Microbial Problems, Causes, and Solutions in Meat and Poultry Processing Operations

Helen G. Brown, PhD
Research Specialist
Tyson Foods, Inc
NR
– Non-Compliance Record

• Plant Process
  – SSOP
  – HACCP

• Description of Non-Compliance
  – On_____a complete set of 51_____samples for chicken carcasses had been analyzed. The sample results indicate that you have failed to meet performance standards outlined in 9 DFR 381.94 (b). The establishment shall take immediate corrective action in accordance to 9 CFR 381.94 (b) to meet the performance standards.
## Performance Standards (source USDA)

<table>
<thead>
<tr>
<th>Poultry Type</th>
<th>Maximum</th>
<th>Std %</th>
<th># of Samples</th>
<th># of +</th>
</tr>
</thead>
<tbody>
<tr>
<td>Broilers</td>
<td>20.0</td>
<td>51</td>
<td>51</td>
<td>12</td>
</tr>
<tr>
<td>Gr. chicken</td>
<td>44.6</td>
<td>53</td>
<td>53</td>
<td>26</td>
</tr>
<tr>
<td>Gr. turkey</td>
<td>49.9</td>
<td>53</td>
<td>53</td>
<td>29</td>
</tr>
</tbody>
</table>
“Causes”: Live Poultry

- Environment:
  - heat, humidity, stress;
- type of houses, litter base, management, waterers, beetles, bird density;
- water quality: pH (hardness), bacteria;
- rodent and wild bird control
Incidence of Salmonella Positives

Salmonella Positives (%)

- Before Chiller:
  - Inspexx: 72%
  - Chlorine: 56%

- After Chiller:
  - Inspexx: 16%
  - Chlorine: 14%
Inspexx Efficacy Trials at Tyson Foods

Salmonella Positives (%)

<table>
<thead>
<tr>
<th></th>
<th>Wilkesboro</th>
<th>Temperanceville</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chlorine Pre</td>
<td>5</td>
<td>59</td>
</tr>
<tr>
<td>Chlorine Post</td>
<td>15</td>
<td>14</td>
</tr>
<tr>
<td>Inspexx Pre</td>
<td>21</td>
<td>72</td>
</tr>
<tr>
<td>Inspexx Post</td>
<td>12</td>
<td>16</td>
</tr>
</tbody>
</table>

Average Percent Reduction

Pre  Post  Pre  Post  Pre  Post
Chlorine  Inspexx  Chlorine  Inspexx  Chlorine  Inspexx
(10)  9  45  56

ECOLAB
OLR “Solutions”: Poultry

- **Rhodia** Avgard: TSP (trisodium phosphate) Avgard XP (Sodium Meta-silicate)
- **Alcide** Sanova (Acidified Sodium Chlorite)
- **Ecolab** Inspexx (peroxyacetic acids)
- **Zep** Zaps (Chlorine Dioxide)

*Safefoods:Cecure

* Others
*three composition and use patents for mixed peracid chemistry in meat and poultry processing

Peroxyacetic Acid

\[ \text{CH}_3\text{COOOH} \]

Peroxyoctanoic Acid

\[ \text{CH}_3\text{(CH}_2\text{)}_6\text{COOOH} \]
Applications Peroxyacids

- CIP sanitizer-
- Hard surface sanitizer - Vortexx
- Fruit and vegetable antimicrobial- Tsunami
- Odor control agent for rendering
- Red meat antimicrobial- Inspexx 200
- Poultry Chill water and spray – Inspexx 100
Solutions: Multiple Hurdle Poultry


Water-chlorine volume

OLR antimicrobial
“Problems”: Beef Raw

- Fecal
- 0157
“Solutions”: Triple Clean™

Steam vacuum & trimming

Carcass washed + acids

Cabinet + steam pasteurization
<table>
<thead>
<tr>
<th>Process</th>
<th>E.Coli 0157:H7</th>
<th>S. Typhimurium</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water Wash</td>
<td>2.0-2.9 (2.4)</td>
<td>1.7-3.0 (2.3)</td>
</tr>
<tr>
<td>Water wash + hot Water</td>
<td>3.7-4.2 (4.0)</td>
<td>3.5-4.7- (4.2)</td>
</tr>
<tr>
<td>Water wash + lactic acid</td>
<td>4.2-5.0 (4.6)</td>
<td>4.8-5.0 (4.9)</td>
</tr>
<tr>
<td>Water wash + hot water + lactic acid</td>
<td>4.5-5.0 (4.9)</td>
<td>4.3-4.8 (4.5)</td>
</tr>
<tr>
<td>Water wash + lactic acid + hot water</td>
<td>4.2-&gt;4.6 (4.4)</td>
<td>4.2-4.5 (4.4)</td>
</tr>
<tr>
<td>Trim</td>
<td>2.8-3.6 (3.1)</td>
<td>4.2-4.5 (4.4)</td>
</tr>
<tr>
<td>Trim + hot Water</td>
<td>&gt;4.7-&gt;4.9 (&gt;4.8)</td>
<td>4.5-4.9&gt;(4.7)</td>
</tr>
<tr>
<td>Trim + hot Water + lactic acid</td>
<td>&gt;4.8-5.0 (&gt;4.9)</td>
<td>4.5-4.9 (4.7)</td>
</tr>
<tr>
<td>Trim + lactic acid</td>
<td>&gt;4.7-4.9 (&gt;4.8)</td>
<td>4.7-5.0 (4.9)</td>
</tr>
<tr>
<td>Trim + hot Water + lactic acid</td>
<td>&gt;4.8-5.0 (&gt;4.9)</td>
<td>4.5-4.9 (4.7)</td>
</tr>
<tr>
<td>Trim+ lactic acid + hot Water</td>
<td>&gt;4.5-&gt;4.7 (&gt;4.6)</td>
<td>4.4-4.8 (4.6)</td>
</tr>
</tbody>
</table>
Substances approved for use in the production of meat carcasses, parts, and comminuted products for the purpose of microbial reduction.

<table>
<thead>
<tr>
<th>Ingredient Name</th>
<th>CFR Reference/Other Reference</th>
<th>Products for Which Application Approved</th>
<th>Classification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sodium and Potassium Lactate</td>
<td>9 CFR 424.21 (c)</td>
<td>Various meat and poultry products.</td>
<td>Direct food additive</td>
</tr>
<tr>
<td>Sodium Citrate buffered with citric acid to pH 5.6</td>
<td>Acceptability determination</td>
<td>Non-standardized comminuted meat and poultry products.</td>
<td>Direct food additive</td>
</tr>
<tr>
<td>Sodium Diacetate</td>
<td>9 CFR 424.21 (c)</td>
<td>Various meat and poultry products.</td>
<td>Direct food additive</td>
</tr>
<tr>
<td>Lactoferrin</td>
<td>GRAS Notice (FDA Website)</td>
<td>Beef carcasses and parts</td>
<td>Direct food additive</td>
</tr>
<tr>
<td>Peroxyacids</td>
<td>21 CFR 173.370</td>
<td>Beef carcasses.</td>
<td>Secondary direct food additive/Processing Aid</td>
</tr>
<tr>
<td>Acidified sodium chlorite</td>
<td>21 CFR 173.325</td>
<td>Carcasses, parts, and trimmings, as well as all processed, comminuted or formed meat food products.</td>
<td>Secondary direct food additive/Processing Aid</td>
</tr>
<tr>
<td>Ozone</td>
<td>21 CFR 173.368</td>
<td>All meat and poultry products.</td>
<td>Secondary direct food additive/Processing Aid</td>
</tr>
<tr>
<td>Sources of ionizing radiation</td>
<td>21 CFR 179.26</td>
<td>Pork, poultry, and beef products as listed.</td>
<td>Food additive</td>
</tr>
</tbody>
</table>
Solution: Inspexx efficacy beef

Reductions, Beef

- **Salmonella typhimurium**: Log Reduction = 0.71
- **E. coli 0157:H7**: Log Reduction = 0.38
- **Listeria monocytogenes**: Log Reduction = 0.33

Comparison of Log Reductions:
- **Water**
- **Inspexx 200**
aLF detaches virtually all E.coli O157:H7 after a 6-log challenge

Testing: 6 pack plant simulation at N Terminus Laboratory, Pomona, Ca. November, 2002...validated by outside meat scientists; assay not sensitive below 2 logs
aLF extended display life of case ready meat vs. control

Activated Lactoferrin

Control

aLF after 10-d retail display

Control after 10-d retail display
“Solutions”

- There is no magic bullet

Pay attention to all areas from farm to table plate.

Multiple hurdles
Recall Release
FSIS-RC-002-2003
CLASS I RECALL
HEALTH RISK: HIGH Congressional and Public Affairs
(202) 720-9113; FAX: (202) 690-0460
Sarah Tarshis
South Dakota Firm Recalls Beef Products For Possible *Listeria* Contamination
WASHINGTON, Jan. 22, 2003– Dakota Foods Inc., a Sioux Falls, S.D., establishment, is voluntarily recalling approximately 2,100 pounds of cooked beef products that may be contaminated with *Listeria monocytogenes*, the U.S. Department of Agriculture’s Food Safety and Inspection Service announced today.
“Problem”: Fully Cooked Products

**Recalls**

**Risk**

***Listeria***
**Class I:** A health hazard situation where there is a reasonable probability that the use of the product will cause serious, adverse health consequences or death

**Class II:** A health hazard situation where there is a remote possibility of adverse health consequences from the use of the product

**Class III:** A situation where the use of the product will not cause adverse health consequences.
"Causes": Fully Cooked Products

***Listeria***

--Environmental

--Grows in damp

--Sets up niches-biofilm

--Grows in refrigeration, vacuum packages
“Solutions”: Listeria Fully Cooked Products

--Sanitation

--Heat

--Acid-ingredients
1- **Apply** post lethality treatment **AND** antimicrobial or process to control LM

2- **Apply** post lethality treatment **OR** antimicrobial agent or process

3- **Does not** apply post lethality treatment or agent or process so it **has to** have sanitation program, test food contact surface and hold when test is positive.
Post lethality treatment:
Radiant, UV, Heat, Pasteurization, High pressure

Antimicrobial agents:
lactates, salt, acid, nitrites, etc.

Antimicrobial process:
Drop water activity, freezing, lactates
### Optiform *Listeria* Control Model

<table>
<thead>
<tr>
<th>Antimicrobial</th>
<th>level (%)</th>
<th>L. Monocytogenes Grown Inhibition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sodium lactate</td>
<td>3</td>
<td>70 days no pathogen growth</td>
</tr>
<tr>
<td>Sodium diacetate</td>
<td>0.25</td>
<td>50 days no pathogen growth</td>
</tr>
<tr>
<td>Sodium acetate</td>
<td>0.25,0.5</td>
<td>20 days no pathogen growth</td>
</tr>
<tr>
<td>Sodium lactate</td>
<td>6.0</td>
<td>120 days no pathogen growth and reduced pathogen growth</td>
</tr>
<tr>
<td>Sodium diacetate</td>
<td>0.5</td>
<td>120 days no pathogen growth and reduced pathogen growth</td>
</tr>
<tr>
<td>Control</td>
<td>0</td>
<td>Increased to 6 log in 20 days</td>
</tr>
</tbody>
</table>
Solutions: Multiple Hurdle Poultry

Sanitation, testing programs.

Post lethality treatment

Antimicrobial agent or process