

Role and mechanism of stabilizers and emulsifiers in ice cream.

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Role of emulsifier and stabilizer

- Stabilizers interfere with ice crystallisation and limit the growth of large crystals. Use of stabilizer makes the smoother body.
- At a given rate of heat removal the coarseness of a population of crystals depends on the relative rates of nucleation and growth and it has been postulated that stabilizers act either by increasing nucleation or reducing the rate of growth.
- It is observed that while stabilizers have no significant effect on rate of nucleation, the growth of ice, in a model system, is drastically retarded and the morphology altered by the presence of a stabilizer gel network.
- The effect on ice growth rate and morphology has been explained qualitatively in terms of mechanical interference with the growth of ice.
- It is probable that the gel fibres cause the ice interface to develop a radius of curvature of similar size of the mesh size of the network and thus to depress the freezing point. The gel fibres themselves are placed under stress and may rupture.

- The effect of stabilizer is greater than expected and this may be due to the presence of sucrose as an additional solute.
- The effect of stabilizers cannot be explained wholly in terms of the effect on ice growth. The three dimensional network formed binds, restricts movement of water in the frozen product and thus minimise the potential for formation of large crystal during temperature fluctuations.
- The viscosity of the mix is also increased as a result of interactions between gum type stabilizers and partially denatured proteins.
- Emulsifiers act as surface active agents and reduce the energy requirement to maintain the integrity of the fat globules.
- In an emulsifier such as glycerol mono-stearate, the lipophilic portion of the molecule, the fatty acid chain enters the fat phase, while the hydrophilic portion the glycerol portion enters the water phase.
- Added emulsifiers are more effective than milk proteins due to their smaller molecular size and greater mobility.
- Paradoxically an additional beneficial function of emulsifiers is to destabilize the fat globule. This permits a degree of clustering and prevents rapid melting.

Effect of pasteurisation

1. Microbiological safety
2. Whey proteins gets denatured and uncoiled which expose the lipophilic part of the molecule
3. When proteins starts to act as emulsifier and the water binding capacity increased
4. Increase the available binding site of protein: hydrocolloid interaction thus enhances the action of stabilizers like carrageenan
5. During heating emulsifiers is melted and heat activated stabilizers are brought into colloidal solution
6. Excess heat treatment leads to unacceptable organoleptic deterioration

Effect of ageing

1. Skim milk powder and stabilizers become fully hydrated
2. Emulsion induced disruption of protein starts
3. Substantial crystallization of fat. Triacylglycerols of the highest melting point are the first to crystallize and are situated closest to the surface of the fat globule.
4. The quantity of fat remaining liquid depends on the specific fat involved but balance between liquid and crystallised fat is essential for good quality.
5. Use of unsaturated fat in ice cream results relatively low degree of fat crystallization