

PASTEURIZATION OF MILK

(Objectives of pasteurization, Pasteurization requirements for milk, Methods and equipment for long hold batch type pasteurization, HTST pasteurization, UHT pasteurization)

Pasteurization is the process of heating the product to a predetermined temperature and holding it until all or nearly all objectionable microorganisms, which may be present, are killed. (This was developed by Louis Pasteur, 1960)

Objectives of pasteurization

- To make the product safe for human consumption by destroying the pathogenic organism, which may be present.
- Improves preservation quality by destroying almost all spoilage organisms.
- Helps to retain good flavor over a longer period of time.

Pasteurization requirements for milk

Pasteurization by heating and time treatments are a compromise among bacterial killing along with a number of other factors such as taste, phosphate inactivation, cream line reduction, etc. The target microorganism for milk processing is *Micobacterium tuberculosis* (TB germ). The following Table 5.1 shows how the pasteurization process has been standardized considering these factors. Accordingly, the methods of pasteurization can be given as in Table 5.2.

Table 5.1. Standardization of pasteurization requirements for milk

Requirement	30 min	15 sec
Kill TB germ	138°F	158°F
Phosphate inactivation	142°F	160°F
Pasteurization requirement	145°F (63°C)	161°F (72°C)
Creamline reduction	146°F	162°F

Table 5.2. Methods of pasteurization for milk

Methods	Treatment
Long hold batch type / Vat pasteurization	63°C-30 min
High temperature short time (HTST) pasteurization	72°C-15 s

Ultra high temperature (UHT) pasteurization	88°C-3 s
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However, the time and temperature combination maintained in a dairy plant may vary from the above Table values depending on the initial microbial load and other considerations.

LONG HOLD OR VAT PASTEURIZATION

The long hold or vat pasteurization is a batch type method where the pasteurization is carried out at 63°C for 30 min. The basic operations involved in a vat pasteurizer are given in Fig. 5.1.

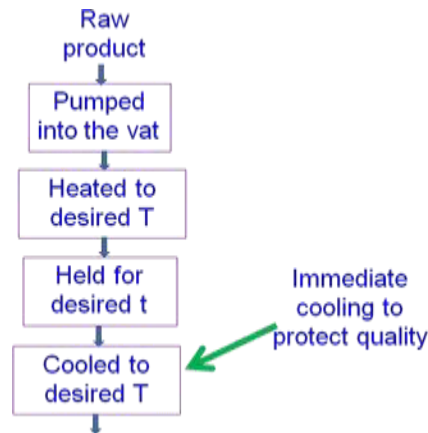


Fig. 5.1 Basic operations in a vat pasteuriser

Types of vat pasteurizers (Classification based on flow of heating medium)

1. Spray type
2. Flooded type
3. High velocity flooded type

General requirements

The following are the requirements for a successful batch pasteurization process.

- **Rapid heating:** Generally the circulation of heating medium is started as soon as filling of the vat is begun, thus shortening the heating time.
- **Immediate cooling:** In some designs the cold water is circulated over the outside of the inner lines as soon as the holding period is completed, so a part of cooling can be done in the vat itself.
- Heating medium should be only a few degrees warmer than milk to prevent formation of milk stones on heating surfaces and cause minimum injury to cream line or flavour.
- **Agitation.** Agitation of milk within a certain degree helps in improving the heat transfer.
 - Agitation is easier in case of hot fluid than cold ones.
 - Agitation should not develop foam and it should not injure the cream line.
 - Viscosity of the fluid greatly affects the type of agitator.

- Less viscous materials require small diameter high speed agitator. Highly viscous materials require slow speed large surface blade type agitators.

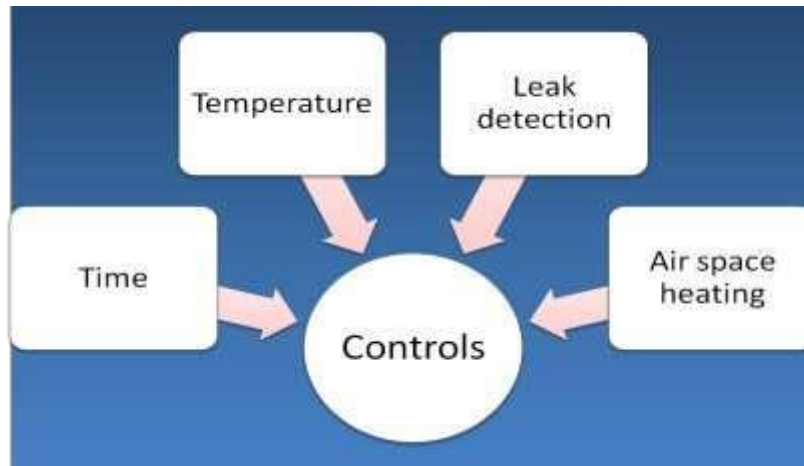


Fig. 5.2 Pasteurizer Controls

For vat pasteurizers, an electric or air operated control can be connected with a timing clock so that the heat is shut off when the proper milk temperature has been reached and a bell rings when the proper length of holding time has elapsed. Also temperature of heating water can be controlled during the holding period.

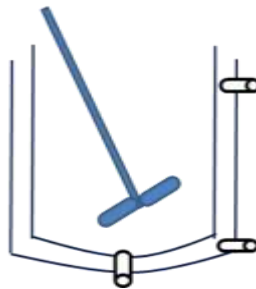


Fig. 5.3 Schematic representation of a long hold batch type pasteurizer

Advantages

- Well suited for small plants, low volume products
- Variety of products can be handled.
- Well suited for cultured products such as bottle milk, sour cream, etc.
- Simple controls
- Low installation cost

Disadvantages

- Batch type
- Slow process
- As the controls are mostly manual, it requires constant attention.
- Both heating and cooling are relatively expensive (as we do not have heat regeneration).

