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Lecture 4 :: Methods of treating milk

2.3 Methods of pasteurization of Milk

Basically pasteurization of milk involves three essential steps:

• Heating raw milk to a predetermined temperature

• Holding at this temperature for a predetermined time

• Immediately cooling down to at least below 100 C (500 F).

Therefore, the two most important variables are pasteurization temperature and the exposure or holding time. At present there are at least three accepted methods of pasteurization of milk:

The holding or vat method

The holding or vat method, also known as the low temperature holding time process, is a method of holding the milk in a vat (container) to a temperature of 630c (1450 F) for 30 minutes.

The high temperature-short time method

This is a continuous process by which milk is rapidly brought to a temperature of 710c (1610 F) and heated continuously for 15 seconds.

During this process the milk has been preheated in the regeneration (heat exchanger) first and then its temperature is brought rapidly up to about 1610 F and is held there through a holding tube for a period of 15 seconds, after which the milk is returned to the regenerator.

For all practical purposes if milk is said to be properly pasteurized it must satisfy the following three conditions:

• The milk must be cooled adequately (500 F or less) before pasteurization so as to prevent the formation of heat resistant staphylococcal enterotoxin

• The pasteurization equipment should function properly and adequately

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• Precautions should be taken to prevent any post pasteurization n contamination.

The ultra-high temperature (UHT) method

In this process the milk is heated to at least 880 C (1910 F), held at this temperature for at least one second and then immediately cooled to at least below 100 C (500 F).

This method has been developed very recently and is used only in a few developed countries because it requires complex equipment and the highest levels of precision and handling. As it can be seen, in all the three processes of heating, after the proper temperature and exposure time are achieved the milk is immediately cooled down to at least below 100 C (500 F). This is because a temperature below 100C normally arrests the growth of most bacteria and thence extends the shelf life of the pasteurized milk.

After cooling the pasteurized milk is usually distributed in clean sterile containers. The containers are often of a single-service disposable type and should be discarded after use. In homes or institutions they should preferably be kept in refrigerators or in other means that can be kept at least below 100 C. Under conditions where this is impossible, consuming the milk as soon as it is brought home is important. The same care should be taken during transport or storage of pasteurized milk.

2.4 Limitations of pasteurization

In developing countries like Ethiopia pasteurization of milk has several limitations:

• It can only be effectively done on a commercial basis

• It requires special and expensive equipment and budget

• It requires skilled technicians to operate

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• It requires a centralized collection, processing and distribution management center.

2.5 Sanitary problems in pasteurization plants

In order to market safe milk precautions have to be taken in such pasteurization plants:

• The plant should first of all be **properly designed**

• The equipment used for pasteurization, storage, bottling, cooling, etc should be of standard design, easily washable, sterilizable etc.

• There should not be any contact or leak of unpasteurized or raw milk into the finished product

• Time keeping and thermometers are necessary at all times

• Since foam and splashed milk on the vat surface will not be properly heated, steam or hot air should be applied from the top

• All valves used in milk pasteurizing plants should be leak protector types. If any leakage occurs, the leaking milk is wasted and should not pass down the holding tube.

• **Manual control of milk plants** has proved to be unreliable because of contamination due to carelessness. For this reason it is now being advocated that an automatic continuous **flow type should be used**

• An automatic milk flow stop is necessary to stop the forward low of sub temperature milk in time when the heat source fails to provide the optimum temperature.

3. Sterilization

In this process milk is heated to destroy all micro-organisms including spore forming and can only be done by keeping the milk at a temperature above normal boiling point (1000 c or212 0 F) for at least 20 minutes.

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If the temperature of the heat treatment is higher and the sterilization effect is greater, there will be a more marked change in the color and taste of the milk. One important phenomenon is that with increasing temperatures spore destruction rates increase more than the influence upon the taste and the color of the milk.

The nutritive value of the milk, namely some vitamins (heat sensitive vitamins) and proteins, is affected depending upon the type of the sterilization process. 30

4. Drying

This is a method where the entire water constituent is removed from the milk by evaporation. The solids remaining form what is called milk powder (dry milk). Milk powder can then be made into liquid milk by adding a proper amount of water. Drying is not a simple operation that can be accomplished by heating and evaporation in the home. It needs special equipment and arrangement. There are two known methods of drying.

4.1 Roller drying

The milk in small quantities is slowly poured over a heated and revolving roller. The roller is heated by steam or hot air.

.4.2 Spray drying

This is also a mechanism whereby the milk is subjected to hot air. The process is simply spraying the milk through a current of hot air. The remaining powder will also be collected and packaged. In both processes the milk powder is collected in sterile containers, usually cans.

5. Cooling

Since milk is an ideal medium for the multiplication of most disease producing organisms, the milk should be kept at 50.0 F or below starting

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immediately after milking. This is very important especially if milk is going to be delivered raw to consumers. This temperature range is essentially needed to arrest the growth of micro-organisms specially brucella organisms. However milk should not be allowed to freeze.

The simplest method of cooling milk is submerging the cans of milk in troughs or tanks of ice water if possible. A trough should be concrete, preferably insulated by layers of cork or cotton pads. A 120-liter tab of water kept at 370 F will coo 40-liters milk from 850 F to 450 F, the recommended temperature.

Good Luck