaceans	**5**	**2**	**5 x 10^5**	**10^7**
Cooked, chilled, and frozen crabmeat	**5**	**2**	**10^5**	**10^6**
Fresh and frozen bivalve molluscs	**5**	**0**	**5 x 10^5**	**-**

[1] Number of representative sample units.
[2] Maximum number of acceptable sample units with bacterial counts between m and M.
[3] Maximum recommended bacterial counts for good quality products.
[4] Maximum recommended bacterial counts for marginally acceptable quality products.

Plate counts below "m" are considered good quality. Plate counts between "m" and "M" are considered marginally acceptable quality, but can be accepted if the number of samples does not exceed "c." Plate counts at or above "M" are considered unacceptable quality (ICMSF, 1986).

Analytical Procedures

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Food sampling and preparation of sample homogenate (USFDA) Top

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 Appendix I) Top

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Enumeration of total aerobic bacteria in food products and food ingredients using 3M™ Petrifilm™ aerobic count plates (HC MFHPB-33) Top

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Most probable number from serial dilutions (USFDA) Top

Calculation of the most probable number (MPN) of Growth Units for HGMF Methods (HC Appendix C) Top

Calculation of the Most Probable Number (MPN) (HC Appendix D)

Other APC Methods Top

- Aerobic plate count in foods: Dry rehydratable film (AOAC, 1995a).
- Aerobic plate count in foods: Hydrophobic grid filter method (AOAC, 1995b).
- Aerobic plate count: Pectin gel method (AOAC, 1995c).

Commercial Test Products Top

AOAC Research Institute Approved Performance Tested Methods℠ - Microbiology

References Top

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