

Dairy Products Additives: -

1- Starter preparation: -

-Lactic cultures are isolated and identified then grown in buffered media to facilitate maximum growth without acid inhibition .

-The cells are concentrated by centrifugation.

-The cell concentrate is fast frozen or freeze dried (lyophilized).

Frozen (-40C) or lyophilized cultures can be stored for several months without large loss of activity.

2- Rennet preparation & Rennet properties: -

The traditional enzyme is rennet (chymosin) which is derived from the abomasums of the milk fed calf. Rennet is made by extracting, for several days, chopped or macerated Deep-frozen stomachs with a 10%NaCl solution containing about 5% boric acid. then additional salt up to a total of 16-18% is introduced followed by filtration and clarification. The suspension is adjusted to pH 5 to activate pro-chymosin (zymogen) (inactive form) by adding acid (HCl). The acid is then neutralized and the rennet extract is concentrated until enzyme strength reaching a typical potency of about 1:15,000.preservatives to maintain the strength of the finished rennet are sodium benzoate, propylene glycol, and salt. Chymosin is freeze dried and distributed as rennet powder.

- The molecular weight of this enzyme is 40000dalton.

- it is highly sensitive to shaking, heat, light, dilution, alkaline medium and chemicals
- stability is highest when stored at 7°C and pH 5.4 to 6 under dark conditions.
- It is more stable when concentrated.
- Optimum pH is about 5.5-6. It is an aspartate-proteinase, hence an endopeptidase, which means that it can split proteins into relatively large fragments.
- The main and best enzyme used in cheese making is calf rennet (chymosin) mainly because, in producing a smooth curd, it is insensitive to small shifts in pH; it has a high ratio of clotting to proteolytic activity (C/P). (The MC/PA ratio is used as a quality characteristic of coagulants and it is directly related to cheese yield, one of the most important economical characteristics in the cheese making process.). This ratio is dependent on the specificity of the enzyme for the Phe105-Met106 bond of κ -casein. A high MCA to PA ratio prevents excessive nonspecific proteolysis during manufacture and leads to a curd with high tension, less losses of casein and fat in the whey and increased cheese yield.
- Most rennet substitutes are more proteolytic than rennet (i.e., low MCA to PA ratio) and cause diminished yields of casein and fat, and bitterness (excessive proteolysis spatially of β -casein is associated with development of bitter taste) during cheese storage and ripening.

3-Calcium chloride: -

Calcium chloride is added in a few amounts ranging between 0.01-0.02% of milk weight which used in cheese manufacturing to replace calcium redistributed

during pasteurization to achieve constant coagulation time and produce curd with suitable properties.

-Milk coagulation by rennet during cheese making requires an optimum balance among ionic calcium and both soluble and insoluble calcium phosphate salts. Because calcium phosphates have reverse solubility with respect to temperature, the heat treatment from pasteurization causes the equilibrium to shift towards insoluble forms and depletes both soluble calcium phosphates and ionic calcium. thus CaCl_2 is added to restore ionic calcium and improve rennet ability. The calcium assists in coagulation (time and curd characteristics'), reduces the amount of rennet required and producing curd with high tension or strength, easy to cutting and whey drainages with little lost of fat and casein in whey which leads to obtained higher cheese yield.

4- Hydrogen peroxide

hydrogen peroxide is sometimes used (0.05-0.08 %) as an alternative treatment for pasteurization (antimicrobial agent) after milking, it is inexpensive substance and easily decomposed by the catalase enzyme, using of hydrogen peroxide leads to the negative aspects such as dilution of milk and decreasing of nutritional value by oxidation of some essential amino acids like Thr (sunlight flavor).

5- Carbon dioxide:-

is added to pasteurized cheese milk to produce carbonic acid which lowers the pH to calf rennet optimal pH and in turn assists coagulation, Increased rate of gel firming and higher curd firmness at cutting.

6- Colorants:-

The most important dyes for coloring chesses and butter are derived from plants and vegetables and include yellow-orange annatto, carotene and paprika.

Annatto is the most widely used color material for natural and process cheese. The fruit of the annatto tree (*Bixa orellana*), found in the tropics, is the source of annatto color for cheese and butter. Its active coloring agent is bixin which becomes norbixin when extracted with an alkali.

For use in cheese; annatto is extracted by an alkaline solution such as 0.1M NaOH. Commercial annatto solution is added in range 10-20ml \100kg milk depending on cheese type and should be diluted with water about five times before adding to cheese milk then stirred in well. The alkaline extracted form is water soluble and attaches to casein in cheese.

Butter Annatto is prepared by extraction with vegetable oil such as rape- seed. This product, unlike the annatto for cheese, is fat soluble.

Annatto intended for use in butter is not recommended in cheese as is it may not disperse well and the cheese surface may appear spotty.

The following are some facts about annatto.

- color material is added to dairy products to standardize seasonal changes in color or to create orange -yellow products.

- Annatto is a carotenoid similar to -carotene and Vitamin A in structure, but it has no Vitamin A activity.

About 10% of annatto goes into the whey or in butter milk.

-Annatto color is red to yellow pigment but it usually appears as orange. The red constituent is more apparent with decreasing pH (6-4.8) changing the orange to pink while at pH < 4.8 the pink becomes nearly white.

--Bleaching of annatto is also caused by oxidizing agents(annatto is oxidized easy) such as copper, iron, chlorine and light.

Oxidation of annatto is also confident by heat.

Alternatives to annatto are:

Beta-carotene which is too yellow and makes the cheese taste like carrots.

Apo-8-carotenal which has the advantage that it is not lost in the whey.

7- Sodium or potassium nitrate:-

is added to the milk to control the undesirable effects of *Clostridium tyrobutyricum* in cheeses such as Edam, Gouda, and Swiss.

8- Stabilizers:-

Stabilizers used include alginates (**carageenan**), **gums and gelatins**. It can form a network of linkages between themselves and the milk constituents as it contains hydrogen or carboxyl radicals present in their structure.

Stabilizer prevent serum separation is the main textural defect occurred in yogurt during storage, and it is industrially known as “Wheying off” or whey syneresis

In ice cream making 0.3 to 0.5% stabilizer is added, stabilizers help to keep the small crystals isolated and prevent the growth of large crystals, which causes ice

cream to be grainy, icy and unpleasant to eat. enhance smoothness in body and texture, as well as slow the melting rate

9- Emulsifiers:-

Emulsifiers are processing agents Emulsifiers used in dairy products include **egg yolks lecithin and mono- and diglycerides.**

that are used to retain a uniform dispersion of one liquid in another, such as fat in water. The hydrophobic portion of the emulsifier dissolves in the fat phase, while the hydrophilic portion dissolves in the aqueous phase, thus forming a dispersion of small fat droplets. Just a small quantity is added into dairy products to improve the texture and stability, prevent milk fat from separating and ensure the uniform dispersion of fat-soluble flavor compounds throughout a product.

-During ice cream processing 0.15-0.3% emulsifier is used to help keep the milk **fat evenly dispersed in the ice cream during freezing and storage. A good distribution of fat helps stabilize the air incorporated into the ice cream and provide a smooth product.** preventing large ice crystal formation in frozen ice cream. Additives with such stabilizing properties improve the volume, evenness, and consistency of the final product

-Sodium citrate or phosphate and Glycerol- monostearate (GMS) usually added to emulsifying fat in some types of cheeses such as procced and ricotta which results in texture improving GMS is effective in providing good emulsion stability as well as prevent creaming.