

ICE-CREAM & FROZEN DESSERTS

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**B. Tech. (Dairy Technology) ► DT-3 ► Resources ► Lesson 10. PREPARATION OF ICE CREAM MIX –STANDARDIZATION, BLENDING AND HOMOGENIZATION***Module 4. Technological aspects of ice cream manufacture***Lesson 10****PREPARATION OF ICE CREAM MIX –STANDARDIZATION, BLENDING AND HOMOGENIZATION****10.1 Introduction**

Ice cream is a complex product containing milk components like emulsified fat, protein in colloidal form and a solution of lactose and salts along with or without cane sugar, eggs, fruit juices, fruits, flavours, colours, stabilizers and emulsifiers.

10.2 Preparation of Ice Cream Mix

Preparation of ice cream mix involves various essential steps viz.

- Selection of ingredients
- Formulation of ice cream mix
- Blending of mix
- Pasteurization of mix
- Homogenization of mix
- Cooling of mix
- Ageing of mix

10.3 Selection of Ingredients

Good quality materials are essential if the resultant product need to be satisfactory in all aspects. The raw ingredients necessary to provide the components of ice cream must contain sufficient fat and milk solids in proportions that can be combined to make a mix of the desired composition.

Selection of ingredients depends on their

- Availability
- Perishability
- Convenience in handling
- Effect on flavour, body and texture of ice cream
- Cost
- Equipments available etc

Ice cream ingredients may be grouped into dairy and non-dairy products.

10.4 Dairy Ingredients

Dairy products that supply fat and MSNF – Sweet cream, Sweet milk, fresh butter, unsweetened, condensed and evaporated milks , full-cream milk powder, separated milk powder.

Dairy products that supply MSNF alone – Skim milk, skim milk powder, condensed skim milk, sweet-cream buttermilk.

10.5 Non-Dairy Ingredients

- Sweetening agents – Cane sugar, beet sugar, corn sugar, corn syrup, invert sugar, saccharin

- Stabilizers– Gelatin, sodium alginate, guar gum, etc.
- Emulsifiers– Mono or di-glycerides of fat forming fatty acids
- Flavours– Vanilla, chocolate, strawberry, pineapple, lemon, banana, mango, orange, etc.
- Colours– Yellow, green, pink, etc.
- Egg solids – Yolk solids
- Fruits & nuts – Apple, banana, mango, pine apple, grape, almond, pistachio, cashew nut, walnut and groundnut.

10.6 Formulations of Mix

Consideration of various factors is highly essential to obtain a proper mix. The fundamental requirement of mix formulation is to obtain a well balanced mix which also satisfies the legal standards. A well balanced mix should always ensure:-

- A correct total solids to water ratio – if too high, sandiness and rough texture and if too low, glassy or icy texture with weak body. Usually total solids of 36.0 to 40.0% will result in organoleptically acceptable ice cream.
- There is inverse relation between fat and SNF in ice cream mix for e.g. super premium ice cream (high fat) will have lower SNF than good average (moderate fat) ice cream.
- A correct fat to sugar ratio – to prevent fatty mouth feel in case of high fat ice cream the sugar content has to be raised accordingly. For instances 16% fat ice cream should ideally have 17% sugar as against 15% sugar for economy (10% fat) ice cream.

As a thumb rule, the MSNF should be about 15.6% (slow turn over) to 18.5% (rapid turn over) of the TS of the mix, depending on the turnover of the ice cream. The maximum MSNF that can be kept to prevent sandiness in ice cream is as follows.

For slow turn over the formula is

$$\text{Max. MSNF}\% = \frac{100 - (\text{Sum of \% of all other solids in mix other than serum solids})}{6.4}$$

For rapid turn over the formula is

$$\text{Max. MSNF}\% = \frac{100 - (\text{Sum of \% of all other solids in mix other than serum solids})}{5.4}$$

For proper formulation of the mix, prior calculation of the mix with regard to the proportion of ingredients to be added is mandatory. The following methods can be used to calculate the mixes:

- Pearson square method
- Serum point method
- Formula tables / graphics method
- Algebraic method
- Computer developed formulations

10.7 Standardization of Ice Cream Mix

In order to attain the desired composition of ice cream mix, the calculated quantities of ingredients (dairy and non dairy) is arrived at through standardization. This is accomplished using either (a) Algebraic method, (b) Serum Point method.

In algebraic method the following three equations are used

Quantity equation

$$W + C + P = 100 - NDP \text{ --- (1)}$$

Fat equation

$$W \times F_1 + C \times F_2 + P \times F_3 = \text{Desired fat \%} \times 100 \text{ --- (2)}$$

SNF equation

$$W \times SNF_1 + C \times SNF_2 + P \times SNF_3 = \text{Desired SNF \%} \times 100 \text{ --- (3)}$$

Where

W= whole milk, C= Cream, P= Skim milk powder, NDP= Non Dairy Product (Sugar+stabilizer+emulsifier), F_1 , F_2 and F_3 = fat percentage of W, C and P respectively.

SNF_1 , SNF_2 and SNF_3 = SNF percentage of W, C and P respectively.

Desired fat and SNF may be 10.0 and 12.0 per cent respectively.

Equating the above three equations we can arrive at the individual quantities of each ingredient of ice cream mix.

10.8 Blending of Mix

The ingredients to be blended are taken in a vat, where it can be heated to facilitate dissolving, blending and pasteurizing. Mixing process varies from a small batch operation type to a large scale automatic continuous type depending upon the amount of mix to be processed.

The order in which ingredients are to be added is as follows:-

- Liquid ingredients are mixed together and heated to 49°C prior to the addition of all dry ingredients.
- Sodium alginate is mixed with a portion of sugar and slowly added to the liquid maintained at 71.1°C at a moving agitator point.
- When gelatin is used, it should be dissolved in nine times water by weight with equal volumes of sugar before the liquid temperature reaches 49°C.
- If butter, plastic cream, frozen cream or other frozen products are used, they should be cut into small pieces and allowed for complete melting before pasteurization.

10.9 Homogenizing Mix

Homogenization of ice cream mix is a most essential step to make a permanent and uniform suspension of the fat by reducing the size of the fat droplets to a very small diameter, preferably not more than 2 µm.

Advantages of homogenization

Proper homogenization of the mix will never allow the fat to form the cream layer

- More uniform ice cream
- Smoother texture
- Improved whipping ability
- Shorter ageing period
- Less opportunity for churning to occur in freezer

- Less stabilizer is required

Homogenization of mix is usually done at temperature ranging from 63 to 77°C. A pressure of 2000 to 2500 psi (135 to 170 kg/cm²) with one valve or 2500 to 3000 psi (170 to 200 kg/cm²) on the first and 500 psi (35 kg/cm²) on the second stage will usually give good results for an average mix.

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