



TECHNICAL APPLICATION
INFORMATION



Ice Cream and Ice Cream Desserts

ICE CREAM AND ICE CREAM DESSERTS

Ice cream and ice cream desserts are an international and steadily growing market with strong seasonal dependence and very high technological demands.

Already 3000 years ago frozen desserts were consumed in China and also the ancient Greeks and Romans already appreciated flavoured snow as delicacy.

Thanks to the generation of artificial coldness by invention of industrial refrigeration engineering, a market with a great variety of products available the whole year round is offered to the consumers today.

In order to meet the growing demands of the market as regards texture properties of the final products, especially the stabilising system, that means the use of added hydrocolloids such as H&F Pectins plays an important role. In the industrial production of ice cream pectins from H&F have been used successfully since a long time in fruit preparations and fruit sauces which are processed in combination with ice cream. However, also for the stabilisation of ice cream itself, H&F offers special pectins which meet the high technological demands.

Ice cream is offered in different types such as milk ice cream, yoghurt ice cream, ice cream for diabetics as well as fruit ice, water ice and ice desserts (e.g. sorbet) in most different flavours and in a variety of packagings (portion packs, family packs, large packs).

The various types mainly differ in the amount of milk components (fat-free milk soluble solids) and fat (milk fat, vegetable fats).

Ice cream which is produced using milk components and fats, is a disperse multiphase system consisting of an aqueous sugar solution in which colloiddally dissolved proteins as well as added hydrocolloids, emulsified and suspended fat droplets with crystalline shares as well as enclosed air bubbles are present side by side.

Fruit ice, sorbet and water ice do not contain milk components and fat, the system consists of a sugar solution with a more or less high share of fruit components in which the added binding agent such as pectin is present in colloiddally dissolved form beside the ice crystals and air bubbles and which stabilises the system.

Industrially ice cream is produced according to the following process:

1. Pre-mix

The basic raw materials (liquid and dry) as well as the temperature-resistant flavouring ingredients are mixed and dissolved at temperatures of approx. 65°C.

2. Pasteurisation / Homogenisation

During pasteurisation at 85°C the pre-mix becomes germfree. In recipes containing fats, the fat droplets are reduced in the following homogenisation process at approx. 72°C to a size of approx. 1µm in order to prevent fat separation and to increase the whipping ability.

3. Cooling and ageing of the mix

In the following the mass – maybe after adding fruit preparations – is cooled very quickly to temperatures of 2-4°C. Now the cooled mix is stored for 24h (approx.) for the so called ageing. During this time the viscosity increases due to the swelling of the hydrocolloids, the solubilisation of milk protein from the dry milk powder and the setting of the milk fat by crystallisation.

4. Aeration and pre-freezing

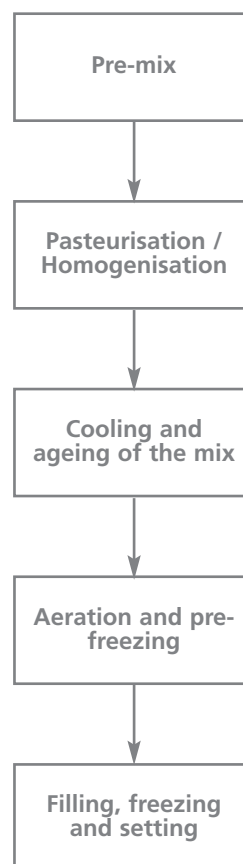
During aeration a micro foam structure is formed, the volume is strongly increased. The enclosed air delays the heat transfer rate resulting in a delayed melting process. In the whipped mix, ice crystals with a size of 10-20µm are formed in the freezer at temperatures of approx. -5°C.

In this step the formation of small, uniform ice crystals and the prevention of undesired clustering of ice crystals are of great importance in order that the final product is perceived smooth.

5. Filling, freezing and setting

Due to its creamy-plastic texture the pre-frozen mass can now be filled into any forms and merged with pre-cooled fruit preparations or fruit sauces if desired. At temperatures of -30°C the product now is set in its final form and then stored at temperatures of min. -18°C. During this storage further crystallisation procedures occur.

Fig. 1: Procedure for industrial production of ice cream



The quality criteria of ice cream are decisively influenced by type and amount of ingredients as well as by the production technology.

Basically ice cream consists of the following ingredients:

Water

The share of ice crystals formed by the water defines the firmness while amount and size of the ice crystals define texture and mouth-feeling. An extra smooth and creamy mouth-feeling is reached by a high amount of very small ice crystals.

Sugars, sugar syrups

Sugars and sugar syrups increase the viscosity and improve the whipping behaviour. The addition of sugars causes a reduction of the freezing point. The total soluble solids influence texture and body of the final product.

Milk components (fat-free milk solids)

The milk protein ensures a stable emulsion during homogenisation and improves the creaming process. In the final product the milk protein improves flavour, structure and body.

Fats (milk fat, vegetable fats)

The added fats increase form stability and melting resistance. Fats provide a creamy, smooth texture to the final product and are a flavour carrier at the same time.

Additives (hydrocolloids, emulsifiers)

Emulsifiers provide a reduction of the surface tension at the boundaries water/fat and water/air and, together with the added binding agent (hydrocolloid), ensure the state of the finely dispersed phase mix.

With that the fat separation during the ageing storage is prevented and the ice mix is stable towards the high impact during whipping and pre-freezing.

Despite their low concentration especially the added binding agents have a great influence on the quality of the final product.

Especially for the stabilisation of ice cream H&F has developed pectins which, due to their technological functionality, can be used singly or also in combination with other hydrocolloids.

- Due to the water binding properties of H&F pectins, the viscosity of the ice cream mix is increased resulting in an increased micro foam formation during whipping.
- The fine disperse air-water-fat emulsion is additionally stabilised by the water binding properties as well as the pectin's property to act as protective colloid.
- During the following freezing process the water, which is bound by the addition of pectin, can no longer crystallise out. The remaining free water forms small ice crystals resulting in a pleasant smooth mouth-feeling of the final product.
- In the final product pectin additionally effects a strong melting delay and prevents syneresis.
- Pectins by H&F can also be used at relatively low pH-values and support the flavour release, the fruit typical fruity flavour and effect a creamy texture of the products with high mouth-feeling and body.

- In ice cream which does not contain any milk components such as fruit and water ice or sorbet, the addition of H&F pectins results in stable products with large volume, very pleasant melting behaviour and full-bodied texture.
- As today the relevance of healthy food is strongly increasing, the natural material pectin also convinces with its consumer-friendly labelling.

H&F pectins for stabilisation of ice cream and ice desserts

For ice cream and ice desserts (e.g. sorbet) the H&F Pectin Classic AJ 201, Pectin Classic CJ 201, and Pectin Combi AC 10 are ideal binding agents.

The addition of these pectins effects an increased viscosity of the mix, enables the formation and stabilisation of a homogeneous micro foam structure as well as the formation of finely dispersed, homogeneously small ice crystals and with that results in products with smooth, high mouth-feeling and excellent melting behaviour.

Pectin Instant CJ 204 is an agglomerated pectin for the use in ice cream which offers additional advantages due to its excellent solubility when added to the aqueous phase.

Herbstreith & Fox KG		Recipe
Fruit Ice		
Product Pectin Classic CJ 201		
4g Pectin (= 0.4%)		Production
200g Fruit puree		A Mix pectin, sucrose and citric acid
200g Sucrose		B Mix fruit and water.
630g Water		C Stir the dry substances into B and pasteurize.
Citric acid, flavours, colourings		D Add colourings and flavours.
Input: approx. 1040g		E Cool to -10°C in the ice cream machine.
Output: approx. 1000g		F Further cooling to -30°C.
TSS: approx. 22%		G Store at -18°C.
pH-value: approx. 3.2		