

Age Group	Number of People
13-17	10
18-24	5
25-34	5
35-44	10



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Module 3. Ingredients in ice cream and frozen desserts

NON-DAIRY INGREDIENTS IN ICE CREAM

Ice cream is made utilizing both dairy as well as non-dairy food ingredients. In this section, the role played by Non-dairy ingredients namely sweeteners, flavourings and colourings will be discussed.

While a sweet ice cream is generally desired by the public, sweeteners should be used in moderation, not only for optimum palatability, but also for handling properties.

- To increase the acceptance of the product, not only by making it sweeter but also by enhancing the pleasing creamy flavour and the delicate fruit flavour.
- It increases the viscosity and TS content of mix; this improves the body and texture.
- It depresses the Freezing point of mix, resulting in slower freezing and thus requiring a lower temperature for proper hardening.
- It is usually the cheapest source of TS in the mix.

Lack of sweetness produces a flat taste, while too much tends to overshadow desirable flavours. Sugar may slow up the whipping of the mix.

For plain ice cream, level of sugar of 14-16% is found desirable. In case of fruit and chocolate ice cream, a higher sugar content of 17-18% is desirable.

- Sugar (Sucrose) or sugar syrup
- Dextrose

- Intense sweeteners (viz., Saccharin, Aspartame, Acesulfame-K, Sucralose, Stevioside, etc.)

Table 9.1 Relative sweetness of sweeteners

Sweeteners	Dextrose Equivalent*	Relative sweetness
Sucrose		1.00
Fructose		1.75
Invert sugar		1.05
Glucose (Dextrose)		0.74
Corn syrup		
High conversion	62 DE	0.68
Medium conversion	52 DE	0.58
Low conversion	42 DE	0.50
Low conversion	32 DE	0.42
90 HFCS		1.60
Lactose		0.16
Polyols:		
Sorbitol		0.50-0.70
Xylitol		1.00
Saccharin		200-700
Aspartame		160-200
Acesulfame-K		200
Cyclamate		30-60
Sucralose		600-800
Stevioside		300

* DE – Dextrose Equivalent

Dextrose equivalent (DE)

It is the percentage weight of dextrose present in the hydrolysed starch referred to as

dextrose equivalent: higher the DE, higher will be the sweetness of the corn sugar.

9.2.4 Sucrose

It is a disaccharide composed of glucose and fructose. It is obtained from cane sugar and sugar beets. It may be used in dry or liquid form (67% sucrose). It provides a sweet taste without secondary or after flavours. However, sucrose is a contributor to dental caries. Invert sugar can be prepared by hydrolysis of sucrose with attendant increase in sweetness over that of sucrose.

9.2.5 Fructose

It is a white crystalline powder. It contains as many calories as sucrose. It is available under trade name 'Xyrofin' by Xyrofin Ltd. It seems to have potential as a sweetener in dietetic ice cream because of the high relative sweetness value. It produces a softer, more easily scoopable product when held at -18°C. In fruit ice cream it brings out the flavour of fruit and berries. However, products containing fructose are susceptible to browning reactions.

9.2.6 Corn sweeteners

These are available in three major types viz., (i) Refined corn sugar (Dextrose), (ii) Dried corn syrup (referred to as corn syrup solids), and (iii) liquid corn syrup.

The advantages of incorporating corn syrup solids or corn syrup as part replacement of sucrose is as follows:

1. It provides firmer and heavier body to finished ice cream.
2. It serves as an economical source of solids.
3. It improves the shelf life of the finished product.
4. High fructose corn syrups (i.e. 42, 55 and 90%) also play an important role as sweetener in ice cream.

9.2.7 Dried corn syrup solids

It is produced by dehydration of corn syrup. It contains sugars like dextrose and maltose, together with dextrin, but usually contains no starch. It is economical than use of cane sugar but due to its lower sweetening effect, it is required to be used in greater amount. The effect on F.P. (raised) and smoothness (stabilizing effect due to higher TS contribution) gives Corn Syrup Solids (CSS) an advantage over that of dextrose. Recommended usage is 25-35% of the total sweetener that is to be supplied by CSS.

9.2.8 Dextrose

It is a white crystalline or granular sugar obtained by hydrolysis of corn starch. It is economical than sucrose. It is recommended for use in high-fat mixes for more desirable body, texture and melting properties. It is necessary in Sherbets and Ices to inhibit the crystallization of sucrose on the surface. Its effect of lowering the Freezing point limits the amount of dextrose that can be used to less than 25.0% of the total desired sugar.

9.2.9 Polyols

a) Sorbitol

It is a hexahydric alcohol, obtained by catalytic hydrogenation of D-glucose or invert sugar at high temperature and pressure, followed by ion-exchange treatment. It is easily water soluble and possess a 'sweet cool' and pleasant taste. This sweetener is useful in formulation of 'soft ice creams' and 'diabetic mix'.

b) Xylitol

It is a pentahydric alcohol naturally occurring in fruits and vegetables. Commercially it is obtained by acid hydrolysis of xylan. However it has an excellent taste and has a cooling effect greater than sorbitol. It can be used as an excellent sugar substitute for diabetics.

c) Intense sweeteners

1. Saccharin

It is the first non-nutritive sweetener used commercially— a product derived from coal tar. It has sweetening effect up to 550 times that of sucrose. However, its use is drastically reduced due to its implication to occurrence of cancer in laboratory animals.

2. Aspartame

It is a dipeptide consisting of phenylalanine and L-aspartic acid. It is available under trade names 'Nutra Sweet' or 'Saneeta'. Absence of bitter character and sucrose-like flavour makes it a source of sweetener superior to other high-intensity sweeteners like saccharin. It is non-cariogenic.

3. Sucralose

It is produced from sucrose by chlorination of 3-hydroxyl groups. It has been developed jointly by Mc Neil Specialty Products and Tate and Lyle Specialty Sweeteners. It is a non-caloric sweetener and offers unique combination of a sweet, sugar-like taste, free of any unpleasant aftertaste.

4. Stevia

With its steviolglycoside extracts having up to 300 times the sweetness of sugar, stevia has garnered attention with the rise in demand for low-carbohydrate, low-sugar food alternatives. Because stevia has a negligible effect on blood glucose, it is attractive as a natural sweetener to people on carbohydrate-controlled diets. It is available commercially as stevioside.

Frozen desserts are valued mainly for their pleasing flavor and their cooling and refreshing effects. Among the flavouring substances, the important ones are vanilla, chocolate and cocoa, fruit and fruit extracts, nuts, spices, etc.

The type of flavourings utilized in ice cream and frozen desserts include:

- (a) Natural flavourings:** Non-citrus fruit, citrus fruit, tropical fruit, natural flavours from botanicals, spices, cocoa and chocolate, coffee, natural flavourings from vanilla beans and nuts.
- (b) Synthetic flavourings:** These include aromatic chemicals and imitation flavours.
- (c) Liqueur flavourings:** Alcohol, whiskey and other distilled beverages, fruit brandy distillate and brandy flavour essence and fruit liqueurs.

The last category (c) is prevalent in countries abroad.

It is obtained from beans of an orchid *Vanilla fragrans*. The natural compound which produces vanilla flavour is vanillin. It is available in liquid or powder forms as pure vanilla, reinforced vanilla with vanillin and imitation vanilla. Cured vanilla beans contain 1.5-2.0% vanillin on dry basis.

Fruit may be crushed and used as such, but often it is necessary to add further flavours, either natural concentrated extracts or even synthetic to bring out the full flavour. The popular fruit flavourings used in ice cream include mango, strawberry, pineapple, orange, apple, papaya, jamun, etc.

9.3.3 Chocolate and cocoa

These are derived from beans of tree *Theobroma cacao*. When used as an ingredient in ice cream, about 2-3% cocoa is used. To overcome the bitter flavour of cocoa, additional sugar is necessary (17-18% sugar). The chocolate is also used as couverture (coating of other flavoured ice cream) to enrobe a small individual portion of ice cream.

9.3.4 Nutmeats

Several kinds of nutmeats are popular including almonds, raisins, hazelnuts, pistachio, walnuts, pecans, etc. It must be ensured that the nutmeats are clean, free from shells or other extraneous matter and free from rancidity. The nutmeats may preferably be roasted or even fried in oil prior to its use.

9.4 Colourings in Ice Cream

Ice cream should have a delicate, attractive color that suggests or is readily associated with its flavour. Fruit ice cream needs to be colored because about 15% fruit commonly added, produces only slight effect on color. Chocolate ice cream is one of the exceptions, wherein the required amount of cocoa furnishes the desired color.

Most of the colors are synthetic origin. A weak alkaline solution of Annatto color is about the only vegetable color used in ice cream.

The list of permitted colorings for use in ice cream is furnished in Table 9.2.

Table 9.2 Colourants permitted by FSSAI (2006) in ice cream

Several natural colourings have emerged due to negative health impact of the permitted synthetic colorants in ice cream. However, these have not got wide acceptance due to problems in stability of the colourants.

Some examples of natural colourants that has been tried in ice cream and frozen desserts is depicted in Table 9.3.

Table 9.3 Natural colorants for use in ice cream

Colourant	Natural source	Color hue imparted
Annatto	<i>Bixa orellana</i>	Yellow
Betanin	Beet root	Red
Curcumin	Turmeric	Yellow
Caramel	Sugar	Brown
Paprika	Paprika leaves	Pale yellow
Anthocyanin	Grapes	Red
Carotenoid	Saffron	Saffron

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