PASTEURIZATION
Summing up (What and Why?)

Major methods of heat processing

Blanching

Pasteurization

Sterilization
Pasteurization (What and Why?)

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.

(Developed by Louis Pasteur, 1960)

Purpose

• 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.
## How?

### Pasteurisation

<table>
<thead>
<tr>
<th>Requirement</th>
<th>30 min</th>
<th>15 sec</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kill TB germ</td>
<td>138°F</td>
<td>158°F</td>
</tr>
<tr>
<td>Phosphate inactivation</td>
<td>142°F</td>
<td>160°F</td>
</tr>
<tr>
<td>Creamline reduction</td>
<td>146°F</td>
<td>162°F</td>
</tr>
</tbody>
</table>
How?

<table>
<thead>
<tr>
<th>Requirement</th>
<th>30 min</th>
<th>15 sec</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kill TB germ</td>
<td>138°F</td>
<td>158°F</td>
</tr>
<tr>
<td>Phosphate inactivation</td>
<td>142°F</td>
<td>160°F</td>
</tr>
<tr>
<td>Pasteurization requirement</td>
<td>145°F</td>
<td>161°F</td>
</tr>
<tr>
<td></td>
<td>(63°C)</td>
<td>(72°C)</td>
</tr>
<tr>
<td>Creamline reduction</td>
<td>146°F</td>
<td>162°F</td>
</tr>
</tbody>
</table>

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.

Our enemy: Micobacterium Tuberculosis
# How?

## Methods of pasteurization

<table>
<thead>
<tr>
<th>Methods</th>
<th>Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Long hold batch type / Vat pasteurization</td>
<td>63°C-30 min</td>
</tr>
<tr>
<td>High temperature short time (HTST) pasteurization</td>
<td>72°C-15 s</td>
</tr>
<tr>
<td>Ultra high temperature (UHT) pasteurization</td>
<td>88°C-3 s</td>
</tr>
</tbody>
</table>

(Check the time and temperature combination in a dairy plant in your locality and see if they are really maintaining 72°C-15 sec or not. If there is a difference, find out the reason for the same.)
Long hold or Vat pasteurization

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

1. Spray type
2. Flooded type
3. High velocity flooded type
Long hold or Vat pasteurization

Raw product

Pumped into the vat

Heated to desired T

Held for desired t

Cooled to desired T

Storage

Immediate cooling to protect quality
Long hold or Vat pasteurisation

General requirements

• **Rapid heating:** Generally the circulation of heating medium can be 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.
Long hold or Vat pasteurisation

General requirements

Agitation

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 ➔ Small dia high speed agitator
Highly viscous materials ➔ Slow speed large surface blade
Temperature control

Time control

Leak detector valve

Air space heater - to heat the milk particles entrapped in the bubble on the surface of the pasteuriser.

Long hold or Vat pasteurisation

Pasteuriser Controls
Vat pasteurization

- 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.
<table>
<thead>
<tr>
<th>Advantages</th>
<th>Disadvantages</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Well suited for small plants, low volume products</td>
<td>• Batch type</td>
</tr>
<tr>
<td>• Variety of products can be handled</td>
<td>• Slow process</td>
</tr>
<tr>
<td>• well suited for cultured products such as bottle milk, sour cream, etc.</td>
<td>• Manual controls → Constant attention</td>
</tr>
<tr>
<td>• Simple, low installation cost</td>
<td>• Both heating and cooling are relatively expensive (as we do not have heat regeneration).</td>
</tr>
</tbody>
</table>
HTST pasteurization

Continuous flow systems using heat exchangers.

Generally plate type heat exchangers with regenerative heating, heating and cooling systems are used.
Plate heat exchanger

HTST pasteurization
HTST pasteurization

Flow pattern in plate heat exchangers
Types of plates used in plate type heat exchanger

HTST pasteurization
HTST pasteurization - Can we use this??

Tubular heat exchanger
Basic components of HTST pasteurization system

- In the regenerator it is heated to 60°C.
- Final cooling is done by cold water (0°C) to 4-5°C
HTST pasteurization Controls

- Flow rate
- Temperature
- Pressure
Thank you