Clean-label sweetness with Saphera® FMP

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Clean-label sweetness with conversion, not replacement
Clean-label sweetness

How does lactase enable clean-label sweetness?

Why Saphera and not another lactase?

What innovations does this unlock for product developers?
### Relative sweetness of food sugars

<table>
<thead>
<tr>
<th>Sugar</th>
<th>Relative sweetness¹</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lactose</td>
<td>0.39</td>
</tr>
<tr>
<td>Sucrose</td>
<td>1.0</td>
</tr>
<tr>
<td>D-Fructose</td>
<td>1.14</td>
</tr>
<tr>
<td>D-Galactose</td>
<td>0.63</td>
</tr>
<tr>
<td>D-Glucose</td>
<td>0.69</td>
</tr>
</tbody>
</table>

¹ *Lehrbuch der Lebensmittelchemie, 5. Auflage, Belitz-Grosch-Schieberle, Springer Verlag, 2001*
How lactases work

Lactose → Hydrolysis with lactase → Monosaccharides

- Galactose
- Glucose
Improved performance compared to industry standard yeast-lactase
Saphera®

First lactase from a strain of *Bifidobacterium*

- Superior purity
- Better lactase performance at reduced pH
Novozymes Saphera® is an exceptionally pure lactase
Fewer impurities compared to yeast lactases

Relative number of host enzymes

5-6 times lower number of host enzymes in Saphera compared to yeast lactases
Novozymes Saphera® is an exceptionally pure lactase
invertase is not detectable in Saphera®
Novozymes Saphera® is an exceptionally pure lactase
Protease activity nAU/g is below detection level for Saphera
Lactase overview and applications in milk, cream and yoghurt

Novozymes lactases temperature and pH activity

![Graph showing lactase activity at different temperatures and pH levels]

- **Lactozym® Pure**
- **Saphera®**
- Typical yeast lactase

Relative activity (%)

- °C
- pH

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[Graph showing lactase activity at different temperatures and pH levels]

- **Lactozym® Pure**
- **Saphera®**
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Relative activity (%)

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[Graph showing lactase activity at different temperatures and pH levels]

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[Graph showing lactase activity at different temperatures and pH levels]

- **Lactozym® Pure**
- **Saphera®**
- Typical yeast lactase

Relative activity (%)

- °C
- pH
Product Innovation with sweetness from lactose hydrolysis
Novozymes Saphera® in lactose-free yogurt

- Lab test using Saphera® 2600 L with culture blend (5hrs, 43°C)
- Lactose in 3% fat milk

![Graph showing lactose levels over fermentation time](image-url)
Culture performance is not affected

pH decrease during fermentation

- control
- 0.1g Saphera/L
- 0.7g Saphera/L
### Lactase overview and applications in milk, cream and yoghurt

#### Lactase for sugar reduction

Less added sugar with Saphera®. But how much?

<table>
<thead>
<tr>
<th>Compound (g/100g)</th>
<th>Normal milk</th>
<th>Lactose-free milk</th>
<th>Added sugar, normal milk</th>
<th>Reduced sugar, lactose-free milk</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lactose</td>
<td>5.0</td>
<td>0.0</td>
<td>5.0</td>
<td>0.0</td>
</tr>
<tr>
<td>Sucrose</td>
<td>0.0</td>
<td>0.0</td>
<td>5.0</td>
<td>3.5</td>
</tr>
<tr>
<td>D-Fructose</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>D-Galactose</td>
<td>0.0</td>
<td>2.6</td>
<td>0.0</td>
<td>2.6</td>
</tr>
<tr>
<td>D-Glucose</td>
<td>0.0</td>
<td>2.6</td>
<td>0.0</td>
<td>2.6</td>
</tr>
<tr>
<td><strong>Total relative sweetness</strong></td>
<td>1.95</td>
<td>3.47</td>
<td>6.95</td>
<td>6.97</td>
</tr>
</tbody>
</table>

#### Flavored milk

- **30% less added sugar**

### Yoghurt

<table>
<thead>
<tr>
<th>Compound (g/100g)</th>
<th>Normal yoghurt</th>
<th>Lactose-free yoghurt</th>
<th>Added sugar normal yoghurt</th>
<th>Reduced sugar lactose-free yoghurt</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lactose</td>
<td>3.6</td>
<td>0.0</td>
<td>3.6</td>
<td>0.0</td>
</tr>
<tr>
<td>Sucrose</td>
<td>0.0</td>
<td>0.0</td>
<td>5.2</td>
<td>4.1</td>
</tr>
<tr>
<td>D-Fructose</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>D-Galactose</td>
<td>0.7</td>
<td>2.6</td>
<td>0.7</td>
<td>2.6</td>
</tr>
<tr>
<td>D-Glucose</td>
<td>0.0</td>
<td>1.9</td>
<td>0.0</td>
<td>1.9</td>
</tr>
<tr>
<td><strong>Total relative sweetness</strong></td>
<td>1.87</td>
<td>2.97</td>
<td>7.07</td>
<td>7.07</td>
</tr>
</tbody>
</table>

- **20% less added sugar**
Sugar reduction in yoghurt with Saphera

Sensory analysis of yoghurt samples with different amounts of sugar added:
With Saphera it is possible to reduce the amount of added sugar by 1g/100g yoghurt.

Sensory evaluation of yoghurt samples (n=7)
Sensory assessment of plain yoghurt with Saphera

Sensory analysis of no-sugar-added yoghurt after 2 weeks @ 4°C; mean scoring from n=6 tasters.
Drinking yoghurt

- Control, 7.2% sugar
- Saphera 0.4g/L, 6.2% sugar
- Lactozym Pure 0.6g/L, 6.2% sugar
- Comp. yeast lactase 0.6g/L, 6.2% sugar

Acidity, viscosity, homogeneity, smoothness, and sweetness are measured for 5 days and 27 days.
Quark – the next big dairy food?

- Less salt than soft cheese or cottage cheese
- More protein than Greek yogurt
- More flavour than sour cream
- Smoother than ricotta
- Less firm than cream cheese
- Less fat than mascarpone
Protein Supplement

WPC80 containing 4-10% lactose
Reduce or eliminate added sugar, Stevia or sucralose
Why aren’t there low lactose dairy powders as sweetener ingredients?

Permeate  Whey  Protein content  MPC WPC-80  WPI

Syrups  Reduced yield or new state-of-the-art spray dryers  Typical spray dryer processes
Clean-label sweetness with Saphera®

**How does lactase enable clean-label sweetness?**
Lactose is much less sweet than Glu/Gal

**Why Saphera and not another lactase?**
Purity and performance at reduced pH

**What innovation does this unlock for product developers?**
Cultured dairy products, beverages, whey-based sweeteners, more
Thank you

https://www.youtube.com/watch?v=BZoiZTL6l4I