Margarine

Vegetable oils and fats from Walter Rau.
Margarine

A multifunctional product

Whether at home or in the industry, hardly another product is as versatile in its range of applications as margarine. Created from a supply shortage, margarine has conquered a broad slice of the market for spread fats over the course of time. Compared to the products based on butter, the various margarine types offer better functionality, cost savings and also nutritional benefits for people who have an increased need for essential, unsaturated fatty acids.

From a technical point of view, margarine is an emulsion of water in oil. It contains both fats and oils. A special task referring to the end product: The solid fat builds the structure of the margarine; it provides a kind of network which prevents the liquid part from oiling out. Furthermore, the solid component is responsible for the solidity of the margarine and influences melting behaviour and spreadability.

The liquid components are particularly interesting from a nutritional perspective in particular: the more oil components are included, the more valuable multiple unsaturated fatty acids can be found in the margarine. The solid phase of margarine – the hard stock – is crucial for structure and consistency. Mixtures and/or transesterifications from the various acids are often solid by nature, like palm oil and coconut oil. The use of hardened oils, like rapeseed oil or sunflower oil, is also widespread. But here, the content of the unwanted trans-fatty acids, which are interesting from a nutritional perspective, must be taken into account.

Wherever possible, we recommend to renounce to partially hardened fats and to use instead combinations of fractions or fully hardened, trans-free fats.

The raw materials and the mixing ratio depend, above all, on the desired application of margarine: cream margarines, baking margarines, puff-pastry margarines and household margarines have very different tasks to fulfill and differ significantly, for instance, in their consistency, melting behaviour, and spread properties.

As a rule, margarine consists of an oil phase and a water phase, which are refined to the end product by using emulsifiers and a sophisticated process technology.

When selecting the ingredients, various criteria play a role. Initially, the process focuses on the technical requirements – it must be defined precisely what requirements the margarine to be produced must fulfill. In doing so, shelf life stability, spreadability, browning or spray behaviour when heating up in the pan are the parameters that can be applied. The requirement profiles of households and the industry often differ greatly.

The desired nutritional properties constitute another important basis. As a rule, the current trend to renounce to partially hardened fats with trans-fatty acids and also to reduce the level of saturated fatty acids as long as technically feasible applies here. The composition of the unsaturated fatty acids can be controlled by using different oils. Thanks to the correct combination of linseed oil, sunflower oil, rapeseed oil, for example the desired ratio of ω3:ω6 fatty acids can be achieved. The requirements that arise from the declaration and the superordinate laws and directives are closely linked to the topic. The definition of spread fats in general are governed by the EC spread fat directive 2991/94 directive (EC) No. 2994/94 of the council of 5 December 1994 with norms for spread fats. Once the recipe is created, the correct production mode must be selected. Initially, the oil and water phase are created separately, which are then mixed in the correct ratio by simultaneously emulsifying and crystallising them in a sophisticated cooling system. Depending on the requirements, mechanical post-processing levels and/or resting tubes are used to achieve the correct plasticity, for instance. With state-of-the-art packaging technology, the products that are spreadable to solid at room temperature are packaged in wrappers, cups and cardboard boxes. Some of the filled products are subjected to a post-tempering process for stabilisation before they are shipped.

A typical example of such a system can be found at: http://www.gs-as.com/Deutsch/Applikationen/Beispiel_fuer_eine_Kristallisations-Linie.aspx

Product application

Margarine components and industrial production
Product application

Example of a crystallisation line

Storage
- Storage container for liquid oils and fats (area 1)
- Further raw materials are stored in barrels or on pallets

Batch area
- Container for emulsification approach (emulsifier and liquid oil) (area 2)
- Container for the approach of the water phase (water and water-soluble ingredients) (area 3)
- Container for mixing the oils and oil-soluble ingredients and a later addition of the water phase to form a water-in-oil emulsion (area 4)

Production
- Low-pressure pasteurisation (holding hose pasteurisation or plate heat exchangers) (area 5 shows a plate heat exchanger)
- High-pressure pump (area 6)
- With high-pressure pasteurisation – scraped-surface heat exchanger for heating and cooling
- High-pressure push scraped-surface heat exchanger, combiner or perfector (area 7)
- Cristalliser(s) (area 8)
- Resting tube for products to be packaged (area 9)
- Melt-back plate heat exchanger Can also be carried out using a push heat exchanger (e.g. for half-fat products) (area 10)

Recipes

A classic household margarine that must contain at least 80% fat according to regulations can, for instance, be composed as follows:

Fat phase with recommended melting point of 28–30°C
- 25–35% from the area of the medium phase and hard stock, depending on desired solidity
- 45–55% from the area of the liquid phase, e.g. Sonnin 10020
- 0.4% mono-diglyceride
- 0.2% lecithin

Water phase
- ~18% water to achieve a 100% recipe
- 0.4% mono-diglyceride
- 0.2% lecithin
- 0.1% potassium sorbate

Liquid margarine for cooking and frying:

Fat phase with recommended melting point of 24–26°C
- 3% hardened vegetable oil 78610
- 76.6% from the area of the liquid phase, e.g. Sonnin 10020
- 0.3% polyglycerine ester for the reduction of spraying
- 0.1% lecithin

Water phase
- ~18% water to achieve a 100% recipe
- 1% common salt
- 1% skimmed milk powder
- 0.1% potassium sorbate

Baking and cream margarine:

Fat phase with recommended melting point of 32–34°C
- 35% from the area of the medium phase, e.g. Warasan 11980
- 25% from the area of cooling sensitivity, e.g. Cocopur 10060
- 19.6% from the area of the liquid phase, e.g. Sonnin 10020
- 0.2% polyglycerine ester
- 0.2% mono-diglyceride

Water phase
- ~17% water to achieve a 100% recipe
- 1% common salt
- 1% sugar
- 1% skimmed milk powder
- 0.1% potassium sorbate

Further fat-soluble additives (aromas, colorants, vitamins) according to customer specifications

Citric acid to adjust the pH value of the water phase to 4–6
**Service**

Good products are those which meet the customers’ requirements. Therefore, new products are created in close cooperation with you, our customers. In our product developments, cultural and religious values will be just as much taken into consideration as nutritional-physiological trends or the new consumer habits.

The expert staff of our Application Technology Department will not only guide you regarding the selection of suitable fats and oils but also support you in every way possible with the tuning of your preparations and processes – at our Technological Centre or on-site with you. We will also be ready to solve more in-depth issues with the support of our competent laboratory team, which can fall back on a wide range of analysis methods.

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### Explanation of the abbreviations

<table>
<thead>
<tr>
<th>SAFA %</th>
<th>MUFA %</th>
<th>PUFA %</th>
<th>TFA %</th>
</tr>
</thead>
<tbody>
<tr>
<td>share of saturated fatty acids</td>
<td>share of monounsaturated fatty acids</td>
<td>share of polyunsaturated fatty acids</td>
<td>share of trans-fatty acids</td>
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### Table

<table>
<thead>
<tr>
<th>Product name</th>
<th>Type</th>
<th>Melting range</th>
<th>Solids</th>
<th>Applications</th>
<th>SAFA %</th>
<th>MUFA %</th>
<th>PUFA %</th>
<th>TFA %</th>
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</thead>
<tbody>
<tr>
<td>Sonnin 10020</td>
<td>Hydro</td>
<td>20° C</td>
<td>11 34 56</td>
<td>&lt; 2</td>
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<td></td>
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<tr>
<td>Sonnin 22140</td>
<td>Nonhy</td>
<td>30° C</td>
<td>47 5 16 23</td>
<td>&lt; 14</td>
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<td>Coopur 10060</td>
<td>Nonhy</td>
<td>23–26</td>
<td>91 7 2</td>
<td>&lt; 2</td>
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<tr>
<td>Canolin 20070</td>
<td>Hydro</td>
<td>46–50</td>
<td>67 32</td>
<td>ca. 1.5</td>
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<td></td>
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<td>Canoletta 17360</td>
<td>Nonhy</td>
<td>34–37</td>
<td>19 22 5 55</td>
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<td>Palmetta 10080</td>
<td>Nonhy</td>
<td>35–40</td>
<td>51 39 10</td>
<td>&lt; 2</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Palmetta 10380</td>
<td>Nonhy</td>
<td>46–54</td>
<td>66 28 6</td>
<td>&lt; 2</td>
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<tr>
<td>Warasan 11440</td>
<td>Hydro</td>
<td>43–45</td>
<td>83 13 4</td>
<td>&lt; 2</td>
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<tr>
<td>Warasan 11870</td>
<td>Nonhy</td>
<td>38–41</td>
<td>46 40 14</td>
<td>&lt; 2</td>
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<tr>
<td>Warasan 11960</td>
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</tr>
<tr>
<td>Warasan 11980</td>
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<td>39–42</td>
<td>67 27 7</td>
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<tr>
<td>Kernetta 19370</td>
<td>Hydro</td>
<td>36–38</td>
<td>94 2 1 3</td>
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<tr>
<td>Waretta 78610</td>
<td>Hydro</td>
<td>– 60</td>
<td>9 91 12</td>
<td>&lt; 1</td>
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<tr>
<td>HO-sunflower oil</td>
<td>Hydro</td>
<td>60</td>
<td>9 91 12</td>
<td>&lt; 1</td>
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<tr>
<td>HO-rapeseed oil</td>
<td>Hydro</td>
<td>60</td>
<td>6 80 14</td>
<td>&lt; 1</td>
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### Packaging options

<table>
<thead>
<tr>
<th>Packaging options</th>
<th>liquid</th>
<th>paste-like</th>
<th>solid</th>
<th>general remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Block 4 x 2.5 kg / 10 kg / 12.5 kg / 20 kg / 25 kg</td>
<td></td>
<td></td>
<td>●</td>
<td></td>
</tr>
<tr>
<td>Bag 25 kg</td>
<td></td>
<td></td>
<td>●</td>
<td>powder, pearls, scales on request (for high-melting products)</td>
</tr>
<tr>
<td>Bag in Box 3–20 litres</td>
<td>●</td>
<td>●</td>
<td></td>
<td>several nozzles possible</td>
</tr>
<tr>
<td>Tinplate buckets 10 litres</td>
<td>●</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Plastic buckets 25 litres</td>
<td>●</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Drum 180 kg</td>
<td>●</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bulk container 1,000 litres</td>
<td>●</td>
<td>●</td>
<td></td>
<td>optionally with electrical heating, IBC or steel</td>
</tr>
<tr>
<td>Tank trucks</td>
<td>●</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Barge &gt;250 tons</td>
<td>●</td>
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</tbody>
</table>

### Product consistency

- **liquid**
- **paste-like**
- **solid**
- **general remarks**

- **Tinplate buckets 10 litres**
- **Plastic buckets 25 litres**
- **Drum 180 kg**
- **Bag in Box 3–20 litres**
- **Block 4 x 2.5 kg / 10 kg / 12.5 kg / 20 kg / 25 kg**
- **Bag 25 kg**
- **Tank trucks**
- **Steel IBC (Aseptic IBCs)**
- **Heated IBCs**
- **Folding IBC**
- **Standard IBCs**

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