Dairy for Clean Label

Innovations in Dairy Based Ingredients for Clean Label Solutions

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DISCLAIMER

The use of brands and images of branded products is intended only to provide examples of concepts being discussed, and does not imply endorsement of any brand or product.
Summary

• Clean label discussion is evolving and **dairy ingredients are well positioned** to deliver.

• Milk’s unique composition provides dairy ingredients with **diverse functional properties and versatility** for the development of clean label food products.

• Dairy ingredients can help clean label formulations in 2 ways:
  • By using “off-the shelf” dairy ingredients and **leveraging their unique composition and inherent functionality**
  • By **“tailoring” dairy ingredients** to achieve targeted solutions
Agenda

1. Implications for food Ingredients in clean label

2. How can dairy ingredients help?
   1. Dairy Ingredients 101
   2. Leveraging dairy ingredients inherent functionality
      1. Dairy protein ingredients functionality and flavor
      2. Milk fat Ingredients
   3. Tailoring dairy ingredients to achieve “targeted solutions”
Implications for Food Ingredients in Clean Label
Role of Food Ingredients in Food Products

Ingredients

Taste
- Neutral Flavors
- No off-notes
- Complement
- Enhance eating experience

Nutrition
- Macro and Micro-Nutrients
- Enhance Nutrition/Claims

Function
- Ease in processing
- Texture
- Enhance eating experience
- Product Stability
- Shelf Life (Enhancement)
How can Dairy Ingredients help?

By using “off-the-shelf” dairy ingredients

• Leverage their unique composition and inherent functionality
  • Protein, Lactose, Fats, Minerals
  • Take advantage of dairy’s “clean” image

By tailoring dairy ingredients to achieve “targeted solutions”

• Casein and whey protein modifications
  • pH
  • Temperature
  • Mechanical (process modification)
  • Enzymatic/Catalytic
• Lactose bioconversion
  • Fermentation
  • Enzymatic
  • Catalytic
Dairy Ingredients 101
# Let's start from the basics...composition

Cow’s Milk

<table>
<thead>
<tr>
<th>Component</th>
<th>Typical Composition, %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water</td>
<td>87.5</td>
</tr>
<tr>
<td>Proteins</td>
<td>3.4</td>
</tr>
<tr>
<td>Lactose</td>
<td>4.8</td>
</tr>
<tr>
<td>Fat</td>
<td>3.9</td>
</tr>
<tr>
<td>Ash (Minerals)</td>
<td>0.8</td>
</tr>
<tr>
<td>Caseins</td>
<td>2.7 %</td>
</tr>
<tr>
<td>Whey Proteins</td>
<td>0.8 %</td>
</tr>
</tbody>
</table>

Lets start from the basics...dairy unit operations

- Pasteurization
- Cream Separation
- Fermentation
- Evaporation
- Membrane Filtration
- Drying

Fluid Milk and Cream
- Fluid Milk
- Cream
- Butter
- Butter Oil/AMF
- Cheese
- Yogurt
- Evaporated Milk
- Condensed Milk
- Milk Powders (WMP/SMP/NDM)
- Whey Powders
- Milk Protein Ingredients (MPC, MPI, MCC, Specialty Milk Proteins)
- Whey Protein Ingredients (WPC, WPI, Specialty Whey Proteins)
## Milk Protein Ingredients

<table>
<thead>
<tr>
<th></th>
<th>Milk Powders SMP, NDM</th>
<th>MPC-70</th>
<th>MPC-80</th>
<th>MPI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Protein, %</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lactose, %</td>
<td>49.5 – 55.0</td>
<td>20.0 (max)</td>
<td>9.0 (max)</td>
<td>5.0 (max)</td>
</tr>
<tr>
<td>Fat, %</td>
<td>0.6 – 1.25</td>
<td>2.5 (max)</td>
<td>2.5 (max)</td>
<td>2.5 (max)</td>
</tr>
<tr>
<td>Minerals, %</td>
<td>8.2 – 8.6</td>
<td>10.0 (max)</td>
<td>8.0 (max)</td>
<td>8.0 (max)</td>
</tr>
<tr>
<td>Moisture, %</td>
<td>3.0 – 5.0</td>
<td>6.0 (max)</td>
<td>6.0 (max)</td>
<td>6.0 (max)</td>
</tr>
</tbody>
</table>

**Casein : Whey Protein = 80 : 20**

Sources:
1. [http://www.thinkusadairy.org/products](http://www.thinkusadairy.org/products)
## Whey Protein Ingredients

<table>
<thead>
<tr>
<th></th>
<th>WPC 34</th>
<th>WPC 80</th>
<th>WPI</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Protein, %</strong></td>
<td></td>
<td><strong>No Caseins</strong></td>
<td></td>
</tr>
<tr>
<td>Lactose, %</td>
<td>48.0 – 52.0</td>
<td>4.0 – 8.0</td>
<td>0.5 – 1.0</td>
</tr>
<tr>
<td>Fat, %</td>
<td>3.0 – 4.5</td>
<td>4.0 – 8.0</td>
<td>0.5 – 1.0</td>
</tr>
<tr>
<td>Minerals, %</td>
<td>6.5 – 8.0</td>
<td>3.0 – 4.0</td>
<td>2.0 – 3.0</td>
</tr>
<tr>
<td>Moisture, %</td>
<td>3.0 – 4.5</td>
<td>3.5 – 4.5</td>
<td>4.0 – 6.0</td>
</tr>
</tbody>
</table>

Sources:
1. [http://www.thinkusadairy.org/products](http://www.thinkusadairy.org/products)
Lactose Rich Ingredients

<table>
<thead>
<tr>
<th>Source</th>
<th>Whey Powder</th>
<th>Whey Permeate/Dairy Product Solids</th>
<th>Lactose (Food Grade)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Protein, %</td>
<td>11.0 – 14.5</td>
<td>2.0 – 7.0</td>
<td>0.1</td>
</tr>
<tr>
<td>Lactose, %</td>
<td>63.0 – 75.0</td>
<td>76.0 – 88.0</td>
<td>99.0 (min)</td>
</tr>
<tr>
<td>Fat, %</td>
<td>1.0 – 1.5</td>
<td>0.0 – 1.5</td>
<td>---</td>
</tr>
<tr>
<td>Minerals, %</td>
<td>8.2 – 8.8</td>
<td>8.0 – 14.0</td>
<td>0.1 – 0.3</td>
</tr>
<tr>
<td>Moisture, %</td>
<td>3.5 – 5.0</td>
<td>3.0 – 5.0</td>
<td>4.5 – 5.5</td>
</tr>
</tbody>
</table>

Sources:
1. [http://www.thinkusadairy.org/products](http://www.thinkusadairy.org/products)
How can Dairy Ingredients help?

By using “off-the-shelf” dairy ingredients

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  • Take advantage of dairy’s “clean” image

By tailoring dairy ingredients to achieve “targeted solutions”

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  • pH
  • Temperature
  • Mechanical (process modification)
  • Enzymatic/Catalytic
• Lactose bioconversion
  • Fermentation
  • Enzymatic
  • Catalytic
Quick Refresher: Functional Properties

“Functional properties describes how ingredients behave during preparation and cooking, how they affect the finished food product in terms of how it looks, tastes, and feels.”

https://www.ifst.org/lovefoodlovescience/resources/functional-properties-food

(Damodaran and Paraf, 1997)
Quick Refresher: How do (dairy) proteins manifest varied functional properties?

Protein Structure and Interactions
(Primary, Secondary, and tertiary)

Response to extrinsic factors
(food formulation, processing, cooking etc.)

Functional Properties

- Water / solvents
- pH / Process
- salt
- Temperature (Freezing-heating)
- Shear
- Pressure
- Chemical / Enzymatic
- Inter and intra- molecular interactions

### Properties of dairy proteins...Versatility!

**TABLE 2: COMPARISON OF SELECTED PHYSICOCHEMICAL PROPERTIES OF CASEIN AND WHEY PROTEINS**

<table>
<thead>
<tr>
<th>PROPERTIES</th>
<th>CASEINS</th>
<th>WHEY PROTEINS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Structure</strong></td>
<td>Lack well-defined secondary, tertiary and quaternary structure; possess random coil structure</td>
<td>Well-defined tertiary and quaternary structure</td>
</tr>
<tr>
<td><strong>Amino acid composition</strong></td>
<td>Low in sulfur-containing amino acids; high in proline</td>
<td>Relatively high in sulfur-containing amino acids; low in proline</td>
</tr>
<tr>
<td><strong>Physical state</strong></td>
<td>Exist as large colloidal aggregates called casein micelles</td>
<td>Exist as globular proteins in form of monomer-octamers, depending on pH</td>
</tr>
<tr>
<td><strong>Solubility at pH 4.6</strong></td>
<td>Insoluble at pH 4.6</td>
<td>Soluble at pH 4.6</td>
</tr>
<tr>
<td><strong>Heat stability</strong></td>
<td>Very heat-stable (can withstand severe heat treatment such as sterilization, ultrahigh temperature (UHT) or retort processing)</td>
<td>Heat-labile (can be completely denatured, particularly when heating at 90°C or higher)</td>
</tr>
<tr>
<td><strong>Coagulation by limited proteolysis or ethanol</strong></td>
<td>Can be coagulated by specific, limited proteolysis (e.g., rennet coagulation) or ethanol</td>
<td>Cannot be readily coagulated by enzyme or limited proteolysis or ethanol</td>
</tr>
</tbody>
</table>

Dairy proteins offer a gamut of functional properties to food products...**Versatility!**

<table>
<thead>
<tr>
<th>Food Product</th>
<th>Functions required for most products</th>
<th>Functions required for some products</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beverages</td>
<td>Solubility, colloidal stability, viscosity, heat stability</td>
<td>Acid stability, emulsifying, water holding</td>
</tr>
<tr>
<td>Bakery</td>
<td>Solubility, emulsifying, gelation, color and flavor development</td>
<td>Foaming, foam stability, water holding, gluten modification</td>
</tr>
<tr>
<td>Confectionery</td>
<td>Foaming, solubility, color and flavor development</td>
<td>Emulsifying, gelation</td>
</tr>
<tr>
<td>Frozen desserts</td>
<td>Emulsifying, solubility, dispersibility</td>
<td>Solubility, water holding, fat mimetic, gelation</td>
</tr>
<tr>
<td>Formed meat products and meat analogs</td>
<td>Emulsification, water holding, color development</td>
<td>Salt solubility, low viscosity, gelation, fat mimetic</td>
</tr>
<tr>
<td>Sauces, soups, gravies</td>
<td>Emulsification, water holding</td>
<td>viscosity</td>
</tr>
<tr>
<td>‘Imitation’ dairy</td>
<td>Emulsifying, colloid stability</td>
<td>Solubility, foaming, foam stability</td>
</tr>
<tr>
<td>Salty snacks</td>
<td>Solubility, heat stability</td>
<td>Foaming, foam stability, gelation</td>
</tr>
</tbody>
</table>

Sources:
1. [http://www.thinkusadairy.org/products](http://www.thinkusadairy.org/products)
Why Dairy Protein Ingredients for Clean Label Foods?

Dairy Protein Ingredients
- Excellent Functionality
- Cleaner Flavor
- Higher protein quality

Use of less ingredients
- Ability to replace:
  - Starches
  - Hydrocolloids
  - Flavor maskers
  - No protein blending required for nutritional equivalency

Clean Label Foods
## Functionality: How do they compare to other protein sources?

<table>
<thead>
<tr>
<th>Functional Property</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water Holding Capacity</td>
<td>Milk ~ Soy ~ Pea &gt; Whey ~ Potato ~ Rice</td>
</tr>
<tr>
<td>Viscosity</td>
<td>Milk ~ Pea &gt; Whey ~ Soy ~ Potato ~ Rice</td>
</tr>
<tr>
<td>Heat Stability (acidic conditions, pH 3)</td>
<td>Whey &gt; Plant &gt; Milk</td>
</tr>
<tr>
<td>Heat Stability (neutral conditions, pH 7)</td>
<td>Milk ~ Whey &gt; Plant</td>
</tr>
<tr>
<td>Emulsion Activity</td>
<td>Milk ~ Whey ~ Pea ~ Soy ~ Potato ~ Rice</td>
</tr>
<tr>
<td>Emulsion Stability</td>
<td>Milk &gt; Whey ~ Pea ~ Soy ~ Potato ~ Rice</td>
</tr>
<tr>
<td>Foam Ability</td>
<td>Whey &gt; Soy ~ Potato &gt; Milk &gt; Pea</td>
</tr>
<tr>
<td>Foam Stability</td>
<td>Whey &gt; Milk &gt; Soy and &gt; Pea &gt; Rice</td>
</tr>
<tr>
<td>Gel Strength</td>
<td>Whey &gt; Potato ~ Pea ~ Soy</td>
</tr>
</tbody>
</table>

Dairy proteins are versatile and offer a comprehensive solution to end users.

Sources:
Sensory Profile: How do they compare to other protein sources?

Sources:
Flavor Differences between Plant and Dairy Proteins

Plant Proteins
- Cereal
- Sulfurous
- Beany
- Pyrazine/bell pepper
- Earthy/potting soil
- Fruity
- Sour aromatic
- Sour taste
- Umami taste

Dairy Proteins
- Cardboard
- Brothy
- Herbal/grassy
- Salty taste
- Bitter taste
- Astringency
- Sweet aromatic
- Milky/cooked
- Soapy
- Animal
- Tortilla

Sources:
# Scenario 1: Choosing My Protein*

## UHT beverages

<table>
<thead>
<tr>
<th>Desired Properties</th>
<th>Milk Protein</th>
<th>Soy Protein</th>
<th>Pea Protein</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clean Taste</td>
<td>●</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Good Solubility</td>
<td>●</td>
<td>●</td>
<td></td>
</tr>
<tr>
<td>Medium Viscosity</td>
<td>●</td>
<td></td>
<td>●</td>
</tr>
<tr>
<td>Good Heat Stability at neutral pH</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Low Foaming</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Good fat emulsification</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
</tbody>
</table>

* For Illustrative Purposes Only
Model UHT Beverage Test at WI-CDR (neutral pH)

Sources:
Scenario 2: Choosing My Protein*

### Protein Waters

<table>
<thead>
<tr>
<th>Desired Properties</th>
<th>Whey Protein</th>
<th>Soy Protein</th>
<th>Pea Protein</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clean Taste</td>
<td>●</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Good Solubility</td>
<td>●</td>
<td>●</td>
<td></td>
</tr>
<tr>
<td>Low Viscosity</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Good Heat Stability at acidic pH</td>
<td>●</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low Foaming</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Clarity</td>
<td>●</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* For Illustrative Purposes Only
Model High Acid Beverage Test at CDR (low pH)

Rice1 separated right after process.
Pea3 separated after sitting in the fridge overnight.

Sources:
Nutrition implication: All proteins are not created equal

- Protein Quality: The ability of a food protein to meet the body’s metabolic demand for amino acids and nitrogen
- Food proteins vary in their protein quality based on:
  - Amino acid composition
  - Digestibility
    - Animal based proteins >90%
    - Plant based proteins 45 – 80%
  - Bioavailability
- PDCAAS (Protein Digestibility Corrected Amino Acid Score) is the current gold standard for assessing protein quality

### PDCAAS for Selected Isolated Proteins and Foods

<table>
<thead>
<tr>
<th>Food</th>
<th>PDCAAS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Milk Protein Concentrate</td>
<td>1.00</td>
</tr>
<tr>
<td>Whey Protein Isolate</td>
<td>1.00</td>
</tr>
<tr>
<td>Soy Protein Isolate</td>
<td>0.98</td>
</tr>
<tr>
<td>Pea Protein Concentrate</td>
<td>0.89</td>
</tr>
<tr>
<td>Rice Protein Concentrate</td>
<td>0.42</td>
</tr>
<tr>
<td>Whole milk</td>
<td>1.00</td>
</tr>
<tr>
<td>Chicken breast</td>
<td>1.00</td>
</tr>
<tr>
<td>Egg (hard boiled)</td>
<td>1.00</td>
</tr>
<tr>
<td>Cooked peas</td>
<td>0.60</td>
</tr>
<tr>
<td>Cooked rice</td>
<td>0.62</td>
</tr>
<tr>
<td>Almonds</td>
<td>0.39</td>
</tr>
<tr>
<td>Chickpeas</td>
<td>0.74</td>
</tr>
<tr>
<td>Tofu</td>
<td>0.56</td>
</tr>
</tbody>
</table>

Table adapted from Phillips SM, *Front. Nutr.*, 2017
Summary: Why Dairy Protein Ingredients for Clean Label Foods?

Dairy Protein Ingredients
- Excellent Functionality
- Cleaner Flavor
- Higher protein quality

Use of less ingredients
- Ability to replace:
  - Starches
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Clean Label Foods
Cream, Butter, and Other Fat Rich Dairy Ingredients

• Major Milk Fat Ingredients
  • Cream
  • Butter
  • Anhydrous Milk Fat

• Advantages for Clean Label Formulations
  ✓ Changing nutritional/health perspectives
  ✓ Clean and unique flavor profile
  ✓ Complex melt profile and crystallization behavior
    ➢ Unique mouthfeel
    ➢ Flavor release and sensory experience
    ➢ Shortening replacements
    ➢ Ability to be fractionated for targeted applications

High fat dairy ingredients are in trend…

McDonald's Is Now Using Real Butter
The chain is weening itself off of liquid margarine.
by Khushbu Shah | Sep 1, 2015, 9:33am EDT

Source: https://www.eater.com/2015/9/1/9239019/mcdonalds-uses-real-butter-axes-margarine-shocker

Coffee Creamers Getting a Clean-Label Makeover

Source: https://www.naturalproductsinsider.com/herbs-botanicals/coffee-creamers-getting-clean-label-makeover


“...Nestle focused on ingredients in its Stouffer's Macaroni and Cheese commonly found in the home, such as freshly made pasta, cheddar cheese and skim milk. One part of the recipe overhaul included replacing margarine with butter.”
How can Dairy Ingredients help?

By using “off-the-shelf” dairy ingredients

• Leverage their unique composition and inherent functionality
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By tailoring dairy ingredients to achieve “targeted solutions”

• Casein and whey protein modifications
  • pH
  • Temperature
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  • Enzymatic/Catalytic
• Lactose bioconversion
  • Fermentation
  • Enzymatic
  • Catalytic
Tailoring dairy ingredients to achieve “targeted solutions”…

- **Component**: Dairy Proteins, Lactose, Minerals
- **Treatment**: pH, Temperature, Mechanical, Enzymatic/Catalytic, Fermentation
Remove “phosphates” with dairy ingredients

- Dairy Proteins (Caseins and Whey Proteins)
- Minerals (Calcium)
- pH

**Component**

**Treatment**

**Result**

- Heat Stability


Figure 3. Heat coagulation time (HCT: min) of enteral dairy beverage formulations prepared using control, 20% calcium-reduced milk protein concentrate (MPC30), and 30% calcium-reduced MPC (MPC30) in phase II with sodium hexametaphosphate (SHMP) at different levels. Values with the same letters (a–e) are not significantly different across all treatments (P > 0.05). Error bars indicate SD (n = 2).
Remove “emulsifiers” with dairy ingredients

Dr. Varadhanabuti, University of Missouri Columbia

Sources:
Kotchabhakdi, A. 2019. Developing clean label emulsifier based on whey protein and pectin complexes
Wang, Y. 2018. Emulsification properties of heated whey protein-pectin formed at neutral pH
Better foaming lattes using milk powders...

Component
- Skim Milk
- Milk Powder
- Ice Cream; Lattes

Treatment
- Dairy Proteins
- Mechanical: High Pressure Jet
- Foaming

Result


Table 2. Interfacial properties of reconstituted skim milk samples (9% TS) at 20 °C

<table>
<thead>
<tr>
<th>Powder used for reconstitution</th>
<th>Surface tension (mN m⁻¹)</th>
<th>Emulsifying activity index (EAI) (m² g⁻¹)</th>
<th>Emulsion stability index (ESI) (%)</th>
<th>Foam expansion index (FEI) (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>51.5±0.8⁸</td>
<td>38.7±0.9⁸</td>
<td>134.1±0.6³</td>
<td>60.0±23.8³</td>
</tr>
<tr>
<td>100 MPa</td>
<td>51.3±0.8⁸</td>
<td>38.2±0.2⁸</td>
<td>137.9±5.3⁶</td>
<td>49.2±21.8⁵</td>
</tr>
<tr>
<td>200 MPa</td>
<td>50.6±0.8⁸</td>
<td>37.1±1.2⁸</td>
<td>131.5±3.4⁶</td>
<td>61.7±23.1⁶</td>
</tr>
<tr>
<td>300 MPa</td>
<td>52.0±0.9⁸</td>
<td>35.0±0.8⁸</td>
<td>130.0±3.0⁶</td>
<td>60.0±13.2⁵</td>
</tr>
<tr>
<td>400 MPa</td>
<td>52.4±1.0⁸</td>
<td>39.8±2.0⁸</td>
<td>134.2±0.7⁶</td>
<td>93.3±16.1⁶</td>
</tr>
<tr>
<td>500 MPa</td>
<td>52.5±0.3⁸</td>
<td>41.7±1.4⁸</td>
<td>148.0±8.0⁸</td>
<td>114.2±2.9⁵</td>
</tr>
</tbody>
</table>

¹Values are given as Mean±SD for triplicate samples. Means followed by different lowercase letters are significantly different (P<0.05; Tukey’s test).
²Before the preparation of emulsions, the reconstituted samples were diluted to 2% TS.
³ESI was measured 4 h after emulsion preparation.
Replace “Na-Caseinate”

Skim Milk → Micellar Casein → Coffee Creamers

- Component: Caseins
- Treatment: Mechanical: Fractionation
- Result: Emulsification

Lactose rich dairy ingredients provide sweetener solutions...

- **Component**: Lactose rich whey ingredients
- **Treatment**: Enzymatic/Catalytic
- **Result**: Clean label solutions for:
  - Artificial Sweeteners
  - Sweetener solutions

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**Article**

*One-pot synthesis of sweetening syrup from lactose*
Shuyun Cheng, Lloyd E. Metzger & Sergio I. Martinez-Montegudo

*Scientific Reports* 10, Article number: 2730 (2020) | Cite this article
290 Accesses | Metrics

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**Diagram**

- Graph showing product distribution (%)
  - Various components like Glucose, Galactose, Fructose, D-Talose, Lactose, and Byproducts.
  - Distributions for different compositions such as SiO₂, 10-MgO/SiO₂, 20-MgO/SiO₂, 30-MgO/SiO₂, and 40-MgO/SiO₂.
Fermentation of lactose rich dairy ingredients for clean label solutions…

- Lactose rich dairy milk and whey ingredients
- Cultured milk
- Cultured whey
- Clean label solutions for:
  - Preservatives
  - Texturizers
  - Flavors

- Component: Lactose
- Treatment: Fermentation
- Result: Bio-preservatives, Exo-polysaccharides, Reaction Flavors

King et al. 1999. DuPont. Patent # US00.59896 12A
Summary

• Clean label discussion is evolving and **dairy ingredients are well positioned** to deliver.

• Milk’s unique composition provides dairy ingredients with **diverse functional properties and versatility** for the development of clean label food products.

• Dairy ingredients can help clean label formulations in 2 ways:
  • By using “off-the shelf” dairy ingredients and **leveraging their unique composition and inherent functionality**
  • By “tailoring” **dairy ingredients** to achieve targeted solutions
Thank You

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