Extending the Shelf-Life of RTE Meat Products

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Shelf Life Extension of RTE Meat Products

- Food Spoilage
  - oxidation of color and flavor

- Safety
  - *L. monocytogenes*
  - *C. perfringens*
Food Spoilage

- **Unsaturated fats**
  - Oxidation catalyzed by heat, light, trace metals.
  - Color
    - Metmyoglobin formation
  - Flavor
    - Cardboard aroma

- **Warmed over flavor**
  - Lean meat products
Antioxidants

- Mostly phenolic compounds
- Traditional antioxidants
  - BHA, BHT, TBHQ, propyl gallate
- Chelating agents
  - Citric acid, phosphates
- Cleaner label antioxidants
  - Spices, fruit extracts
Procedures That Delay the Onset of Oxidation

- Surface browning
- Sauces & gravies
- Vacuum tumbling, mixing, stuffing, etc.
IN THE BLEACHERS

“Could you pass this down, please?”
Clean Label Antioxidants

- Plums, grape seed extract, pine bark extract, rosemary, sage, oregano, marjoram, thyme, mace, allspice, cloves, etc.
Plum Products

- Juice, dried - uncured RTE sausage & roast beef
- Dried paste - sausage
- Effective in pre-cooked and uncured products.
Grape Seed Extract

- Added at 0.02-0.1%
- No flavor issue
- Retards microbial growth of Listeria, *E. coli* and Salmonella.
- Darkens meat color
- Gravinol-Super (Kikkoman)
Rosemary

- Oleoresin
  - use at 0.02 to 0.10%, depending upon the fat content of the product.
  - Herbalox, Kalsec Inc.

- Essential oil
Other Spices

- Oregano
  - Water-soluble extract
  - Oreganox WS, RAD Natural Technologies

- Sage
Food Safety

ZITS

JERRY SCOTT & JIM BORGMAN

Jeremy! I'm so impressed!

I knew that my patience would pay off one day!

It took a long time, but you've finally decided to take the initiative of ironing your own clothes!

Say what?
Food Safety

- **Post-Lethality Treatments**
  - effective after post-lethality exposure to potential environmental contamination
  - achieve a minimum of 1 log reduction of *L. monocytogenes*
  - Listericidal

- **Growth Inhibitors**
  - inhibit growth of *L. monocytogenes* to not more than 2 logs of growth over the duration of the product’s shelf life
  - Listeriostatic
I'll trade you my 'Suspect Salmonella' for your 'Suspect E. coli.'
Traditional Processing

- Freezing product – prevents growth of *L. mono.*, must be kept frozen throughout distribution

- Fermentation
  - High acid content (< pH 4.5)
Traditional Processing

- Sodium nitrite
  - contributes to the overall suppression of *L. monocytogenes* growth

- Product Composition
  - higher fat increases Listeria heat resistance
Antimicrobial Agents

- To prevent growth of post-cook contamination.
- Added to product during formulation.
- Added to finished product before packaging.
- Added to pkg. materials.
- Approved list: USDA Directive 7120.1
Antimicrobial Agents

- **Organic Acids**
  - acetic, citric, lactic, malic

- **Salt of Organic Acids**
  - lactates, diacetates, citrates,

- **Bacteriocins**
  - Nisin, pediocin

- **Clean Label Ingredients**
Potential Antimicrobial Agents

- Smoke – liquid or natural
- Spices
Organic Acids

- Reduce the pH of products
- Inhibits growth and/or death of microorganisms
- Dipping or spraying wieners, cooked ham and bologna slices in acetic acid, lactic acid, and benzoic acid solutions was listericidal.
Organic Acids

- Surface application reduces need for adding to formula.
- Vacuum packaging distributes over surface.
Salts of Organic Acids

- 4.8% sodium and/or potassium lactate and 0.25% sodium diacetate approved as antimicrobial agents in meat product formulation.

- Synergistic effect of lactates and diacetates in inhibiting growth (bacteriostatic) of *L. monocytogenes* in meat products.
Lactates and Diacetates

- Effective when added to product formulations, but not as a dip.
- 2-3% sodium lactate without flavor problems.
- >0.12% sodium diacetate can result in vinegar flavor.
Uncured Products

- Higher levels of sodium lactate addition needed.
- Flavorings may need to be added to mildly flavored products, because of lactate flavor at higher levels.
Purac’s Opti.Form
Listeria Control Model

- Determine amount of lactate and diacetate based upon level of control, and:
- Finished product salt and moisture contents
Sodium Lactate

- Improves water-holding capacity and cooking yields.
- Enhances beef roast flavor and reduces fading of beef bologna.
Buffered Sodium Citrate and Sodium Diacetate

- 1% Ional-Plus inhibits *L. monocytogenes* and *C. perfringens* germination & outgrowth during chilling
- Add dry to product.
- Use with fresh or cooked products.
Bacteriocins

- Polypeptides made by bacteria that inhibit other bacteria.
- Nisin & pediocin are bacteriocidal to *L. mono.* & other Gram+ organisms
- Nisin commercially available
Nisin

- Can be added to formula, applied to surface, coating to the inside of sausage casings, and barrier films.
- Less effective in higher fat products.
Lauric Arginate

- Bacteriocidal upon application
- Limited bacteriostatic effect.

Apply as a surface treatment
- spray into pouch at packaging.
- dip system
- tumble

Max. use (USDA FSIS) - 200 ppm (Protect-M, Purac)
- not on label <44 ppm
Octanoic Acid

- Bacteriocidal fatty acid
  - processing aid, not labeled (US).
- 400 ppm final product weight.
  - Octa-gon (EcoLab)
- Sprayed into RTE package, prior to vacuum sealing (1-2 logs) and heat shrinking (activates).
- No flavor problems.
Cetylpyridinium Chloride (CPC)

- Approved for poultry carcasses (Cecure, Safe Foods Corp.), not approved for RTE products.
- Reduces *Listeria monocytogenes* on RTE products.
Spices

- Garlic, sage, & cloves – inhibit *L. mono*.
- Gram+ more sensitive to effects of spices.
- Spice extracts less effective than actual spices.
- Essential oils of oregano & garlic inhibit *L. mono*. when added to edible films.
Spices

- Levels of spices needed to prevent *L. monocytogenes* in foods high in protein or fat are higher than would commonly be used in meat products.
Smoked Products

- Natural & liquid smoke inhibit growth of *L. mono*.
- New liquid smoke extract (AM-3, without color, Zesti/Kerry) that is sprayed onto RTE meat products, approved as a flavoring.
Clean Label Products for Controlling Listeria

**Cultured sugars**
- Verdad products (Purac)
  - also contains vinegar
- DURAfresh (Kerry Seasonings)
  - 0.05-1% addition level
  - Labelled “cultured corn syrup solids”
Clean Label Products for Controlling Listeria

- Lemon juice & vinegar
  - Surface application, pickles, or direct addition
  - MOstatin (WTI, Inc.)
Post-Packaging
Heat/Pasteurization

- Heat re-applied to package surfaces to destroy any surface cross contam’n.
- Hot water (185°F/85°C, 8 min.)
- Steam (205°F/96°C, 15 sec)
- More effective than antimicrobial agents (USDA).
Post-Packaging Heat Disadvantages

- Difficult to heat all surfaces
- May adversely affect package.
- Product changes with heat (color, texture, purge, etc.)
- Expensive
- Apply heat/moisture in ref. room (condensation, etc.)
Individually-Wrapped Products are Easiest to Post-Package Pasteurize/Heat
Cook-in-the-Bag Processing

- Listeria contamination is not likely to occur as long as package is not opened and exposed to the environment.
- Listeria contamination could occur at the point that final user opens the package.