Butter is a traditional natural dairy product, which has been made for centuries from cream. Butter is an emulsion of water in oil and is made in both sweet and sour varieties. Traditionally, butter is produced from matured cream using a discontinuous process. Nowadays, butter is usually made according to the NIZO process. Using this method, acidification and aroma formation occurs after the sweet cream has been churned. Sweet buttermilk is created during this production process. The sweet buttermilk is easy to use as an ingredient in a wide variety of dairy industry applications. Aroma can be formed by using lactic acids or distilled butter aromas. There is a distinction in the market between sweet, salty and sour butter. In Europe, a geographic separation exists: salty in Southern Europe, sour in Western Europe and sweet in Eastern Europe.

Butter churn
Traditionally, cream was derived from automatically creaming milk fat; the cream was skimmed off from the milk. The invention of the cream centrifuge paved the way to industrialization. Later, the additional processing stage known as churning was likewise further automated. Nowadays, a butter churn is used to process the butter into a finished product.

Sweet and sour
In production, a distinction can be made between processing sweet cream and sour cream into butter. Salty butter production is based on sweet butter, without addition of any active ingredients. However, cultures are used to produce sour cream in order to lower the pH.

NIZO system
The NIZO institute has developed two different production systems. Diacetyl production applies bacteria cultures in combination with natural lactic acid. Another system relies on a combination of natural diacetyl and natural obtained lactic acid. The NIZO procedure enables the upgrade sour butter even further: the buttermilk by-product can be processed into skim milk powder. CSK food enrichment actively contributed to the implementation of the NIZO system in West Europe. Currently, there are advanced applications in the market in Eastern Europe.

Cultures
In addition to cultures for immediate application we also offer a range of acidifying bulk starters. CSK has the ideal solutions for aroma forming starters. Our specialists will be happy to help you make the right choice.

Lactic starter permeate and distillate
CSK has the right products for every method to apply the NIZO procedure. Lactic starter permeate is a milk ingredient-based lactic acid derived through natural fermentation that can be used without being declared. Lactic starter distillate is a naturally derived butter aroma.

Consultancy
CSK’s technology experts will gladly help you to apply cultures, setting up your bulk starter production room for preparing bulk starters, implementing the NIZO procedure and optimising your process, especially the dry solids content in the butter. Our goal is to achieve the maximum value of your milk fat and by-products.

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Application: lactic aromatic butter from fermented cream

Cultures of L or LD type for bulkstarter preparation.

<table>
<thead>
<tr>
<th>Code</th>
<th>Type</th>
<th>Phage resistance</th>
<th>Packaging / Contents</th>
</tr>
</thead>
<tbody>
<tr>
<td>C 19</td>
<td>L</td>
<td>very high</td>
<td>cup 62, 125 g</td>
</tr>
<tr>
<td>C 28</td>
<td>L</td>
<td>very high</td>
<td>cup 125 g</td>
</tr>
<tr>
<td>C 02</td>
<td>LD</td>
<td>high</td>
<td>cup 62, 125 g</td>
</tr>
<tr>
<td>C 10</td>
<td>LD</td>
<td>high</td>
<td>cup 125 g</td>
</tr>
</tbody>
</table>

DVI cultures of L or LD type for cream fermentation.

<table>
<thead>
<tr>
<th>Code</th>
<th>Type</th>
<th>Phage resistance</th>
<th>Packaging / Contents</th>
</tr>
</thead>
<tbody>
<tr>
<td>F 200</td>
<td>L</td>
<td>very high</td>
<td>gable top 250, 500 units</td>
</tr>
<tr>
<td>F 800</td>
<td>L</td>
<td>high</td>
<td>gable top 500 units</td>
</tr>
<tr>
<td>G 300</td>
<td>LD</td>
<td>high</td>
<td>gable top 500 units</td>
</tr>
<tr>
<td>G 600</td>
<td>LD</td>
<td>high</td>
<td>gable top 250, 500 units</td>
</tr>
</tbody>
</table>

Application: lactic aromatic butter according Nizo procedure

Cultures necessary for producing aromatic lactic butter from sweet cream according the Nizo procedure*

<table>
<thead>
<tr>
<th>Code</th>
<th>Type</th>
<th>Phage resistance</th>
<th>Diacetyl production</th>
<th>Packaging / Contents</th>
</tr>
</thead>
<tbody>
<tr>
<td>C 27</td>
<td>L</td>
<td>very high</td>
<td>very high</td>
<td>cup 62, 125 g</td>
</tr>
<tr>
<td>C 26</td>
<td>L</td>
<td>very high</td>
<td>low</td>
<td>cup 125 g</td>
</tr>
</tbody>
</table>

* For further information, also look at product information Ceska®-star lactic permeate.
Milk is the ingredient used to produce Ceska®-lact lactic acid distillate. The milk is fermented and steam distilled. Specially chosen lactic acid bacteria are used to achieve the preferred flavour profile. From 2005 onwards, the lactic acid permeate of CSK food enrichment is Kosher certified by London Beth Din (KLBD-D) and Halal certified by HFFIA (HVV).

Description, preparation and composition
The fermentation and distillation process produce a mixture of volatile fermentation products known as butter aromas. These aromas are used in the production of yellow fats and in the dairy industry when a mild dairy flavour or authentic butter flavour is desired.

According to the European rules on making butter, the use of non-dairy components is prohibited. The application of Ceska®-lact lactic acid distillate is in accordance with the principles of European rules.

Application and advantages
The use of Ceska®-lact lactic acid distillate (instead of cultures) offers the following advantages:
- Heightened process security: controlled flavour development during the butter production;
- Desired amount of diacetyl is immediately found in the proper proportion in the butter. Butter aroma and flavour can be composed according to individual preference;
- Natural flavour solutions without declaration.

Application
Nowadays, butter is typically produced in a continuous process using a butter churn. Aromas used in the production of butter are water soluble. The high amount of butterfat in butter lends a pronounced basic flavour. Therefore, a non-soluble butter aroma is essential. The most important aroma component is diacetyl. Ceska®-lact lactic acid distillate is standardized according to a diacetyl content of 1,000 ppm per litre.

In the NIZO process, an amount of a mixture of 5 litres of Ceska®-lact lactic acid permeate and 1 litre of Ceska®-lact lactic acid distillate per 1000 kg butter is required in order to achieve a pH of 5.0 and diacetyl content of 1.0 ppm in the butter.

Packaging sizes
Ceska®-lact lactic acid distillate is available in:
- 25 litre jerry cans;
- 200 litre vats.

Storage and shelf life
Ceska®-lact lactic acid distillate can be kept for 6 months without any loss of activity provided it is stored in the closed original packaging between 0 and 6 °C.

Technical assistance
Our technical sales staff has years of experience in using lactic acid distillate in the production of butter. For more information, please contact our team of experts.

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Lactic acid permeate is used mainly for the production of butter according to the NIZO butter process. This method was developed by the Netherlands Dairy Research Institute (Nederlands Instituut voor Zuivelonderszoek - NIZO). Sweet cream is turned into acidified butter by adding lactic acid permeate and cultures or lactic acid distillate after churning. This also produces sweet buttermilk instead of sour buttermilk. The butter produced using this method is a natural and pure dairy product and approved for EU intervention. Years of practical experience and the research department’s advanced knowledge make CSK food enrichment the expert on lactic acid permeate for butter production. CSK markets lactic acid permeate under the brand name Ceska®-lact.

**Description, preparation and composition**

Ceska®-lact lactic acid permeate is a naturally fermented milk serum. CSK’s permeate is made from an unsweetened whey medium that is fermented using a special starter culture. After fermentation the medium is ultra filtrated. Next, the permeate is concentrated in a downdraft condenser. Finally, the concentrated permeate is standardized according to degree of acidity and contains 15 % lactic acid. From 2005 onwards, CSK’s lactic acid permeate is Kosher certified by London Beth Din (KLBD-D) and Halal certified by HFFIA. (HVV).

**Advantages**

Using the NIZO process to make butter offers the following advantages:

- upgrade to sweet buttermilk;
- better control over process by dividing the process into three separate steps;
- more stable quality of the butter during the various seasons;
- improved control over the fat free dry matter of the butter;
- enhanced butter quality.

**Recommended dose**

The recommended amount of lactic acid permeate depends on the desired pH of the butter. A mixture of 5 litres of Ceska®-lact permeate together with 7.5 litres cultured Ceska®-star C27 produces a pH of 5.0 and a diacetyl content of 1.0 ppm after oxygenation and dosed for 1,000 kg butter. In order to control the dry matter content of the butter, the cultured Ceska®-star C26 is dosed separately in the butter. (See Appendix 1)

As a good alternative for aroma production the aromatic Ceska®-star C27 can be replaced with the natural butter flavour of Ceska®-lact lactic acid distillate.

**Packaging sizes**

Permeate is available in:

- 25 litre jerry cans (disposable);
- 1,000 litre plastic containers;
- 800 litre stainless steel containers.

**Storage and shelf life**

Ceska®-lact permeate can be kept for 6 months without any loss of activity provided it is stored in the closed original packaging between 0 and 25 °C.

**Technical assistance**

Our technical sales staff has years of experience in using lactic acid permeate in the production of butter. For more information, please contact our team of experts.

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1 = Ceska®-star C26
2 = Lactic acid permeate
3 = Ceska®-star C27
4 = Storage Ceska®-star C26
5 = Storage lactic acid permeate and Ceska®-star C27
6 = Dosage pump water
7 = Storage water
8 = Storage cream
9 = Dosage pump Ceska®-star C26
10 = Dosage pump Lactic acid permeate and Ceska®-star C27
11 = Dosage pump cream
12 = Butter machine
Butter
Ceska® media

Culture media

CSK food enrichment has a long tradition in the dairy industry as a producer of dairy ingredients. The expertise in bulk starter production for butter is used for the development of a broad portfolio of culture media, which are optimally adjusted to the existing Ceska®-star bulk starter cultures.

Characteristics and properties
Culture media are a complex blend of skimmed milk powder, whey proteins, phosphate salts, yeast extracts and other specific growing agents. Culture media are used to improve bulk starter production of butter as an alternative for skimmed milk to ensure a robust system with a consistent acid production, predictable activity and a high protection against phage infection.

Benefits of Ceska®-media

Improved cultures yield
The growth of the culture is maximised by optimal nutrition and growth conditions, due to:
- fast adaptation of the culture after inoculation;
- presence of specific minerals and compounds, which stimulate bacterial growth;
- a buffered acidity system, which maximise the bacteria cell counts;
- culture media are free of any inhibitors like e.g. antibiotics.

Improved production yield
When comparing Ceska®-media with milk powder on basis of 20 % (w/w) of dry matter, Ceska®-media is a cheaper TSNF source.

Fermentation time
When comparing Ceska®-media with milk powder on basis of 20 % (w/w) of dry matter the fermentation time till citric acid is fermented is much shorter. When optimising the yield of butter, the dry matter of media can be increased without negative effects on the fermentation time.

Diacetyl content
When comparing Ceska®-media with milk powder on basis of 20 % (w/w) of dry matter the diacetyl content in Ceska®-media is 50 % higher after mixing with permeate and aeration.

Protection against bacteriophage infection
Ceska®-media contains special phosphate salts, which reduce the amount of available Ca²⁺ ions. In this way bulk starter becomes less susceptible to bacteriophage infections.

Especially the diacetyl producing culture is very phage sensitive, which may cause variable diacetyl levels. Therefore, media is very important to reach more constant diacetyl levels.

Besides, the presence of phosphate salts buffers the acidity, which results in an increase in cell counts and thus a more robust system in case of high bacteriophage infection.

Consistent acidification performance
Due to optimal nutrition and growth conditions a robust system is ensured, which results in a consistent acidification performance, a predictable activity and thus an improved final product consistency.

Availability
With Ceska®-media all milk is available for production, which makes planning of the amount of skimmed milk for bulk starter production not necessary.

Cost effective
An increased culture yield can also be used to reduce the percentage of culture addition up to 20-30 %. This results in an energy and cost reduction on the one hand and a capacity increase on the other hand.
Quality of bulk starter
As the bulk starter reaches its optimum at a higher pH with Ceska®-media than with skimmed milk, the vitality and activity of the bulk starter is higher for longer periods.

Media types
Ceska®-media are available in a dust free and a dust reduced version. The dust reduced version is specific developed for addition via trilender, whereas the dust free version is agglomerated and specific developed for addition via manhole. The agglomerated version also has a higher solubility.

Microbiological composition

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Total plate count</td>
<td>&lt; 20.000 cfu/g</td>
</tr>
<tr>
<td>Aerobic sporeforming bacteria</td>
<td>&lt; 100 cfu/g</td>
</tr>
<tr>
<td>Yeasts and moulds</td>
<td>&lt; 10 cfu/g</td>
</tr>
<tr>
<td>Enterobacteriaceae</td>
<td>&lt; 10 cfu/g</td>
</tr>
<tr>
<td>Salmonella</td>
<td>absent in 25 g</td>
</tr>
<tr>
<td>Listeria monocytogenes</td>
<td>absent in 1 g</td>
</tr>
<tr>
<td>Coagulase-positive staphylococci</td>
<td>absent in 1 g</td>
</tr>
</tbody>
</table>

Quality Control
Ceska®-media is delivered with a high and constant quality, thanks to quality control procedures (ISO 9001). Ceska®-media are carefully checked for their physical-chemical and microbiological properties. Strict control of the production process and standardisation procedures result in an end product that meets the HACCP requirements and all the current high quality demands. The procedures used by CSK are conform international guidelines and recommendations.

Packaging
The culture media within the Ceska®-media range are delivered as powder in 25 kg or 12,5 kg bags of paper with polyethylene inlay or in bigbags with variable content.

Storage and shelf life
The quality of Ceska®-media is guaranteed for 9 months after production, provided it is stored in the closed original packaging under cool and dry conditions between 5 and 25 °C.

Consultancy
CSK’s technology experts will help you to apply cultures, culture media, setting up your bulk starter production room for preparing bulk starters, implementing the NIZO procedure and optimising your process, especially the dry solids content in the butter. Our goal is to achieve the maximum value of your milk fat and by-products.

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## Application: Butter

For very high diacetyl content and optimal growth of mesophilic cultures. Use according to the NIZO method

<table>
<thead>
<tr>
<th>Code</th>
<th>Culture type</th>
<th>Buffering</th>
<th>Level of dust reduction</th>
<th>Incubation (°C)</th>
<th>pH after incubation</th>
</tr>
</thead>
<tbody>
<tr>
<td>MBM</td>
<td>mesophilic</td>
<td>medium, 16 % dm</td>
<td>dust reduced</td>
<td>21</td>
<td>4.7-5.1</td>
</tr>
<tr>
<td>MBM.2</td>
<td>mesophilic</td>
<td>medium, 20 % dm</td>
<td>dust reduced</td>
<td>21</td>
<td>4.7-5.1</td>
</tr>
</tbody>
</table>

MBM: 16 % dm in bulkstarter  
MBM2: 20 % dm in bulkstarter