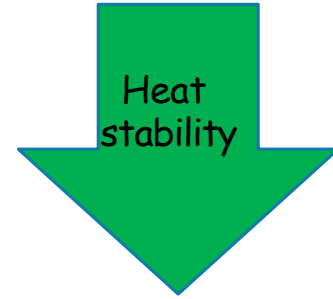


# PLATFORM TESTS



Organoleptic tests - Color, Flavor & taste

Acidity/pH

Alcohol alizarin, Clot on boiling, Alcohol test

2 min resazurin test

Lactometer

# Organoleptic tests

Also called Rapid Platform tests

Flavor:

- Rancid - *Pseudomonas fragi*,
  - phenolic flavors - *Bacillus circulans*
  - Fishy flavor - *Pseudomonas ichthyosmius*, due to conversion of lecithin to trimethylamine.
  - Cooked flavor is due to the sulfhydryl group
- Taste: Bitter taste in milk may be due to *Serratia liquefacines*
- Sediment test

# Tests for acidity

- **Clot on Boiling (COB) Test:** give indication about the susceptibility of milk to heat processing and its keeping quality.
- rapid method to determine the acidity in milk
- Milk with high acidity (More than 0.17% LA) gets coagulated on boiling.
- Other test to determine acidity : Alcohol test, pH test, Alcohol alizarin test

# LABORATORY TESTS

Test	Interpretation	Remarks
Dye reduction test	extent of bacterial contamination	MB reduction test, Resazurin test
Direct microscopic count	type of microorganism	Both live and dead bacteria
Standard plate count	extent of bacterial contamination	Only live bacterias
Freezing point	adulteration of milk with water	Most sensitive test for detecting adulteration with water
Coliform count	faecal contamination	Should be less than 100cfu/ml in raw milk

# DYE REDUCTION TESTS

1. Methylene blue reduction test: to find relative number of bacteria in a milk sample

- Very good: not decolorized in 5 hours
- Good: decolorized in less than 3-4 hours
- Fair: decolorized in less than 1-2 hours
- Poor: decolorized in less than  $\frac{1}{2}$  hour

2. Resazurin reduction test : procedure similar to Mbreduction test. Result in 10minutes

# STANDARD PLATE COUNT

- basis for grading milk
- gives rough estimate of viable microbial growth in the sample
- All plate counts are expressed as the number of cfu /ml.
- SPC doesn't indicate the quality of microbial populations in terms of pathogens and non-pathogens.
- generally accepted as the most accurate and informative method of testing bacteriological quality of milk

# STANDARD PLATE COUNT

<b>Bacteria CFU/ml</b>	<b>Grade</b>
<b>Up to 2 lakhs</b>	<b>Very good</b>
<b>2-10 lakh</b>	<b>Good</b>
<b>10-50 lakh</b>	<b>Fair</b>
<b>More than 50 lakh</b>	<b>Poor</b>

**SPC for pasteurized milk - not more than 30,000 cfu /ml**

### **Bacteriological standards of raw milk (IS-1479 PART III-1997)**

Grades	Direct microscop- ic count per ml (lakhs)	Standard plate count per ml (lakhs)	Methylene blue reduction time (hr)	One hour resuzurin disc. (No.)	Presumptive coliform test (in 0.01 ml) i.e. 1 in 100
Very good	NS	< 2	> 5	NS	absent
Good	< 5	2-10	3-4	4 or higher	absent
Fair	5-40	10-50	1-2	3.5 to 1.0	absent
Poor	40-200	> 50	< 1/2	0.5 to 0	present
Very poor	> 200	NS	NS	NS	NS

NS : Not specified

### **Bacteriological standards of pasteurised milk (IS-6397-1971)**

Test	Requirement
Standard plate count	Maximum 30000 cfu/ml
Coliform count	absent in 1:10 dilution
MBRT	more than 4 hr
Alkaline phosphatase	test negative



# ADULTERANTS

- Adulteration --- addition of cheaper & resembling substances to milk or removal of one or more valuable constituents (like fat).

Common adulterants in milk:

1. Water - most common adulterant in milk
2. Starch, cane sugar
3. condensed milk or milk powder
4. urea, detergents, sodium bicarbonate
5. mixing of cow & buffalo milk

Iodine solution Test	Starch adulteration in milk
Nitric acid	Skim milk powder
Bromocresol purple solution	Detergent in milk
p - dimethyl amino benzaldehyde	Urea adulteration in milk
Resorcinol	Cane sugar detection
Rosalic acid test	Sodium Carbonate
Storch's peroxidase test	Heated milk in fresh milk
Hansa Serum ( Hansa Test)	Mixing of cow & buffalo milk
Picric acid solution/ Mercuric Nitrate	Gelatin in milk
Delvo kit test	Detect antibiotic and sulpha residues
Lactometer reading, freezing point, nitrate detection	Water in milk
Baudin test	Vegetable oil adulteration in ghee

**Table 3. Important tests to detect adulterants in milk**

Adulterant	Test	Interpretation
<i>Thickening agents</i>		
Starch	Boil 10 ml milk --> cool and add 1 ml of 5% iodine	Blue colour
Gelatin	10 ml milk + 10 ml mercuric nitrate, shake + 20 ml water and shake well. Filter. Filtrate + equal volume of saturated aqueous picric acid.	Yellow ppt.
Cané sugar	2 ml milk + 1 ml HCl + 0.1 g resorcinol, boil for few minutes	Red colour
Sucrose	10 ml milk + resorcinol	Red colour
Milk powder	10 ml milk + 1 drop formalin place at 60°C for 10 minutes	Peculiar odour
Skim milk powder	10 ml milk + few drops of nitric acid	Yellow colour
Calcium carbonate	10 ml milk + 1 ml conc. HCl	Effervescence
Sodium bicarbonate	5 ml milk + 10 ml alcohol + rosalic acid solution (1:10)	Rose red colour
Urea	i) 0.2 ml urease + 0.1ml 0.5% bromothymol blue + 5 ml milk	Faint blue colour within 10 min for urea and dark Blue colour for synthetic milk.

# FAT ESTIMATION

Gerber test ( Fucoma Test)

Babcock test

Rose Gottlieb and Adam's test

# Total Solids & SNF estimation

- Gravimetric Method
- Lactometer Method
- Infrared Spectroscopy
- Formulas- Richmond, Babcock, Fleischmann's

# CONDENSED OR CONCENTRATED MILK

**Concentrated milk** - product obtained by **evaporating part of the water** of whole or skim milk **with or without addition of sugar**

- Condensed milk: full cream sweetened milk
- Evaporated milk: full cream unsweetened milk
- Skimmed milk products: sweetened and unsweetened
- **Unsweetened condensed milk - Evaporated milk**
- ratio of concentration of milk solids: **1: 2.5 for full cream products and 1: 3 for sweetened condensed skim milk**

	Fat %	Milk Solids % (minimum)
Evaporated milk	8% (minimum)	26
Condensed milk	9% (minimum)	31
Evaporated Skim milk	0.5% (maximum)	20
Condensed skim milk	0.5% (maximum)	26

**Cane Sugar in sweetened milks: 40% (minimum)**

# Seeding

- Crystallization of lactose by the addition of fine powder of lactose or small quantity of condensed milk from previous batch.
- Purpose: **forms very small crystals** in the supersaturated solution



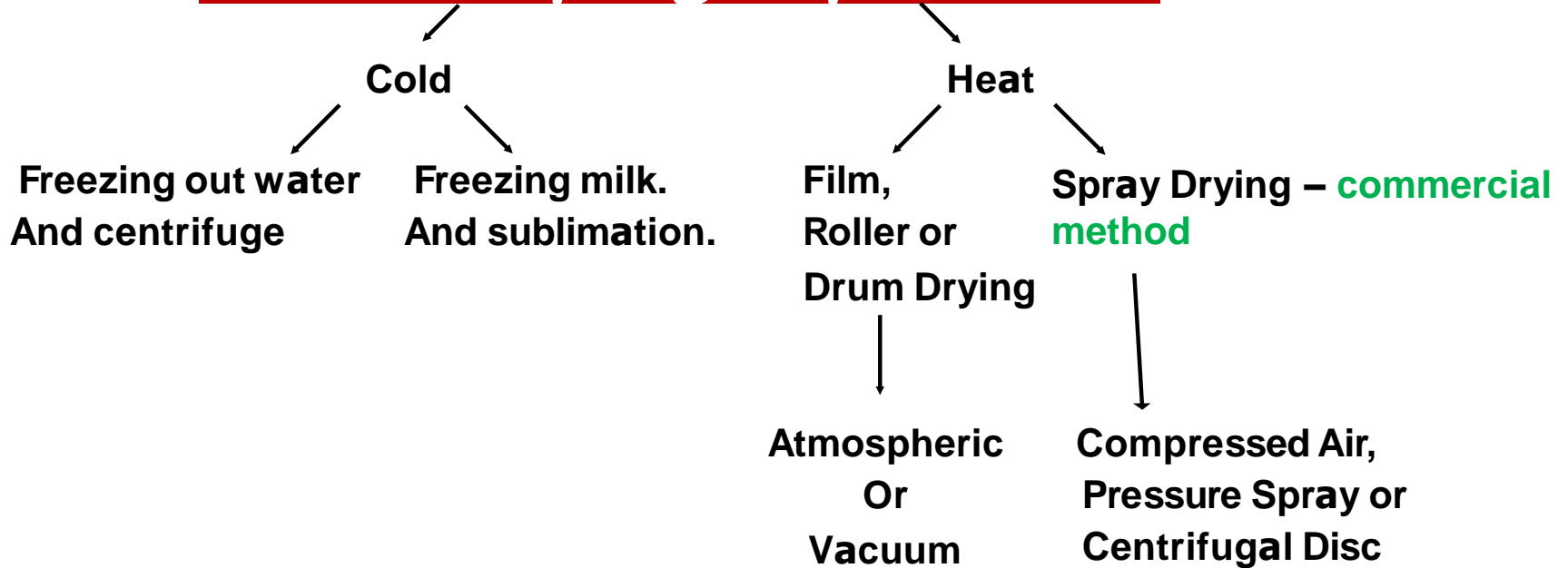
- Pilot Sterilization test: to determine the amount of chemical stabilizer to be added in evaporated milk
- Baume Hydrometer test- most commonly used for density test of condensed milks
- Storage temp.- 5-16 °C

# Dried milks

- Dried milk or milk powder: moisture content 5% or less

	Whole Milk powder (WMP)	Skim Milk powder (SMP)
Moisture % (max)	5	5
Fat %	26 (minimum)	1.5 (max)
Solubility index	15 if roller dried and 2 if spray dried	

# Milk Drying Systems



# Spray drying method:

**Receiving milk**

**Cooling**

5 °C

**Pre-heating at 71 °C.**

**Filtration/clarification**

**Heat**

Combination of 82 °C for 15 minutes

**Condensing**

concentration of 35-40 % total solids is produced

**Pumping**

preheated concentrate at 71° C is forced through the atomizer pressure of 2500 psi.

**Spray drying**

dried with inlet air at 143-232 ° C and the exit air at 74 to 93 °C

**Cooling, Sifting**

A12 mesh screen

**Packaging ,Storage:**

temperatures lower than, 24° C, in a cool, dry place

- **Instantization:** process by which dried milk are made instant soluble
- **Wettability:** measure for the ability of a powder to be wetted with water at a given temperature
- **Agglomeration:** particles collide with each other and adhere
- Skim milk powders more wettable than WMP because of less fat content
- **solubility (reconstitutability):**
- Spray dried milk (once it has been wetted) - soluble up to 98 to 99%
- roller- drying reduces the solubility of the powder to 80 to 85% by damage to the fat globule - **lowest in all methods**

# Fermented milk

- Acidophilus milk: fermented milk developed with *L. acidophilus* culture
- Bulgarian milk : *L. bulgaricus*

Kumiss: originated in Russia - Lactic acid + Alcohol fermented milk

- Formerly mare's milk now cow's
- Alcohol content 2.5%

Kefir: 1% lactic acid + 1% alcohol

Filmjolk: Scandinavian sour milk

# Functional milk products

- specialized dairy items designed to provide additional health benefits beyond basic nutrition
- **lactose-free milk** - made by filtering regular milk to remove half the lactose and adding enzyme Lactase
- **Filled milk**: homogenized product prepared from refined vegetable oil & water.
- **UHT processed milk**: packed & aseptically sealed in pre-sterilized containers. can be stored Unrefrigerated for at least 3 months
- **Designer milk**: as per consumer requirement using biotechnology
- **Irradiated milk**: increased Vitamin D content by UV rays exposure
- Evaporated milk must be fortified with Vit. D

- **Recombined Milk**: product obtained when butter oil (also called anhydrous milk fat), skim milk powder and water are combined in the correct proportions to yield fluid milk.
- **Reconstituted milk**: dispersing milk powder in water
- **Humanized milk**: chemical composition modified to match human milk
- **Imitation milk**: milk of non dairy origin
- **Vegetable toned milk**: milk protein of SMP substituted by groundnut protein (**MILTONE BY CFTRI , Mysore**)



# Cream

According to PFA 1976, minimum fat % - 25%  
(FSSR, 2011):

1. Low fat cream: milk fat not less than 25.0 %
2. Medium fat cream: not less than 40.0 %
3. High fat cream: milk fat not less than 60.0 %

Classification: based on end use

- Table cream, Light cream, Coffee cream : 20-25% milk fat
- Heavy cream Whipping cream: 30-40% milk fat
- Plastic cream: 65-85% milk fat

**PRINCIPLE:** Based on the fact that milk fat is lighter than skim milk portion

PARTICULARS	GRAVITY METHOD	CENTRIFUGAL METHOD
NATURE OF FORCE CAUSING SEPARATION	GRAVITATIONAL	CENTRIFUGAL
SPEED OF SEPARATION	EXTREMELY SLOW	PRACTICALLY INSTANTANEOUS
DIRECTION OF MOVEMENT PARTICLES	VERTICAL	HORIZONTAL
FAT % OF CREAM	10-25	18-25
% fat recovered in cream	Not more than 90	99-99.5

- velocity or rate at which the fat globules rise is given by a equation, which is known as **Stoke's Law**
- **In centrifugal method - skim milk on periphery and cream inside**
- **Cream screw in and skim milk screw out: higher fat% and vice versa**



- skimming efficiency: % age of fat recovered in form of cream from milk
- High acidity of milk precipitate casein resulting in clogging of bowl decreasing efficiency of skimming
- can not be separated from Homogenized milk
- Pasteurization : LTLT → 71 °C for 20 min
- HTST: 95-100 °C for 5-16 seconds
- **Vaceration**: dilutes the cream and it will lower the fat percentage of cream up to 6 - 8 %

# Defects

- **Oxidized/oily/Metallic/Tallowy:** Fat oxidation due to direct contact of milk with **copper or iron**, exposure of milk or cream to **sunlight**, etc.
- **Rancid:** Fat hydrolysis due to **lipase action** in milk or cream
- **Highly acid/sour**
  - i. Using sour milk for separation
  - ii. **Acid development** in cream

# Butter

- Balancing wheel of dairy industry
- water-in-oil type emulsion
- Butter fat- 80% (76% in desi butter) Moisture-16 % Salt-3 % and Curd-1.5 % (FSSR)
- No preservative except common salt
- No coloring material except annato or carotene
- Flavoring agent - Diacetyl (not more than 4ppm)

Indian butter: Butter fat-80.2% Moisture-16.3 % Salt-2.5 % and Curd-1.0%

- fat in water emulsion is changed to water in milk fat emulsion
- Milk → separated to get cream → treatment of cream → conversion to butter → storage
- Coloring agent: natural Annatto, carotene
  - Neutralizers: lime, soda
  - Flavoring agent: Diacetyl

# Fisher and Hooker's phase reversal theory

- Churning is process of phase reversal Changing oil in water to water in oil
  - agitation of cream causes: coalescence and clumping of fat globules
  - ratio of surface area to volume of fat becomes very small
  - no longer contains all the buttermilk in stable form
  - fat in water emulsion breaks



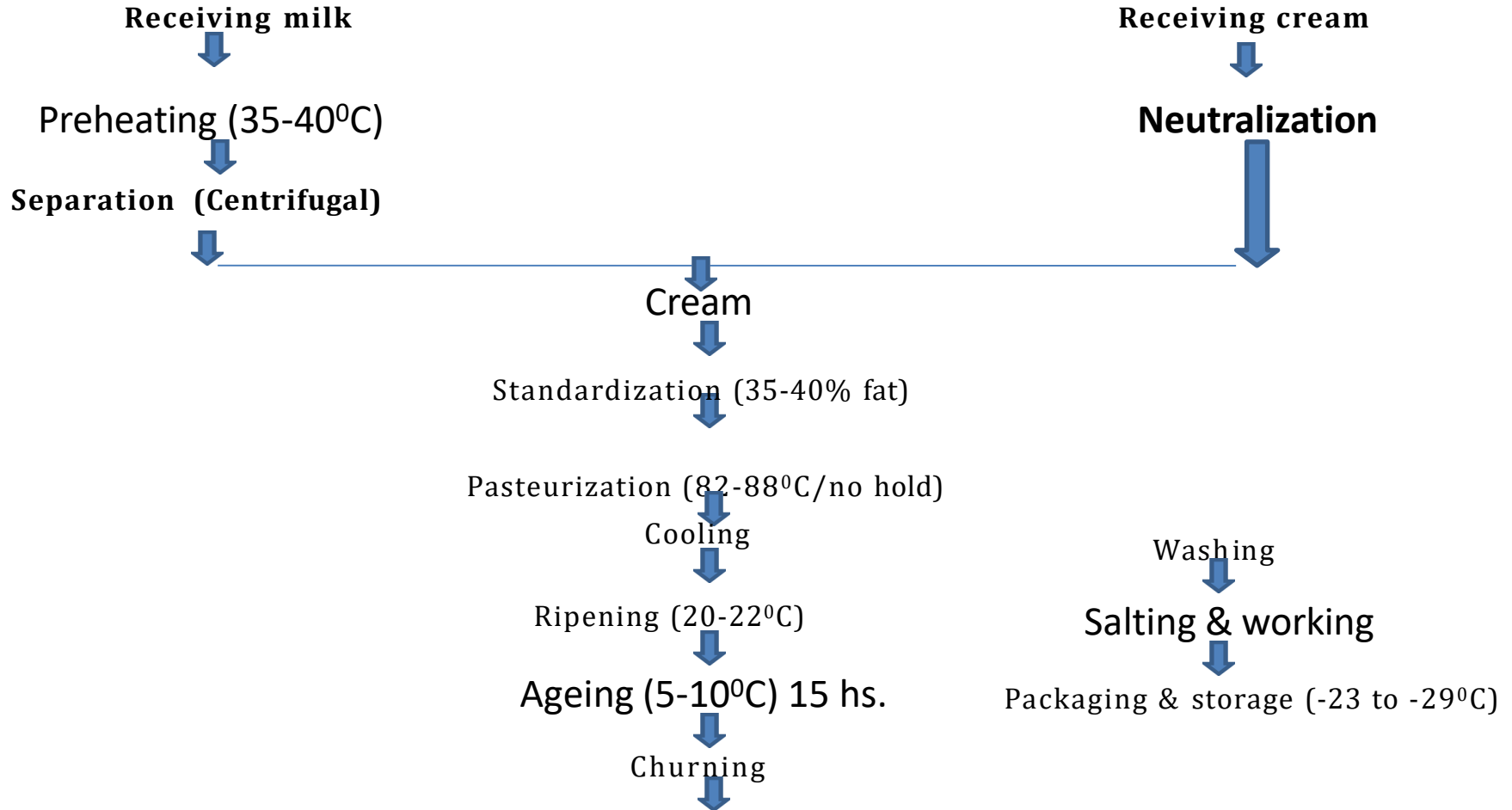
# Rahn's foam theory

- foam produced → fat globule concentrate in foam → bubble due to surface tension → foam producing assumes solid character → foam collapses and fat globules coalesce and butter formed
- based on principle Air/ foam was necessary for churning

# king's modern theory

- churning breaks the clusters and causes foam formation
- fat globules concentrated to air bubble in the foam thus brought close to each other to form large particles

# Method of manufacture, packaging and storage



# Steps in butter making:

- Neutralization of cream: reduce the acidity of cream to 0.14-0.16%
- Standardization of cream: 33-40%
- Pasteurization of cream: 90- 95 °C for 15 or 105-110°C with no holding
- Cooling and ageing at 5-10 °C
- Ripening of cream: by mixture of both acid producing (*Streptococcus lactis*, *S.cremories*) and flavour producing (*S.diacetylactis*, *Leuconostoc citrovorum* and/or *Leuc. Dextranicum*, *Clostridium butyricum*)
- the cream is incubated at about 21°C till desired an acidity is reached.

- Churning of Cream: Winters- 10-13°C  
Summers: 7-9°C (Avg. 9-11)
- Salting & Working: Working of butter is a kneading process in which butter granules are formed into a compact mass
- Storage -23 to -29°C

- Gritty - Undissolved coarse salt, incorrect salting
- Grainy - Incorrect neutralization of high acid cream with lime
- *Yeasty flavour and odour: fermentation of the cream by Torula Cremoris and Torula sphaerica*

# Over run

- increase in the amount of butter made from the given amount of fat caused by the presence of moisture , curd, salt etc in butter
- $\% \text{ OR} = \frac{B-F}{F} \times 100$
- OR= Overrun in butter(%)
- B= Butter made (kg)
- F= Fat in churn (kg)

# ICE CREAM

frozen milk product made by freezing a pasteurized mix with agitation to incorporate air.

should contain not less **than 10% milk fat, 3.5% protein, and 36% total solids**

## Composition of Ice cream mix-

Milk/milk powder + sugar + dextrose + corn syrup + water + flavour + stabilizer (0.3-0.5%) + emulsifier (0.3-0.5%)

## Composition of Ice-cream-

Fat (12-20%), SNF (8-15%), Sugar (13-20%).



# Role of the constituents in ice cream

1. **Milk fat:** full, rich, creamy flavour
2. **Milk solids not fat:** milk sugar adds to the sweet taste. The milk proteins help to make ice cream more compact and smooth
3. **Sugar:** increase the acceptability of ice cream. The desired sweetening effect is only produced by sucrose.
4. **Stabilizers:** prevent the formation of objectionable large ice crystals in ice cream, especially during storage.
5. **Emulsifiers:** improve upon and provide a uniform whipping quality of the mixture.

- Ice cream without Hardening process: Soft serve or Softy
- overrun due to air - Maximum allowable over run up to 100%
- Sandy Texture: caused by Lactose crystals which do not dissolve readily and produce a rough or gritty sensation in the mouth
- Whipping quality: reduced air cell sizes and a homogeneous distribution of air in the ice cream

**Stabilizer**- prevent the formation of objectionable large ice crystals in ice cream, especially during storage

-Sodium alginate, methyl cellulose, gelatin

**Emulsifier**- mainly to improve upon and provide a uniform whipping quality of the mixture, and to produce a drier ice cream with smoother body and texture.

- Egg yolk, sorbitol, propylene glycol esters