PREPARATION OF ICE CREAM MIX –STANDARDIZATION, BLENDING AND HOMOGENIZATION

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.

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

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.

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.

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.

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

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

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) Algaebraic method, (b) Serum Point method.

In algaebraic method the following three equations are used

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

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

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

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.

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 to77°C. A pressure of 2000 to 2500 psi (135 to 170 kg/cm^2) with one valve or 2500 to 3000 psi (170 to 200 kg/cm^2) on the first and 500 psi(35 kg/cm^2) on the second stage will usually give good results for an average mix.

Pasteurization of Mix

Pasteurization is done to destroy all the pathogenic bacteria in the mix so as to render the final product safe for human consumption

Advantages of pasteurization are:-

- It renders the mix completely free of pathogenic bacteria.
- It dissolves and helps to blend the ingredients of the mix.
- It improves flavour.
- It improves keeping quality.
- It produces a more uniform product

Rapid heating and holding of the mix at definite temperature and rapid cooling below 5°C ensures proper pasteurization.

The temperature time combination for pasteurization of the mix as per BIS is as follows

- For Batch method – 68.5°C for not less than 30 min
- HTST method - 80°C for not less than 25seconds
- Vacreation - 90°C for not less than 1-3 seconds
- UHT pasteurization – 98.8 to 128.3°C for not less than 0-40 seconds

High temperature pasteurization is preferred as there is a greater bacterial kill resulting in low bacterial count in ice cream

- Better body and texture
- Better flavour
- Protection against oxidation
- Saving of stabilizer
- Saving of time, labour and space
- Increased capacity

Cooling of Mix

After pasteurization, the mix should be rapidly cooled to a temperature below 4°C using a plate heat exchanger. Unless the mix is cooled to a temperature of 4°C or lower, it will become very viscous and the ice cream will not melt down smoothly. Also, temperatures below 5°C retard the growth of bacteria.

Ageing of Mix

The cooled mix is left to age preferably for a period of 24 h at 4°C.

The changes that occurs during ageing are

- Hydration of milk proteins
- Crystallization of fats
- Absorption of water by any added hydrocolloids
- Viscosity is increased largely due to the previously mentioned changes.
- Ageing is substantially completed within 24 h and longer period should be avoided to control spoilage by psychrotrophs.

Flavour Addition

Frozen desserts are valued mainly for pleasing flavour and refreshing effects. Among the flavouring substances that play an important part in frozen desserts are vanilla, chocolate, strawberry, pineapple, lemon, banana, mango, orange etc. Type and intensity of flavours are important characteristics in ice cream where delicate flavours are preferred to harsh flavours.