Clean Label
Processed Meats

Whole Food Ingredient Solutions

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CuliNex
March 29-30, 2016
CuliNex is a consultancy, providing product development and strategic business services, focused exclusively on clean label products.
Webb Girard

Culinologist – BS in Food Science, University of Idaho; MS in Food Science, University of Maryland
Clean Label Ingredients

- Why clean label?
  - Consumer’s distrust on what is labeled “Natural”, desire to have transparency in labeling
  - Food Litigation News
- How?
  - Use of easily recognizable ingredients to provide the same technical functionality of manufactured ingredients
- Pros
  - Easy to understand where the ingredient comes from
- Cons
  - The ingredient is not necessarily purified and carries other compounds with it
Clean Label Alternatives for Processed Meats

• Curing
  • Vegetable Juice Powder
    • Source of Nitrate
    • Source of Nitrite
  • Cherry Powder
    • Cure accelerator
    • Replacement for Sodium Erythorbate
• Moisture Retention
  • Plum Juice Concentrate
    • Phosphate replacer
Nitrate/Nitrite Replacement

- Why cure?
  - Flavor
  - Color
  - Preservative
  - Antioxidant
  - Texture
- Vegetables grown and harvested for their nitrate content
  - Absorbed from the soil
Nitrates / Nitrites Review

- Nitrates
  - reservoir for nitrite
  - Requires conversion via microbes
- Nitrites
  - Color via Nitric Oxide
  - Assisted by acid (slight decrease in pH, significant increase in reaction)
  - Fixed by heat
  - Toxic (very effective at low usage, control is important)
Competitive Scan
Competitive Scan
Competitive Scan
Vegetable Juice Powder as a Nitrite Source

VJP Then
- Source of Nitrate
- Needed to be converted to Nitrite by Lactic Acid Bacteria
- Strong vegetal flavor carryover
- Variable nitrate concentration

VJP Now
- Source of Nitrite
- Pre-converted by ingredient supplier
- Minimal vegetal flavor
- Standardized concentration (via sea salt)
Keys to Formulation

- pH maintenance
  - Liquid smoke, aquarens
- Potential flavor impact / change
- Labeling implications
- Cost impact
- Type of meat application (whole muscle vs. commuted)
- Need for a curing accelerator
Labeling Implication

• 9CFR 317.17 / 9CFR 319.2

• Must declare
  • “uncured” in front of product name
  • no nitrates or nitrites added except those naturally occurring in xyz
  • Not preserved, keep refrigerated below 40°F at all times
Nitrate/Nitrite Regulations USDA

- **Commed products**
  - Nitrate 1718ppm by green weight
  - Nitrite 156ppm by green weight

- **Immersion Cured**
  - Nitrate 700ppm
  - Nitrite 200ppm

- **Dry Cured**
  - Nitrate 2187ppm
  - Nitrate 625ppm

- **Bacon (skin off)**
  - Nitrate – not permitted
  - Nitrite – 120ppm
  - Erythorbate – 550ppm
Effect of Nitrite – ppm

- 0ppm – no color
- 40ppm – minimum needed for color fixing, color fading after 45 days
- 100ppm – minimum needed for stable color
- 120ppm – minimum needed for “Keep Refrigerated” by USDA
- 156ppm – commuted products
- 200ppm – maximum level, immersion cured
Visual of Synthetic vs. Natural Nitrite Nitrite

Uncured

ppm Nitrite

Sodium Nitrite

Vegetable Juice Powder

0 40 100 120 150
Sodium Erythorbate

- Reacts directly with nitrite to form nitric oxide
- Prevents grey centers in rapid processes
  - i.e. sausage
- Improves flavor stability, color, and shelf life
Use of Cherry Powder

• From acerola cherry
• Provides natural source of ascorbic acid
• Mechanism to replace – nitric oxide reduction
• Needed for
  • Products with a short hold time (sausages)
  • Whole muscle products (ham, bacon)
<table>
<thead>
<tr>
<th>Ingredient</th>
<th>Percentage</th>
<th>Ingredient</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pork Belly</td>
<td>89.29</td>
<td>Pork Belly</td>
<td>89.29</td>
</tr>
<tr>
<td>Water</td>
<td>7.95</td>
<td>Water</td>
<td>7.09</td>
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<tr>
<td>Sea Salt</td>
<td>1.30</td>
<td>Sea Salt</td>
<td>1.25</td>
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<tr>
<td>Sodium Nitrite</td>
<td>0.17</td>
<td>Vegetable Juice Powder</td>
<td>0.72</td>
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<tr>
<td>Sodium Erythorbate</td>
<td>0.09</td>
<td>Cherry Powder</td>
<td>0.45</td>
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<tr>
<td>Turbinado Sugar</td>
<td>1.20</td>
<td>Turbinado Sugar</td>
<td>1.20</td>
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</table>
Bacon Evaluation

- Appearance
  - Is it consistent?
- Flavor
  - Any off notes?
**Beef Jerky Evaluation 156ppm**

### Sodium Nitrite

<table>
<thead>
<tr>
<th>Ingredient</th>
<th>Percentage</th>
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<tbody>
<tr>
<td>Beef, Top Round</td>
<td>88.47</td>
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<tr>
<td>Modern Cure</td>
<td>0.22</td>
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<tr>
<td>Brown Sugar</td>
<td>7.74</td>
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<tr>
<td>Sea Salt</td>
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<tr>
<td>Seasoning</td>
<td>0.83</td>
</tr>
<tr>
<td>Beef Concentrate</td>
<td>0.91</td>
</tr>
</tbody>
</table>

### Vegetable Juice Powder

<table>
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<tr>
<th>Ingredient</th>
<th>Percentage</th>
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</thead>
<tbody>
<tr>
<td>Beef, Top Round</td>
<td>88.06</td>
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<tr>
<td>Vegetable Juice Powder</td>
<td>0.68</td>
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<tr>
<td>Brown Sugar</td>
<td>7.71</td>
</tr>
<tr>
<td>Sea Salt</td>
<td>1.82</td>
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<tr>
<td>Seasoning</td>
<td>0.83</td>
</tr>
<tr>
<td>Beef Concentrate</td>
<td>0.91</td>
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</tbody>
</table>
Beef Jerky Evaluation

- **Appearance**
  - Is it consistent?
- **Flavor**
  - Any off notes?
Nitrite Conclusion

• Vegetable juice powder is an effective source to replace synthetic nitrites
• Balance cost vs. flavor vs. color vs. shelf life for optimal effect
• Use cherry powder to enhance the effect of curing and color retention
Phosphates Review

- Usage – up to 0.5% of the meat block
- Mechanism to replace
  - Alters pH and isoelectric point, increases water holding capacity
  - Enhances protein extraction

- Pros
  - Improves texture
  - Improves yields

- Cons
  - Can develop a soapy flavor if usage level is too high
  - Can inhibit browning in meat
  - Impact on curing effectiveness (increases pH)
Phosphate Replacement – Physical Binders

- Hydrocolloids
- Starches
- Algae
- Fibers vs. Isolates
- Vegetable proteins
- Fruit fibers
- Isolated Soy Protein

- Impact
  - Flavor
  - Texture
  - Label Declaration
  - Cost
Phosphate Replacement – Whole Food

- Plum based products
  - Fresh Plum Juice
  - Dried Plum Powder
  - Dried Plum Concentrate
- University of Arkansas Study

- Impact
  - Flavor
  - Texture
  - Label Declaration
  - Cost
Plum Product Characteristics

• High in sorbitol
  • Moisture binder (humectant)
• High in fiber
  • Moisture binder
• High in antioxidants
  • Suppresses warmed-over flavor, lipid oxidation
• Organic acids (malic, quinic)
  • Flavor enhancement, does not drastically change pH
## Plum Product Comparison

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Fresh Plum Concentrate</th>
<th>Dried Plum Puree</th>
<th>Dried Plum Power</th>
<th>Dried Plum Fiber</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sorbitol</td>
<td>14.46%</td>
<td>14.46%</td>
<td>25.0%</td>
<td>2.47%</td>
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<tr>
<td>Fiber, Soluble</td>
<td>1.54%</td>
<td>4.35%</td>
<td>5.0%</td>
<td>3.1%</td>
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<tr>
<td>Fiber, Insoluble</td>
<td>0.23%</td>
<td>1.15%</td>
<td>4.9%</td>
<td>63.7%</td>
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<tr>
<td>Acidity</td>
<td>1.5-2.2%</td>
<td>1.5-2.2%</td>
<td>trace</td>
<td>none</td>
</tr>
<tr>
<td>Usage Level</td>
<td>0.5% meat block</td>
<td>3% meat block</td>
<td>1.5% meat block</td>
<td>1.5% meat block</td>
</tr>
<tr>
<td>Label Declaration</td>
<td>As ingredient</td>
<td>As ingredient</td>
<td>As ingredient</td>
<td>Isolated plum product</td>
</tr>
</tbody>
</table>
Mechanism of Replacement

• Fresh Plum Concentrate
  • Attracts and hold moisture in open muscle fibers under vacuum, in injection process, in meat grinding

• Dried Plum Puree
  • Attracts and holds moisture in commuted products

• Dried Plum Powder / Dried Plum Fiber
  • Absorbs exterior moisture & prevents seepage, binds moisture in commuted products
Plum Products Usage Limitations

- USDA Regulations
  - As a moisture binder, up to 2.0% meat block
  - For flavor ingredient, no limit
    - Dried Plum Powder
Plum Products Side Benefits

- Flavor enhancer
- Allergen free
- Salt Reduction
- Spice Reduction
- Color Contribution
- Dissolves easily in water
- Caramelization enhancer
- Enhances freeze/thaw stability
- Cure accelerator?
## Sausage Evaluation

<table>
<thead>
<tr>
<th>Ingredient</th>
<th>Percentage</th>
</tr>
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<tbody>
<tr>
<td>Pork Shoulder, Ground</td>
<td>100</td>
</tr>
<tr>
<td>Phosphate</td>
<td>0.5</td>
</tr>
<tr>
<td>Water (Ice)</td>
<td>7.0</td>
</tr>
<tr>
<td>Salt</td>
<td>1.0</td>
</tr>
<tr>
<td>Seasoning</td>
<td>1.5</td>
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</table>

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<tbody>
<tr>
<td>Pork Shoulder, Ground</td>
<td>100</td>
</tr>
<tr>
<td>Plum Juice Conc.</td>
<td>0.5</td>
</tr>
<tr>
<td>Water (Ice)</td>
<td>7.0</td>
</tr>
<tr>
<td>Salt</td>
<td>1.0</td>
</tr>
<tr>
<td>Seasoning</td>
<td>1.5</td>
</tr>
</tbody>
</table>
Sausage Evaluation

- Flavor
  - Any noted differences?
- Texture/Mouthfeel
  - Is there a noticeable difference?
Phosphate Conclusions

• Effective options for replacing phosphates using whole food ingredients
• Multiple forms/options when considering plum ingredients
Conclusions

• Whole food ingredient solutions are effective in replacing synthetic ingredients in processed meats

• Optimizing formulas for
  • Flavor
  • Cost
  • Functionality
Questions?

Thank You

Check out our blog at www.culinex.biz

Acknowledgements

- Chef Rick Perez
- Jason Reicks