CLEANER APPROACH TO EXTENDING SHELF LIFE

Kemin Food Technologies
CA-FORT™
Clean Label Conference, March 26 – 27, 2019
Amanda Houser, PhD
KEMIN INDUSTRIES, INC

Approximately 2,800 employees worldwide

Manufacturing facilities in more than 15 countries

Customers in more than 120 countries

More than $900M annual revenue

More than 500 patents and applications

Founded in 1961 by R.W. & Mary Nelson

Independently owned by the Nelson family
Our Vision

We strive to improve the quality of life by touching over half the people of the world every day with our products and services.
As the fresher, safer, longer experts, we provide the market knowledge, innovation and technical expertise to leverage consumer trends into high-performing value-added ingredients.
CONSUMER TRENDS
IN A GROCERY SHOPPERS SURVEY

57% SAY PRICE IS MOST IMPORTANT

25% SAY THE INGREDIENT LABEL IS MOST IMPORTANT

Source: This survey was conducted online in the US by Harris Poll on behalf of Kemin Industries, Inc. between July 25 and August 1, 2016. The research was conducted among 1006 US adults aged 18+ who are the primary grocery shoppers for their household.
31% say they always read the ingredients label.

49% of those say health claims are most important.

Source: This survey was conducted online in the US by Harris Poll on behalf of Kemin Industries, Inc. between July 25 and August 1, 2016. The research was conducted among 1006 US adults aged 18+ who are the primary grocery shoppers for their household.
1/2 DO NOT AVOID PURCHASING GROCERY ITEMS BECAUSE OF CERTAIN INGREDIENTS ON THE LABEL

1/4 AVOID THE WORD PRESERVATIVE

Source: This survey was conducted online in the US by Harris Poll on behalf of Kemin Industries, Inc. between July 25 and August 1, 2016. The research was conducted among 1006 US adults aged 18+ who are the primary grocery shoppers for their household.
HOW OXIDATION IMPACTS MEAT QUALITY AND CONSUMER ACCEPTABILITY

- Color changes
  - Impact initial purchase
- Flavor changes
  - Impact repeat purchase
- Pepperoni factors
  - High fat, salt
  - Freezing, oxygen, light
• Carotenoids
• Highly conjugated double bonds
• Color fades as carotenoids degrade

Capsanthin

Capsorubin
• Active Ingredient: Carnosic Acid, oil-soluble
• Controls oxidation by quenching free radicals to delay color and flavor changes in many applications
Determine the carnosic acid required to match performance of synthetic antioxidants for pepperoni under lighted refrigerated or frozen conditions.

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Ingredient</th>
</tr>
</thead>
<tbody>
<tr>
<td>Untreated</td>
<td>--</td>
</tr>
<tr>
<td>50 ppm carnosic acid</td>
<td>0.059% CA-FORT™ 1085 Dry</td>
</tr>
<tr>
<td>75 ppm carnosic acid</td>
<td>0.088% CA-FORT™ 1085 Dry</td>
</tr>
<tr>
<td>100 ppm carnosic acid</td>
<td>0.118% CA-FORT™ 1085 Dry</td>
</tr>
<tr>
<td>30 ppm BHA/30 ppm BHT/30 ppm citric acid</td>
<td>0.015% EN-HANCE® A121S + 0.006% EN-HANCE® CA</td>
</tr>
</tbody>
</table>
• Beef/pork blend
• Dry spices and paprika oleoresin
• Fermented, cooked, dried to target MPR
• Sliced and packaged in tray with overwrap
• Storage
  • Refrigerated (4°C) under lights
  • Frozen (-18°C) dark
• Evaluated
  • Hunter color \( L^*a^*b^* \)
  • TBARS

PEPPERONI APPLICATION TESTING
**HUNTER $a^*$ VALUES**

![Graph showing the effect of treatments on $a^*$ values over Days of Lighted Storage (4°C)]

- **Untreated**
- **0.059% CA-FORT 1085 (50 ppm CA)**
- **0.088% CA-FORT 1085 (75 ppm CA)**
- **0.118% CA-FORT 1085 Dry (100 ppm CA)**
- **0.015% EN-HANCE A121S + 0.006% EN-HANCE CA**
<table>
<thead>
<tr>
<th></th>
<th>Untreated</th>
<th>50 ppm Carnosic Acid</th>
<th>75 ppm Carnosic Acid</th>
<th>100 ppm Carnosic Acid</th>
<th>BHA/BHT/Citric Acid</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Day 0</strong></td>
<td><img src="image1" alt="Image" /></td>
<td><img src="image2" alt="Image" /></td>
<td><img src="image3" alt="Image" /></td>
<td><img src="image4" alt="Image" /></td>
<td><img src="image5" alt="Image" /></td>
</tr>
<tr>
<td><strong>Day 2</strong></td>
<td><img src="image6" alt="Image" /></td>
<td><img src="image7" alt="Image" /></td>
<td><img src="image8" alt="Image" /></td>
<td><img src="image9" alt="Image" /></td>
<td><img src="image10" alt="Image" /></td>
</tr>
<tr>
<td><strong>Day 5</strong></td>
<td><img src="image11" alt="Image" /></td>
<td><img src="image12" alt="Image" /></td>
<td><img src="image13" alt="Image" /></td>
<td><img src="image14" alt="Image" /></td>
<td><img src="image15" alt="Image" /></td>
</tr>
<tr>
<td><strong>Day 9</strong></td>
<td><img src="image16" alt="Image" /></td>
<td><img src="image17" alt="Image" /></td>
<td><img src="image18" alt="Image" /></td>
<td><img src="image19" alt="Image" /></td>
<td><img src="image20" alt="Image" /></td>
</tr>
</tbody>
</table>
FROZEN PEPPERONI TBARS

- Untreated
- 0.059% CA-FORT™ 1085 (50 ppm CA)
- 0.088% CA-FORT™ 1085 (75 ppm CA)
- 0.118% CA-FORT™ 1085 Dry (100 ppm CA)
- 0.015% EN-HANCE® A121S + 0.006% EN-HANCE® CA (30 ppm each BHA/BHA/Citric Acid)
QUESTIONS?