Cheese Defects Caused by Bacteria
Biofilms and Cheese Defects

- A biofilm is a result of the adherence of microorganisms to a surface.
- In dairy products, biofilms can lead to cross-contamination and product defects.
Biofilms Can Harbor Thermoduric Organisms

What are thermoduric organisms?

- Organisms that survive pasteurization
- Have the ability to form spores
- Have the ability to persist in processing environments
Common Sources of Thermodurics

- Inadequate equipment cleaning
- Inadequate milking practices
- Soil is a major habitat of spore formers
- Feed and bedding
- Low quality feeds
What is an LPC?

**THERMODURIC BACTERIA COUNT**

- Laboratory Pasteurized Count (LPC) test for thermoduric organisms—often related to spoilage of pasteurized milk.
- The LPC is an SPC performed on milk that has been heated to 145F (62.8C) and held for 30 minutes (low temperature-long time pasteurization).
- Typical mastitis-causing organisms (including coliforms) do not survive pasteurization.
- Thermoduric bacteria may include Micrococcus, Microbacterium, Lactobacillus, Bacillus, Clostridium, and occasional Streptococci.
- These organisms will grow and multiply in the milk handling equipment if cleaning and sanitation procedures are inadequate.

Provided by: Keith L. Engel (GEA-USA)
Reasons for High LPC

• Inadequate equipment washing-DIRTY EQUIPMENT
• Inadequate milk tank washing-DIRTY EQUIPMENT
• Cracked and worn rubber goods
• Prevalent when soil is visible after washing
• Biofilms (seen most in extended milking)
• **Scheduled maintenance not on track.** Need to keep at manufacturers’ recommendation to keep LPCs below 50. If you milk 24 hours per day, sometimes rubber and silicone goods have to be changed more often than the manufacturers’ recommendation.
## Bacteriological Standards

<table>
<thead>
<tr>
<th>Grade &quot;A&quot; Raw Milk for Pasteurization</th>
<th>STANDARD</th>
<th>FEDERAL</th>
<th>CALIFORNIA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bacterial (Standard Plate Count) Limits</td>
<td>Not to exceed 100,000 per ml</td>
<td>Not to exceed 50,000 per ml</td>
<td></td>
</tr>
<tr>
<td>Somatic Cell Count</td>
<td>Not to exceed 750,000 per ml</td>
<td>Not to exceed 600,000 per ml</td>
<td></td>
</tr>
<tr>
<td>Coliform</td>
<td>No Standard</td>
<td>Not to exceed 750 per ml</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Grade &quot;A&quot; Pasteurized Milk</th>
<th>Laboratory Pasteurized Count</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard Plate Count</td>
<td>No Standard</td>
<td>Not to exceed 750 per ml</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Grade &quot;A&quot; Pasteurized Milk</th>
<th>Coliform</th>
<th>Maximum 10 per ml</th>
<th>Maximum 10 per ml</th>
</tr>
</thead>
</table>

## Compositional Standards

<table>
<thead>
<tr>
<th>Grade A Pasteurized Milk</th>
<th>Standard Plate Count</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Milkfat Minimum</td>
<td>Maximum 20,000 per ml</td>
<td>Maximum 15,000 per ml</td>
</tr>
<tr>
<td>Milk Solids-Not-Fat (SNF), minimum</td>
<td>8.25%</td>
<td>8.7%</td>
</tr>
<tr>
<td>Total Milk Solids</td>
<td>No Standard</td>
<td>12.2% Minimum</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Grade A Reduced Fat Milk</th>
<th>Milkfat</th>
<th>Maximum 2.1% No Minimum</th>
<th>Maximum 2.1% Minimum 1.9%</th>
</tr>
</thead>
<tbody>
<tr>
<td>SNF, minimum</td>
<td>8.25%</td>
<td>10.0%</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Grade A Lowfat Milk</th>
<th>Milkfat</th>
<th>Maximum 1.2% No Minimum</th>
<th>Maximum 1.1% Minimum 0.9%</th>
</tr>
</thead>
<tbody>
<tr>
<td>SNF, minimum</td>
<td>8.25%</td>
<td>11.0%</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Grade A Nonfat Milk</th>
<th>Milkfat, maximum</th>
<th>0.20%</th>
<th>0.20%</th>
</tr>
</thead>
<tbody>
<tr>
<td>SNF, minimum</td>
<td>8.25%</td>
<td>9.0%</td>
<td></td>
</tr>
</tbody>
</table>
Four Major Causes of High Bacteria Count

1. Dirty milking equipment
2. Infected udders
3. Environmental contaminants
4. Improper cooling

Provided by: Keith L. Engel (GEA-USA)
Neck of Receiver Jar by Probes

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Keith L. Engel
(GEA-USA)
Gasket Needs Replacing

Provided by:
Keith L. Engel
(GEA-USA)
What do Thermodurics do in the Cheese Make?

- Compete with starter cultures
- Convert lactose into galactose which can later cause cheese body and color issues
- May speed up the cheese make, making it uncontrollable
- May increase moistures
- Cause secondary fermentations
Thermoduric Thermophiles increase during long hours (22-24h) of milk pasteurization (log cfu / mL)

Start  Pre mid-day wash  Post mid-day wash  End

- Thermoduric mesophiles
- Thermoduric thermophiles
Defects in Finished Cheeses

- Flavor Defects
  - Acid and sour, most common
  - Unclean lingering flavors
  - Bitterness
Defects in Finished Cheeses

- Body Defects
  - Soft, pasty, sticky body
  - Gas
  - Slits
  - Openness
Defects in Finished Cheeses

- **Appearance**
  - Excessive browning and large blisters in Mozzarella on pizzas
  - Browning in parmesan cheese in chunks and grated cheeses
Defects in Whey Products

• Loss of functionality
  • Foaming stability
  • Gel strength
  • Loss of ability to sell product in some markets
Defects in Whey Products

- Micro Specifications
  - Some markets accept/reject whey products based on bacteria standards
Soft/Weak/Pasty Body
Open Texture
Open Texture
Questions?