



# USE OF STABILIZER IN ICE CREAM

**Dr. Soma Maji**  
**Department of Dairy Technology**

# Stabilizer

- Group of compounds, usually polysaccharides, responsible for adding viscosity to the unfrozen portion of water and thus holding this water so that it cannot migrate within the product.

## Major functions performed by stabilizer in ice cream include

- Contributing to body or 'substance' and creaminess,
- Imparting a smooth texture and providing melting resistance to ice cream.
- Stabilize the product texture i.e. to prevent or minimize detrimental effect of heat shock during storage and distribution.

## Excessive use of stabilizers causes

- Gumminess,
- Poor meltdown
- Interfere with flavour release.

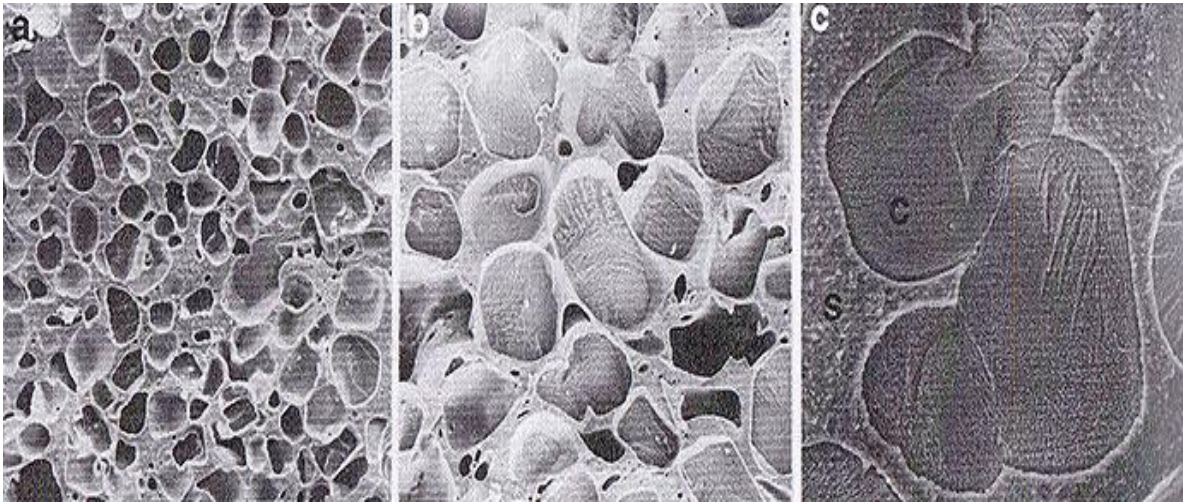


# Selection of Stabilizer

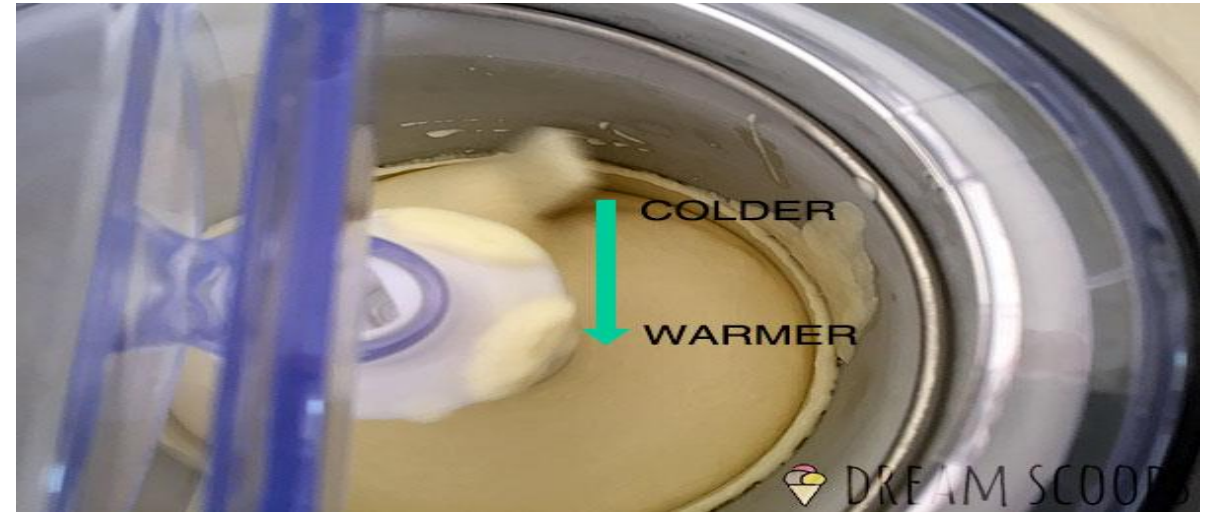
The following factors are important in choosing a stabilizer:

- Ease of incorporation in mix
- Effect on viscosity and whipping properties in mix
- Ease of dispersibility in cold and hot mix
- Type of body produced in the ice cream
- Effect on meltdown characteristics
- Ability to retard ice crystal growth
- Amount required to produce the stabilization
- Cost
- Perception as natural
- Effect on flavour perception

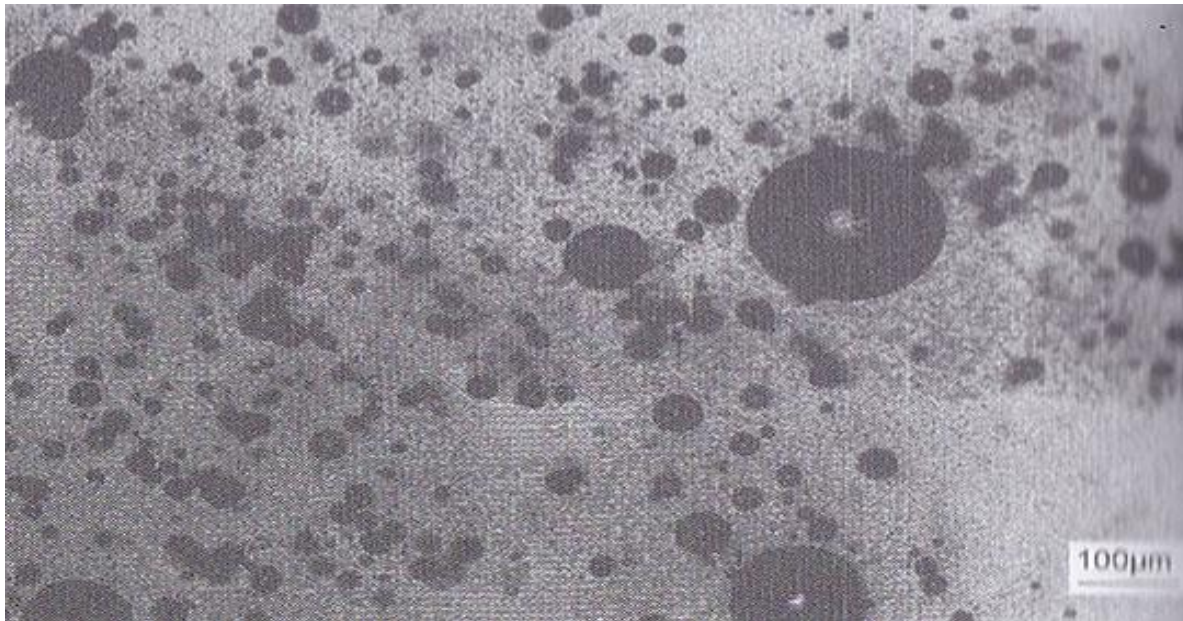




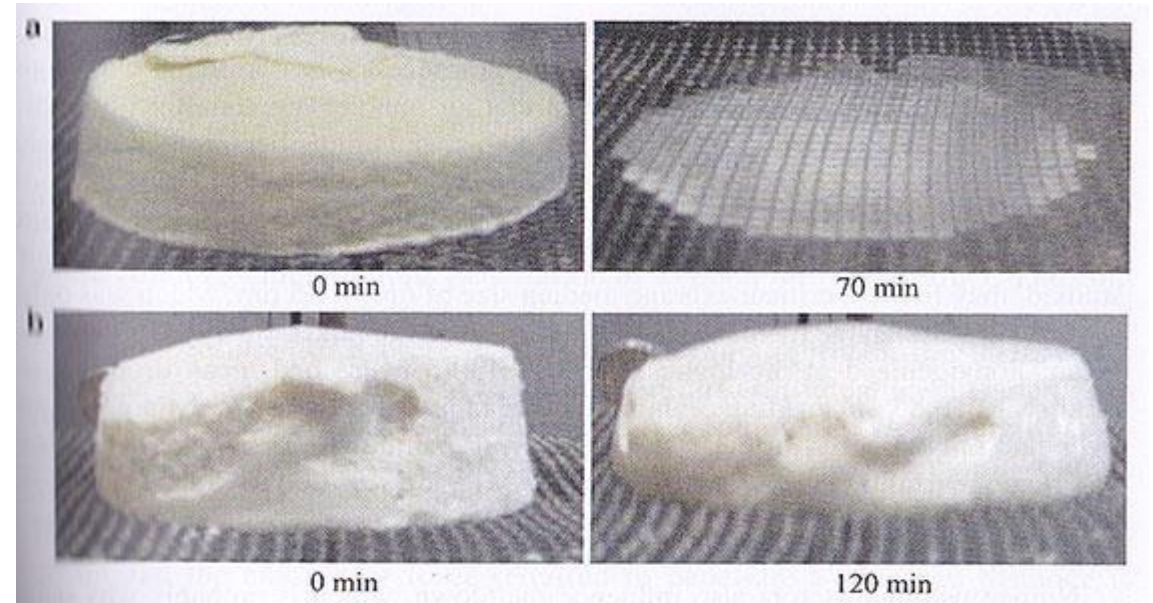
Over time ice crystals grow as they melt and re-freeze (a to c)



Newly formed ice crystals can melt when they move from cold sides to warmer center-- **Ice crystal growth in the ice cream maker**



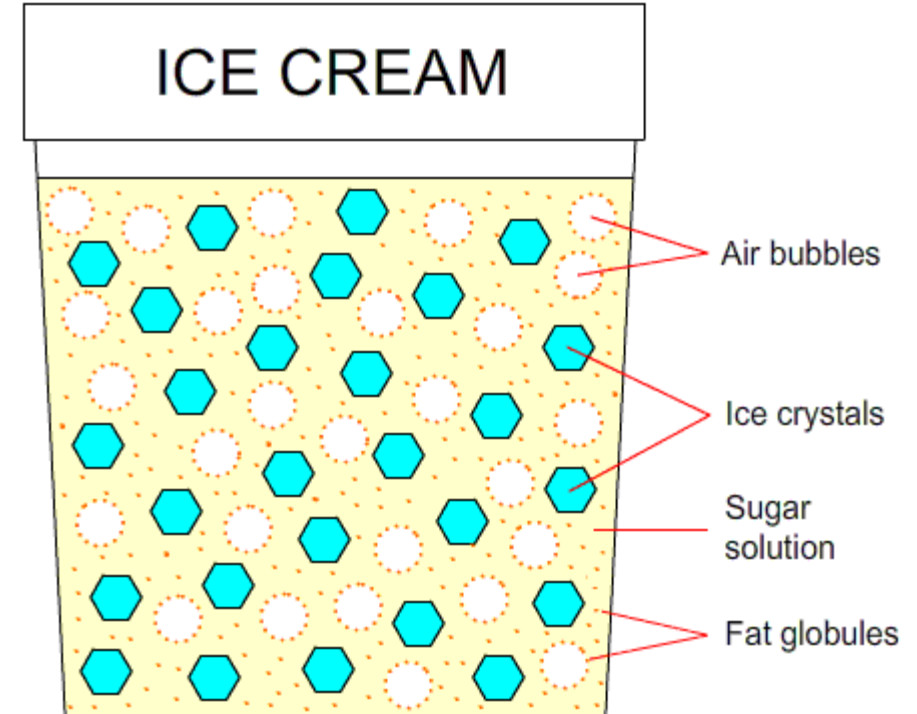
**stabilizers reduce air bubble size in ice cream**



**stabilizers slow down melting**

# Mechanism of action

- Capable of **imbibing large quantities of water** while still remaining dispersed in water and **forming colloidal solutions**, stabilizers are functionally also termed as hydrocolloids.
- Stabilizers **increases the viscosity of the continuous liquid phase**.
- The effect of stabilizers on viscosity exhibits considerable **interaction with milk constituents**.
- The basic viscosity of stabilizer solution is **generally not affected by heat treatment in the absence of milk solids**, but in their presence, with increasing total solids, the effect of stabilizer on heat induced increase in viscosity of the system becomes more pronounced.



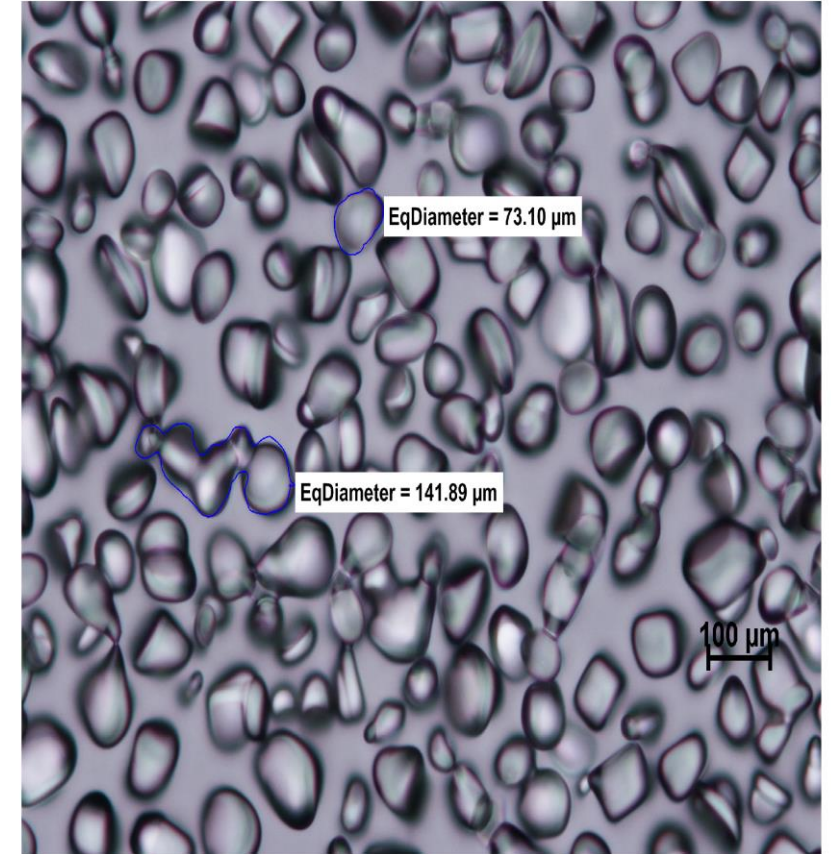
- Upon **hardening**, the water content of ice cream falls considerably with a concomitant **increase in the concentration of stabilizer in the liquid phase**.
- The **increased stabilizer** concentration together with **decreased temperature** greatly increases the **viscosity**, there by substantially **reducing diffusion and mobility of the liquid in the frozen product**.
- Gel formation induced by stabilizer in the mix is believed to effect, considerably, **immobilization of the liquid**.
- The movement of water is **hindered partly by the ability of hydrocolloids to form hydrogen bonds**, too.
- Thus, refreezing of water that originated from melting of ice due to temperature fluctuations would not permit the formation of large ice crystals.

- Increasing the viscosity the desired stabilization of ice structure may not be achieved.
- Increasing the viscosity of a 36% TS mix by addition of 5% polyethylene glycol had no effect on ice crystal size in the frozen dessert.
- Certain stabilizers such as guar gum are effective thickening agents with no gelling ability.
- Influence of stabilizer is related to their molecular structure and orientation besides their gel forming or viscosity building ability.
- However, extrapolation of results from model systems to ice cream is difficult as the later is a complex system with high concentrations of salt, sugar and stabilizers, which interact with other molecules, e.g. protein.

# Influence of stabilizer on mix and ice cream

## 1. Effect on texture:

- Promoting smoothness through control of ice crystal size after initial freezing and hardening.
- Once the ice crystals are formed, it stabilize the size of the ice crystals against growth as a result of temperature fluctuation (heat shock).
- There is an increase in mean ice crystal size each time the temperature fluctuates. Stabilizers help create a situation where a higher proportion of water which changes state during temperature rise recrystallizes as small crystals.
- This is thought to occur through the formation of a system (with high viscosity and /or a gel structure) which immobilizes the melted water, thereby reducing the degree to which it can migrate to existing ice crystals and deposit on them when it refreezes.
- The net effect is to slow the rate of ice crystal growth whenever heat shock occurs.





## **2. Effect on body characteristics:**

This is a major function at the time the product is drawn, during hardening and at the time of consumption. It involves the participation of the stabilizer ingredients in determining the cohesiveness of the product, particularly those aspects described by such adjectives as chewy, sticky, weak, gummy, etc.

## **3. Effect on whipping and overrun retention:**

The structure which is established as water freezes and stabilizer and its complexes are concentrated also play a role in providing strength to the air cell wall. Stabilizers are therefore involved in the amount of air which is incorporated and the degree to which the air cells are stable.

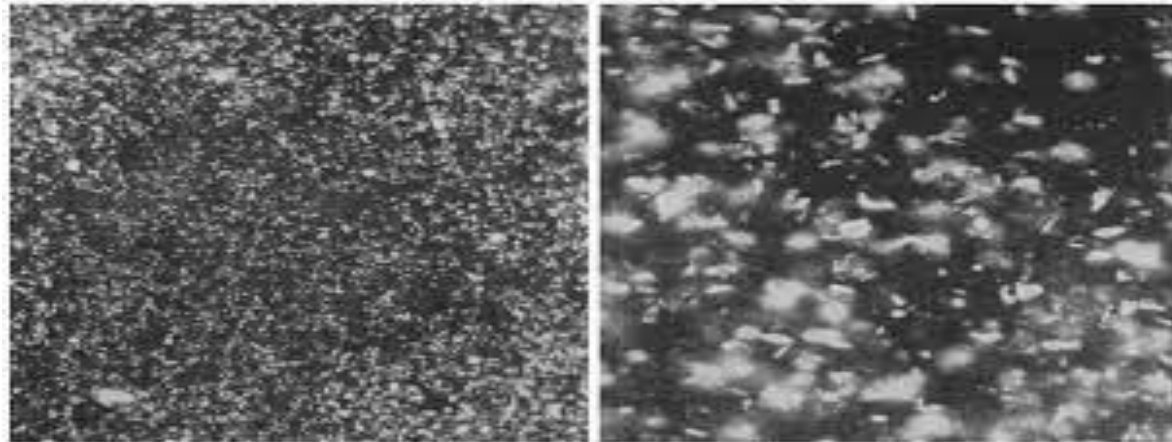


## **4. Effect on melting rate and properties of melted product:**

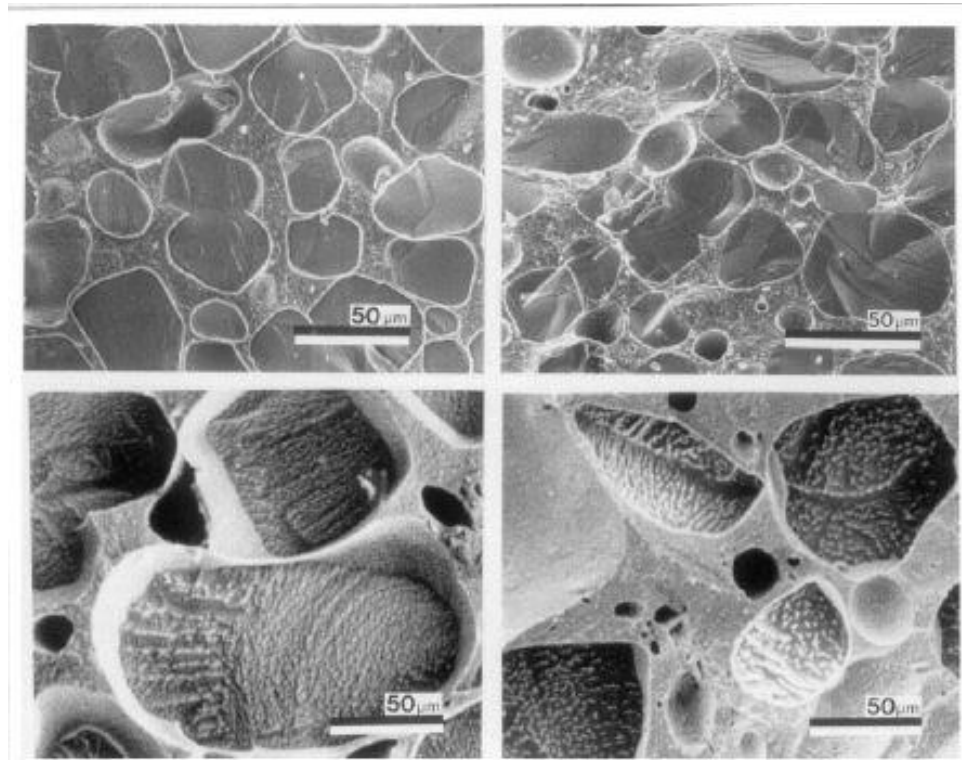
The structure which results from the interaction of gums with water and other ingredients has a direct bearing on the rate of melting and appearance of the melted product. The meltdown appearance function is outcome to the role of stabilizer with respect to protecting against serum separation and fat destabilization in that by reducing the degree of destabilization of fat and protein, stabilizers can avoid the development of curdy appearance in melted product.

## 5. Effect on sandiness:

- Sandiness is caused by lactose. Stabilizers used these days (CMC, natural gums, carrageenan, etc.), functions in a manner similar to control of ice crystal size through decreasing the mobility of unfrozen water during heat shock.
- The supersaturated stages in which sugars responsible for sandiness are prone to crystallize in frozen desserts are reached at temperature associated with a high stabilizer concentration.
- This encourages the distribution of the crystallizing lactose over a large number of small crystals rather than a lesser number of larger crystals which ultimately grow to a size where they can be perceived.
- Microcrystalline cellulose is particularly effective in this function, probably by providing an additional seeding function which encourages the development of small crystals



# Sandiness



Upper pic: In normal freezing temperature  
Lower pic: Temperature fluctuation and  
refreeze

## 6. Effect of stabilizer during ageing:

- Ageing of ice cream mix is an important processing step with regard to stabilizer action.
- Hydration of stabilizer is the most obvious effect of ageing, although not all stabilizers require ageing for complete hydration.
- The effects of ageing are more pronounced with gelatin stabilizers, and improvements in ice cream and freezing performance becomes more evident as the ageing time increases from 4 to 12 h or more.
- Even mixes containing stabilizers which require no ageing for complete activation benefit from a certain minimum ageing due to milk protein hydration and fat crystallization.



# Proprietary stabilizer blends

- Most ice cream manufacturers use blends of several stabilizer ingredients to achieve the desired characteristics which cannot be provided by a single ingredient.
- It is not possible to produce ice cream with desired characteristics by using a single stabilizer.
- For instance,
  - i. A short chewy body of ice cream is associated with the use of CMC.
  - ii. Use of guar gum results in ice cream having a gummy body.
  - iii. Sodium alginate produces a light bodied ice cream.
- Typical stabilizer combinations are:
  - i. Guar gum and xanthan gum
  - ii. Locust bean gum and xanthan gum
  - iii. Locust bean gum and carrageenan
  - iv. Alginates and pectin



For example,

- ✓ To make an ice cream which is somewhat short and chewy, but not to the extent which would be produced by using CMC, it is necessary to select a combination of CMC and alginate or CMC and guar gum to provide the desired properties.
- ✓ Blending of colloids can also be done to reduce the cost of stabilizer.
- ✓ However, indiscriminate change in stabilizer composition might prove counter-productive since noticeable changes might occur in frozen dessert properties.
- ✓ Thus, while selecting a blend of stabilizers, functionality rather than the cost should be the overriding factor.



