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- Table 5.1 Approximate composition of commercial ice cream**

5.3 Raw Materials

5.3.1 Fat

The fat content and type used in ice cream and frozen desserts are used to classify individual products according to the national regulations or standards of identity of most countries. The word ice cream can now be used for four categories of ice cream - non fat – ice cream (less than 0.5% fat), low-fat ice cream (2.0% fat), reduced fat ice cream (2.0-10.0%) and regular, premium, and super premium ice cream (more than 10% fat) as per US regulations.

The existing national ice cream legislations in the individual member states of the EU vary considerably with regard to the fat content of ice cream. For example, minimum fat varies from 5% in the UK to maximum of 12% in the final product and no such requirements existed in Italy.

5.3.2 Milk solids not fat (MSNF)

MSNF consists of proteins, lactose and minerals, the components of which vary considerably. The most commonly used MSNF sources and their composition are shown in the Table 5.2.

Table 5.2 Typical composition of MSNF sources

Ingredient	Constituents (%)					
	Fat	Casein	Whey Protein	Lactose	Ash	Water
Skimmed milk	0.1	2.5	0.8	4.8	0.8	91.0
SMP	1.0	27.7	9.3	52.0	7.0	3.0
Whey powder	1.0	-	13.0	73.0	9.0	4.0
Whey protein concentrate	2.0	-	35.0	51.0	7.0	5.0

The key components of MSNF are proteins which a part from their contribution to nutritional requirements also have an effect on the whipping characteristics and other physical and sensory properties of ice cream. In addition they have good functional properties such as

- Interaction with some stabilizers.
- Stabilization of the fat emulsion after homogenization
- Contribution to structure of ice cream
- Water binding ability

5.3.3 Sweeteners

Sweeteners which include the lactose added via MSNF, make up the major part of the solids contained in the ice cream. The degree of sweetness is determined by the addition of Sweeteners. Due to their depressing effect on the freezing point, sweeteners also control the amount of frozen water in ice cream and thus the softness of the final product. Table-5.3 depicts the most commonly used ice cream sweeteners and compares their influence on the degree of sweetness and freezing point of the ice cream with that of sugar (sucrose).

Table 5.3 Freezing point depression and sweetness in ice cream

Carbohydrate	Average molecular weight	FPDF	Relative Sweetness
Sucrose	342	1.0	1.0
Glucose syrup 42 DE	445	0.8	0.3
HFCS (42% Fructose)	190	1.8	1.0
Fructose	180	1.9	1.7
Invert sugar	180	1.9	1.3
Lactose	342	1.0	0.2
Sorbitol	182	1.9	0.5
Glycerol	92	3.7	0.8
Ethanol	46	7.4	-
Saccharin			300-400
Aspartame			160-200
Acesulfame-K			200
Sucralose			600-800

FPDF– Freezing Point Depression Factor

DE– Dextrose Equivalent

HFCS– High Fructose Corn Syrup

5.3.4 Emulsifiers

Emulsifiers are by definition substances which make the formation of an emulsion possible due to their ability to reduce surface tension. In ice cream oil in water in water emulsion and an air – in – partly frozen mix emulsions are involved. Glycerol esters of fatty acids, commercially known as mono and diglycerides, are the emulsifiers most commonly used in ice cream. The benefits of emulsifiers in ice cream manufacture include:

- The dryness of ice cream on extrusion from continuous freezer
- Improved whipping properties
- Improved body and texture
- Richer mouth feel and creamy sensation
- Improved air cell distribution
- Improved heat shock resistance

5.3.5 Stabilizers

Stabilizers influence the movement of water, partly due to their ability to form H-bonds and partly due to their ability to form a three dimensional network throughout the liquid which leadsto the immobilization of water. The water binding / immobilizing effect improves the storage stability of ice cream. Furthermore, stabilizers have positive influence on body and texture of ice cream. Finally, stabilizers contribute to the melting resistance of ice cream and prevent wheying off during melting. The most commonly used stabilizers are as follows

1. Locustbean gum(LBG)
2. Guargum
3. Sodiumalginate
4. Carrageenan
5. Sodiumcarboxy methyl cellulose(Na – CMC)

In order to obtain desired properties, combinations of stabilizers are used. The dosage of stabilizer combination in ice cream is normally between 0.1 and 0.3%.

5.3.6 Composition of sherbets and water ices

Sherbets, or milk lollies and waterices, or ice lollies, are defined as the frozen products containing none orvery little milk solids in comparison with ice cream. These are usually fruit flavoured and acidulated. Thus, these products notonly contain less food solids and more water, but also have higher concentrations of the sweetener. Their fruit and acid content imparts a characteristic flavour and tartness, and the ‘ice rich’ structure gives the product a typical chewy texture.

A typical sherbet formulation may contain 20-23% sucrose and 7-11% corn syrup solids (CSS), where as the corresponding figures for water ice would be 23-25% and 7-11%. Unlike dextrose, CSS can be used at higher level of sucrose replacement to obtain a smoother texture and a firmer, though stickier body.

Since sherbets and ices contain less total solids, and therefore, less overrun than ice cream, whipping agents (i.e.emulsifiers or surfactants) are generally not required. As most sherbets and practically all ice lollies, besides being fruit flavoured, contain added acid [pH3-4]. The stabilizer used should be stable under such conditions. Alginates, particularly ester alginate, xanthan gum, sodium Carboxy Methyl cellulose(CMC), and certain other hydrocolloids such as gum Arabic, gum karaya, gum tragacanthsetc. have been considered suitable for use in these products.

Fruit-flavoured, especially citrus- flavoured sherbets and ices are acidified to0.30-0.50%

5.4 Sherbets and Related Products

Table 5.4 Examples of sherbets and ice lolly formulations

P = Pectin; G = Gelatin

Novelties: The novelties are from frozen desserts include bars (with or without sticks), sandwiches, cones, molded items, rolls, and cakes.

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