



**Manufacture, packaging,
storage and characteristics
of margarine**

Margarine is an emulsion of edible oils and fats with water. Physical properties of margarine are similar to butter, free from mineral oil and animal body fats, may contain common salt not exceeding 2%, permitted emulsifying and stabilizing agents, BHA up to maximum limit of 0.02%.

FSSR, 2011



Table margarine

- Emulsion of edible oils and fats with water.
- Shall be free from rancidity, mineral oil and animal body fats, may contain common salt not > 2.5%, skimmed milk powder not >2%.

Bakery/ industrial margarine

- Shall be free from added colour and flavour, rancidity, mineral oil and animal body fats.
- May contain common salt not >2.5%,

Constituent	Limit
Fat	Not less than 80% mass by mass(m/m)
Moisture	Not less than 12% and not more than 16% (m/m)
Vitamin A	Not less than 30 IU per gram at the time of sale
Melting point of extract	31 ⁰ C - 34 ⁰ C (by Capillary slip method)
Unsaponifiable matter	Not more than 1.5% by weight extracted fat
Free fatty acids	Not more than 0.25% (as oleic acid) of extracted fat
OR	
Acid value	Not more than 0.5

FSSR-2011 Requirement for table margarine

Constituent	Limit
Fat	Not less than 80% mass by mass(m/m)
Moisture	Not less than 12% and not more than 16% (m/m)
Vitamin A	Not less than 30 IU per gram at the time of sale
Melting point of extract	31 ⁰ C - 41 ⁰ C (by Capillary slip method)
Unsaponifiable matter	Not more than 2.0% by weight extracted fat
Free fatty acids	Not more than 0.25% (as oleic acid) of extracted fat
OR	
Acid value	Not more than 0.5

FSSR-2011 Requirement for industrial margarine

Common Food Permitted Additives

Natural food colours	
Beta carotene	25 mg/kg (maximum)
Annatto extracts (as bixin/norbixin)	20 mg/kg(maximum)
Curcumin	05 mg/kg (maximum)
Antioxidant (Singly or in combination)	
Lecithin	GMP
Ascorbic acid	GMP
Propyl gallate, ethyl gallate, Octyl gallate, Dodecyl gallate or a mixture thereof	200ppm (maximum)
Butylated Hydroxy Anisole (BHA)	200ppm (maximum)
Natural and synthetic tocopherols	
Citric acid, Tartaric acid, Gallic acid	GMP
TBHQ	200ppm (maximum)
Antioxidant Synergist	
Sodium citrate	GMP
Emulsifying agents	
Mono and di glycerides of fatty acids	GMP
Mono and di glycerides of fatty acids esterified with acetic, acetyl tartric, citric, lactic, tartaric acids and their sodium and calcium salts	10g/kg (maximum)
Lecithin	GMP
Polyglycerol esters of fatty acids	5g/kg(maximum)

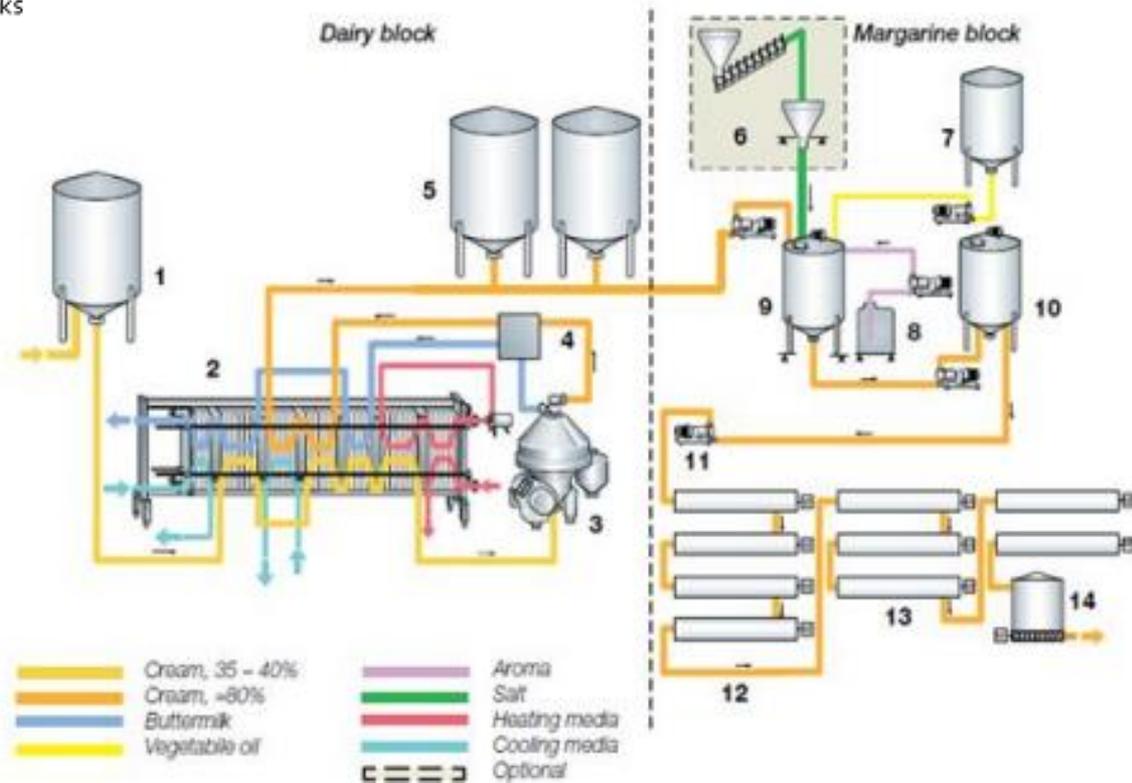
Preservatives	
Sorbic acid	1000 mg/kg(maximum)
Sodium/ Potassium/ Calcium sorbate expressed as Sorbic acid	1000 mg/kg(maximum)
Benzoic acid	1000 mg/kg(maximum)
Sodium/ Potassium/ benzoate expressed as Benzoic acid	1000 mg/kg(maximum)
Acidity regulators	
Citric acid	GMP
Lactic acid	GMP
Flavours	
Natural flavours and natural flavouring substances/ Nature identical flavouring substances/ Artificial flavouring substances	GMP
Diacetyl	4 mg/kg (maximum)

Coloured and flavoured margarine shall only be sold in sealed packages weighing not more than 500 g, test for Argememe oil shall be negative, shall also contain starch not less than 100 ppm and not more than 150 ppm.

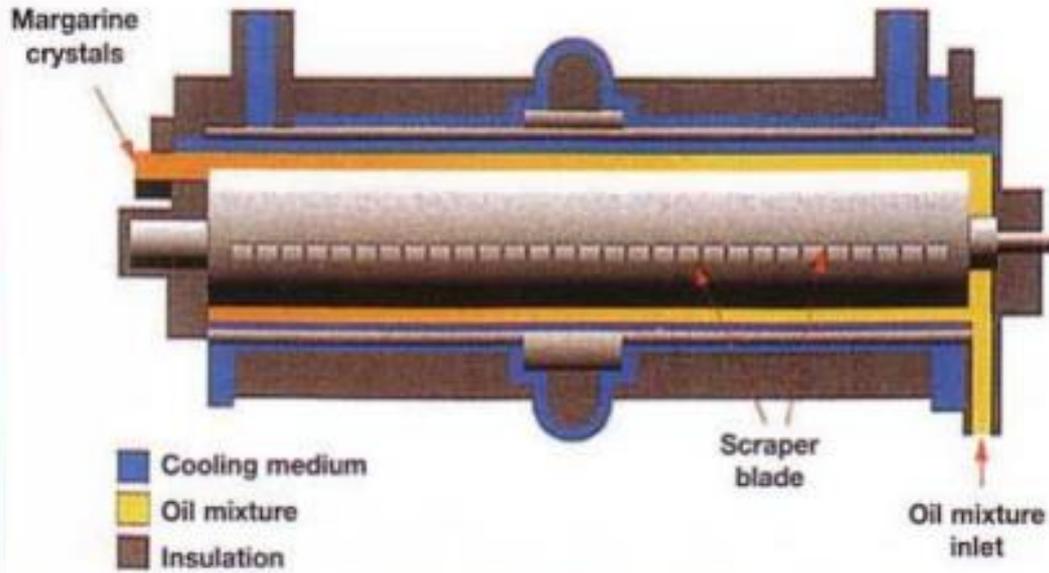
Margarine Process Line

❖ It consists of two blocks: **“Dairy block”** wherein the cream concentration, pasteurization and cooling of cream takes place and **“Margarine block”** where preparation of mix and phase inversion accompanied by working and cooling takes place.

- | | |
|-------------------------------------------|-------------------------------------|
| 1. Salt dosage, optional | 10. Cream Tank |
| 2. Vegetable oil tanks | 11. Plate Heat Exchanger |
| 3. Flavour Dosage | 12. Centrifugal Cream Concentrators |
| 4. Mixing | 13. Cream Standardization |
| 5. Buffer tank | 14. Pre-crystallization tanks |
| 6. High pressure pump | |
| 7. Scrapped surface cooler | |
| 8. Pin rotars | |
| 9. Silo with screw conveyor in the bottom | |

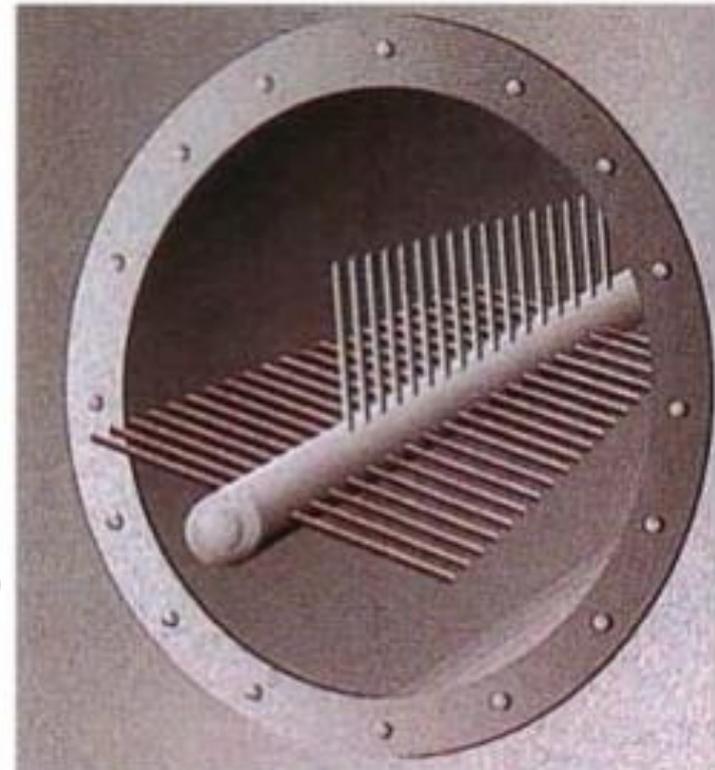


PRE-CRYSTALLIZER (A-UNIT) DIAGRAMATIC



Scrapped surface crystallizer

Pin-rotor



Starts with pasteurized cream of 35-40 % fat content. Temperature is adjusted to 60-70°C before it enters cream concentrator. Cream fat content is automatically controlled by continuous standardization device and 82-84% fat level is reached in concentrator. Cream then cooled to 18-20°C, before routed to holding/pre - crystallization tank

Dairy block



Margarine block

Product mix is prepared and various ingredients are mixed together. Concentrated cream is mixed with appropriate volumes of vegetable oil, salt and water phase. After thorough mixing, the mixture is pumped into buffer tank. Process is continuous from buffer tank, from which the product mix is taken to high pressure pump.

Contd.

Margarine block

It is then fed into the scraped surface coolers, where phase inversion takes place. Before final cooling, the spread is held and worked by pin rotors. Pin-rotors, besides further crystallizing emulsion, also physically breaks up and works the crystals to improve texture of final product. Product enters final cooling stage and then to storage silo and then pumped into filling machine.

Factors Affecting Rheological Quality of Margarine

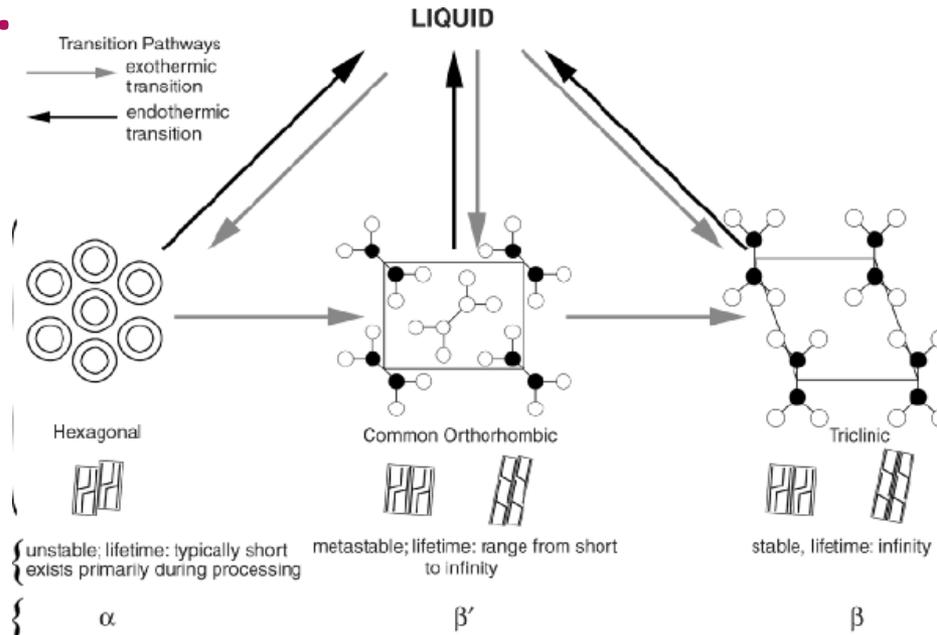
Solid fat content (SFC):

- Solid attributes of margarine fat through temperature range is characterized by its SFC or solid fat index (SFI) profile.
- SFC is an important property of an oil or fat, and is ratio of the solid to the total phase at a particular temperature.
- SFC is measured by nuclear magnetic resonance spectroscopy as number of protons in solid state over the total number of protons in the fat (in both solid and liquid states).
- Consistency of margarine at any temperature can be predicted from its SFC or SFI at that temperature. SFC and crystal components are responsible for consistency of margarine.

Polymorphic form:

- Polymorphic forms are solid phases of same chemical composition with different crystalline structures, but yields identical liquid phases on melting.
- Polymorphs are different forms of solid state, this is due to existence of TAG molecules in number of crystal forms.
- TAGs can crystallize in different polymorphs (sub- α , α , β' and β).
- Fat crystals in margarine and shortening are only in β' and β forms. A pure TAG would be most stable in β form, but mixture of TAGs will be most stable in β' form.

Transformation from one polymorph to another can occur in solid state without melting.



Merits of Margarine

○ **Spreadability:**

Highly regarded attributes and shows good spreadability at refrigeration temperature as compare to butter. Products with solid fat index of 10-20 at serving temperature are optimal on consumer panel. SFI at 10 C have been recorded and in range of 19-21.

○ **Consistency and Texture:**

Consistency is measure of smoothness, evenness and plastic state in margarine. Range from very soft like petroleum jelly, soft, medium, firm, tough, hard and brittle.

Texture varies from smooth to mealy or floury, grassy, granular or sandy and finally, coarse and lumpy.

This attribute can be altered to desired level by using different vegetable oil in formulation whereas; butter has less scope to alter consistency and texture.

- **Contains minimum or no cholesterol in the product**
- **Product is cheaper than butter**

Demerits of Margarine

- **Bland in flavor and taste:**

Flavour and mouthfeel of margarine is weak as compare to butter.

- **Oil Separation:**

There is possibilities of oil separation when crystal matrix is inadequate to entrap liquid oil. This occurs because of transformation of crystals to β -form. β -crystals continuously grow bigger (causing sandiness) until network can no longer retain its lattice structure to entrap liquid oil. Liquid oil then exudes from product and aqueous phase coalesces.



○ **Sandiness:**

□ β' polymorph is desired form in margarine.

□ β' has very small crystals so that it can incorporate a large volume of liquid oil in crystal network giving smooth, continuous and homogenous product. However, β -crystals have tendency to grow bigger and bigger into needle-like agglomerates.

□ Large crystals impart a sensation of sandiness in mouth.

Packaging of Margarine

Wrapping material must be:

Impervious to light, flavoring and aromatic substances

Impermeable to moisture

**Parchment
paper**

**Aluminum
foil**

**Outer paper
cartons with
PE layer inside**

**Plastic tubs
of PP**

**Can withstand
storage
temperature
of 50 C**

Greaseproof

Uses of Margarine

**Table margarine
used for direct
consumption in
place of table
butter**



**Industrial
margarine used in
confectionery and
bakery industry as
shortner**

