Listeria monocytogenes

- Facultative anaerobic, Gram+ bacterium
- Many different L.m. serotypes and some are pathogenic
- Ubiquitous to nature (soil, water, vegetation, animal feed, food contact surfaces, slaughterhouse wastes, raw salmon, etc)
Listeria monocytogenes

- It grows in refrigerated temperatures as low as 0ºC and up to 13% NaCl
- Mortality rate is high in infections of the invasive form. People at risk are pregnant women, AIDS, transplant and cancer patients, young children, fetuses and the elderly.
- Listeriosis requires infection by a large number of organisms.
Deaths caused by food-borne pathogens

- Listeria: Low incidence rate ➔ high fatality rate

- Salmonella: 30%
- Listeria: 28%
- Parasites: 21%
- Viruses: 7%
- Campylobacter: 6%
- E.coli O157:H7: 3%
- Rest: 5%

Mead, 1999
So what can we do?

- *Listeria m.* is everywhere
- Listeriosis has a high mortality rate
- *Listeria m.* can grow in high salt conditions and at refrigerated temperatures down to 32 F

Go with what works!
Go with interventions that have been well documented for efficacy.

There is very good news to report!
On Saturday September 20\textsuperscript{th}

\textbf{Sodium diacetate} will be published in the gazette and therefore approved for use in cooked meat and poultry products.
Opti-Form

- Optimum Formulation of
  - Natural sodium or potassium lactate and
  - Sodium diacetate
- Unique balance of flavor and effectiveness
- Neutral pH
- Bacteriostatic properties
  (ongoing suppression of pathogen growth)
- Available as a Liquid or Powder
The Antimicrobial Effects of Opti.Form
NaL $\rightarrow$ L$^-$ + Na$^+$

H$^+$ + L$^-$ $\Leftrightarrow$ HL

- Lactate and sodium diacetate is in equilibrium with Lactic Acid and acetic acid
- Undissociated lactic acid and acetic acid penetrate into organism
- Acids dissociate, resulting in a lower internal pH of the cell
- Cell needs energy to raise the pH
- Cell stops growing and multiplying

Opti-Form MODE OF ACTION
Internal Cell Acidification
Opti-Form MODE OF ACTION
Feed Back Mechanism

- Micro organism derives energy from glycolysis (energy metabolism)

- Due to concentration of lactate or acetate outside the cell, the proton pump pathway is blocked

- Slows down glycolysis (interference with energy metabolism)
Opti-Form MODE OF ACTION

Reduces water activity

Lower water potential \( (\Psi) \) leads to lower turgor pressure. High turgor pressure is essential for cell growth and cell division

\[ \Psi = \Psi_s + \Psi_p \]  
\( \Psi_s \) : solute part, \( \Psi_p \) : hydrostatic pressure part/turgor pressure
Food Preservation
Multiple Hurdle Technology

- Each hurdle affects the growth of microorganisms
- More hurdles mean more restrictions for bacteria growth
- Many small hurdles contribute to protecting food safety

PURASAL Opti.Form
Effect of Lactate and Diacetate on *Listeria* in Ham

![Graph showing Lm Count (log cfu/g) over time at 39°F (weeks) for Control, 2.5% lactate, and 0.15% diacetate.](image)

(Seman *et al.*, J. of Food Protection, 2002)
Effect of *Opti-Form* on *Listeria* in uncured cooked sausage

Source: TNO, The Netherlands, 2003
Effect of **Opti-Form** on **Listeria** in Frankfurters

(Samelis et al, J.of Food Protection, 2002)

![Graph showing the effect of Opti-Form on Listeria in Frankfurters](image-url)
2007 Model for Cured and Uncured meats

Opti-Form® Listeria Control Model 2007

:: Run the Model
:: About the Model
:: About PURASAL Opti/Form
:: Product Information
:: Regulations
:: FAQ
:: Literature
:: Terms and Conditions
:: Contact Us

Includes latest new products Opti/Form Vinegar and Highly concentrated PURASAL Opti/Form PD Plus

Opti-Form.com
Listeria Control Model 2007

- Mathematical model to simulate Listeria m. growth in cooked meat products

- Variables:
  - Lactate concentration
  - Storage temperature
  - pH
  - Salt content
  - Moisture content
  - Cured or uncured
  - Initial count of Listeria

- Validated with 30 application studies
New features

“Uncured products”
(100 ppm ingoing cured)

Includes latest introductions;
Opti Form® Vinegar,
Opti Form® Powder, P Plus and
Opti Form® Ultra
Confidence levels

Estimate on a 90% and 95% confidence level

“Press calculate”
## Product Line

<table>
<thead>
<tr>
<th>Benefit</th>
<th>Product</th>
<th>Description</th>
<th>Flavor</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Shelf life extension</strong></td>
<td><strong>PURASAL S</strong></td>
<td>Sodium lactate</td>
<td>Mild saline</td>
</tr>
<tr>
<td></td>
<td><strong>PURASAL HiPure P PLUS 78% Assay</strong></td>
<td>Potassium lactate</td>
<td>Neutral</td>
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<tr>
<td></td>
<td><strong>PURASAL Lite</strong></td>
<td>Sodium &amp; potassium lactate blend</td>
<td>Balanced</td>
</tr>
<tr>
<td><strong>Food safety</strong></td>
<td><strong>PURASAL Opti.Form Vinegar</strong></td>
<td>Potassium lactate and vinegar</td>
<td>Mild vinegary</td>
</tr>
<tr>
<td></td>
<td><strong>PURASAL Opti.Form SD4 ULTRA</strong></td>
<td>Lactate and sodium diacetate blends</td>
<td>Mild / neutral (best liquid flavor profile)</td>
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<tr>
<td></td>
<td><strong>PURASAL Opti.Form PD4 ULTRA</strong></td>
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<tr>
<td></td>
<td><strong>PURASAL Opti.Form Lite ULTRA</strong></td>
<td></td>
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<tr>
<td><strong>Powders</strong></td>
<td><strong>PURASAL S 100 Powder</strong></td>
<td>Sodium lactate</td>
<td>Slight salty</td>
</tr>
<tr>
<td></td>
<td><strong>PURASAL Opti.Form Powder</strong></td>
<td>Sodium lactate and sodium diacetate</td>
<td>Mild salty vinegar</td>
</tr>
<tr>
<td><strong>Pathogen killer</strong></td>
<td><strong>Protect M</strong></td>
<td>Lauric Arginate (not yet approved in Canada)</td>
<td>Flavorless liquid</td>
</tr>
</tbody>
</table>

- GRAS, surface treatment, derived from coconuts, palm oil and arginine (an essential amino acid)
- Provides kill of gram positive and gram negative organisms
Conclusions

- *Listeria monocytogenes* is a bad bug
- Ongoing suppression is critical to controlling outgrowth of Lm
- Lactates and *Opti-Form* provide ongoing growth suppression of pathogens
- Food safety should be non-competitive, consider different alternative interventions.
- Food safety is everyone’s job!

Do you know where your lactates come from. Are they “Made in China”? Are you sure?
Thank you!