K-STATE RESEARCH AND EXTENSION

Kansas State University

FOCUS ON PROCESSED AGRICULTURAL PRODUCTS

VOLUME 11 ISSUE 3

DECEMBER 2000

INSIDE THIS ISSUE:

Happy Holidays!

Dr. Fadi Aramouni and his staff are in Call Hall: (785) 532-1668

Focus on Bacteria

Clostridium botulinum

The concern: Growth of the bacterium *Clostridium botulinum* in canned food may cause botulism — a deadly form of foodborne illness. These bacteria exist either as spores or as vegetative cells. The spores, which are comparable to plant seeds, can survive harmlessly in soil and water for many years. When ideal conditions exist for growth, the spores produce vegetative cells which multiply rapidly and may produce a deadly toxin within 3 to 4 days of growth in an environment consisting of:

- a moist, low-acid food
- a temperature between 40 degrees F and 120 degrees F
- less than 2 percent oxygen

Botulinum spores are on most fresh food surfaces. Because these spores grow only in the absence of air, they are harmless on fresh foods.

The processing method: Whether food should be processed in a pressure canner or boiling-water canner to control botulinum, depends on the acidity of the food. Acidity may be natural, as in most fruits, or added, as in pickled foods and tomatoes. Low-acid canned foods contain too little acidity to prevent growth of these bacteria. Acid foods contain enough acidity to block their growth, or destroy them more rapidly when heated. The term "pH" is a measure of acidity; the lower its value, the more acid the food. The acidity level in foods can be increased by adding lemon juice, citric acid or vinegar. Most "thermally processed" foods that are received for analysis at the KSU / Kansas Value-Added Foods Laboratory are tested for the pH value to ensure the products are acid foods with a pH of 4.6 or lower. [1]

The disease: Foodborne botulism results from eating food in which *Clostridium botulinum* has grown and produced neurotoxin. The toxin is absorbed and binds to nerve endings. It causes vomiting, diarrhea, fatigue, dizziness and headache. Later there is constipation, double vision and difficulty speaking and swallowing. Involuntary muscles become paralyzed. Cardiac and respiratory failure, and ultimately, death occurs. Today,

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Infantile Botulism

Infantile botulism, affecting infants under 14 months, is another type of botulism. This disease can occur after infants ingest bacterial spores which colonize and produce toxin in the intestinal tract. Spores have been found in honey and syrups and have been implicated in some cases of infantile botulism. Because of this, avoid feeding honey and corn syrup to infants.[2]

Brochure Now Available

A new brochure, *"Unmatched Innovation... from Concept to Consumer"* is a description of K-State value-added services for food, fiber, and meat processing operations. This publication is sponsored by K-State Research and Extension in cooperation with the Kansas Department of Commerce & Housing's Agriculture Products Development Division. For your free copy, please contact:

Tom B. Lindquist,
Kansas Value-Added Foods
Laboratory Manager
Phone: 785-532-1667
Fax: 785-532-3295
E-mail: *Tlindqui@oznet.ksu.edu*

Suggestions Please

If you have suggestions to improve the FOCUS Newsletter, or ideas for articles, please call: (785) 532-1667.

Kansas Value-Added Foods Lab

Nutrition facts, chemical analysis available from K-State

If you would like to send samples to our lab, please pack the items carefully to prevent breakage, and send to:

Tom B. Lindquist
Kansas State University
Animal Sciences & Industry
Room 222 Call Hall
Manhattan, KS 66506

If you request a nutrition facts panel along with the chemical analysis of your sample, the fee will be $93.80 per sample. This will include the chemical analysis, a copy-ready nutrition facts panel, and a review of your label. Please include the following with your sample: Product name and formula (in measurable amounts), name, company name, address, city, zip, phone (work and home) and anticipated container size. For more information, call: 785-532-1667.

Bacteria

Continued from page 1

because of rapid treatment, botulism is fatal in fewer than 10 percent of the cases.

The organism: *C. botulinum* spores are widely distributed in soils, shore and bottom deposits of lakes and streams, gills and viscera of fish and seafood. They can be found on fruits and vegetables, as these items are often in contact with the soil.

Control: Conditions favoring growth and toxin production by *C. botulinum* include high moisture, low-salt, low-acid (pH greater than 4.6), low-oxygen foods such as canned or vacuum-packed products, and storage at room temperature. Foods commonly involved include canned vegetables, fish, meats, chili sauce, chili peppers, tomato relish and salad dressing.

The majority of outbreaks have been caused by home-processed foods. Other foods include foil-wrapped baked potatoes held at warm, not hot temperatures (above 140 degrees F); cooked onions also held at warm temperatures; and garlic in oil mixtures stored at room temperature.

C. botulinum spores can be found on fruits and vegetables, as these items are often in contact with the soil.

C. botulinum spores are heat resistant. Therefore, canned meat, poultry, fish and low-acid vegetables (i.e., corn, beans, spinach, beets) require pressure canning to achieve a high enough temperature (240-250 degrees F) for sufficient time to destroy the spores.

[1]*Penner, Karen P.* Clostridium botulinum *and Foodborne Illness. 1995. Food and Nutrition - 5. Kansas State University Research and Extension.*

[2]*Microorganisms and Foodborne Illness. Reference Guide For Kansas Food Processors. Kansas Department of Commerce and Housing's Agriculture Products Development Division and K-State Research and Extension. 1998.*

Client Corner

Question: *What type of heat process does my salsa need before bottling?*

Answer: First of all, the pH from our lab analysis of your product was 4.22, and the Water Activity (A_w) was 0.985 @ 24.8 degrees C. Water in food which is not bound to solutes can support the growth of bacteria, yeasts and molds (fungi). The term water activity (A_w) refers to this unbound water. The water activity scale extends from 0 (bone dry) to 1.0 (pure water), but most foods have a water activity level in the range of 0.2 for very dry foods to 0.99 for moist fresh foods. The risk of food poisoning must be considered in low acid foods (pH>4.6) with a water activity greater than 0.85 A_w. With your product having a pH of 4.22, it is considered an acidic product.

It is important to have clean facilities, and use good manufacturing practices when it comes to processing. You should be able to use the open kettle method when bottling your product. After all ingredients are combined, the product needs to be brought to at least 190-195 degrees F, fill the containers that have been sterilized (and are still hot), and use closures that have been sterilized in hot water (and are still hot). Additional processing in a boiling water bath for 10-15 minutes would improve the shelf-life of the product.

You will have to use a special lid (since your salsa is an acid food product) that has a resin inside (plastisol) that will soften in the hot water, and the lid will seal properly against the glass jar when the product cools and a vacuum is produced. (Inversion of the jar after capping will aid in the softening of the plastisol, and help to sterilize the lid surface.) When you order your closures, make sure you tell the supplier what you will be processing, and the technique you will be using.

Relationship Between pH, Water Activity and Acidified Food Regulations

		Registration and Processing Required	
pH (Final Equilibrium)	Water Activity (A_w)	Low Acid* (21 CFR 108.35/ 113)	Acidified (not naturally)** (21 CFR 108.25/114)
<4.5	≤0.85	no	no
<4.5	>0.95	no	yes
4.6	≤0.85	no	no
4.6	>0.85	no	yes
≥4.7	≤0.85	no	no
≥4.7	>0.85	yes	no

< = less than; > = greater than; ≤ = less than or equal to; ≥ = greater than or equal

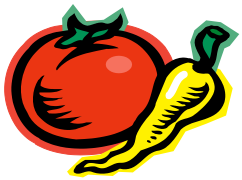
*** Low-Acid (21 CFR Part 108.35 & 113) A "yes" under this column defines the product as low-acid and requires registration of the processing plant and filing scheduled process information for that low-acid product. A "no" in this column means that registration of the processing plant or filing scheduled process information is not required.**

**** Acidified (21 CFR Part 108.25 &114) A "yes" under this column defines the product as acidified and that registration of the processing plant and filing scheduled process information is required. A "no" under this column means neither registration nor filing scheduled process information is required since the product is not acidified.**

Source: A Complete Course in Canning

Acidify Those Tomatoes

Making salsa or other tomato-based products with fresh tomatoes? If so, the tomatoes *must* be acidified. To ensure a safe acid level in whole, crushed, or juiced tomatoes, add 2 tablespoons of bottled lemon juice or 1 teaspoon of citric acid per quart of tomatoes. Add sugar to offset acid taste, if desired. Four tablespoons of a 5-percent acidity vinegar per quart may be used instead of lemon juice or citric acid. However, vinegar may cause undesirable flavor changes.



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FOCUS: On Processed Agricultural Products is published for Kansas agricultural processors to promote quality and value-added food products.

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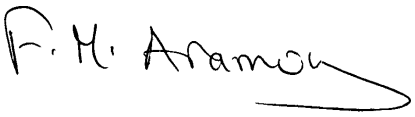

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New Lab Fees Set

The following lab fees have been adjusted, and are effective January 1, 2001

Kansas Value-Added Foods Lab
— FDA Regulated Products —

Description (per Sample)	Fee*
pH	$ 20.10
A_w (Water Activity)	$ 20.10
Sodium	$ 34.17
Fat	$ 6.70
Protein	$ 7.37
Moisture	$ 4.02
Ash	$ 2.68
Brix	$ 26.80
Viscosity	$ 34.17
Drain Weight	$ 20.10
Headspace Analysis	$ 20.10
Total Plate Count	$ 26.80
Yeast and Mold	$ 26.80
Coliforms	$ 26.80

** Fees are doubled for out-of-state companies and individuals.*

Description (Per Product)	
Basic Safety and Quality Testing — 3 samples minimum (pH, water activity, 4 week shelf-life study)	$ 268
Acidified Food Testing and Consulting — 9 samples minimum (pH, water activity, shelf-life)	$ 328.30
New Product Testing and Consulting — common products, 3 samples minimun (pH, water activity, shelf-life, label review, nutrition information)	$ 436
New Product Testing and Consulting — unique products	$ 67 / hr
Nutrition Label — (Nutrition Facts; copy-ready) computer generated, no analysis	N / C
— With chemical analysis and label review	$ 93.80
Shelf-life analysis — 4 samples minimum (Includes chemical, physical, basic sensory and basic microbial analyses.)	$ 201
Thermal Processing Lab Use	$ 268-536
Food Product Development and Testing — Includes chemical, basic sensory and physical analyses	$40.20 / hr ($402 min.)