Omar A. Al-Mahmood, Ph.D.
Department of Public Health
College of Veterinary Medicine, University of Mosul, Mosul, Iraq
https://orcid.org/0000-0003-2065-6165
https://www.researchgate.net/profile/Omar-Al-Mahmood

Preservation of Milk and Milk Products

Milk Pasteurization

Prior to industrialization, dairy cows were kept in urban areas to limit the time between milk production and consumption, hence the risk of disease transmission via raw milk was reduced. As urban densities increased and supply chains lengthened to the distance from country to city, raw milk (often days old) became recognized as a source of disease. For example, between 1912 and 1937, some **65,000** people died of **tuberculosis** contracted from consuming milk in England and Wales alone.

Developed countries adopted milk pasteurization to prevent such disease and loss of life, and as a result milk is now considered safer food.

What is pasteurization?
Heating of every particle of milk or milk product to a specific temperature for a specified period of time to eliminate pathogens and extend shelf life during the heat treatment process.

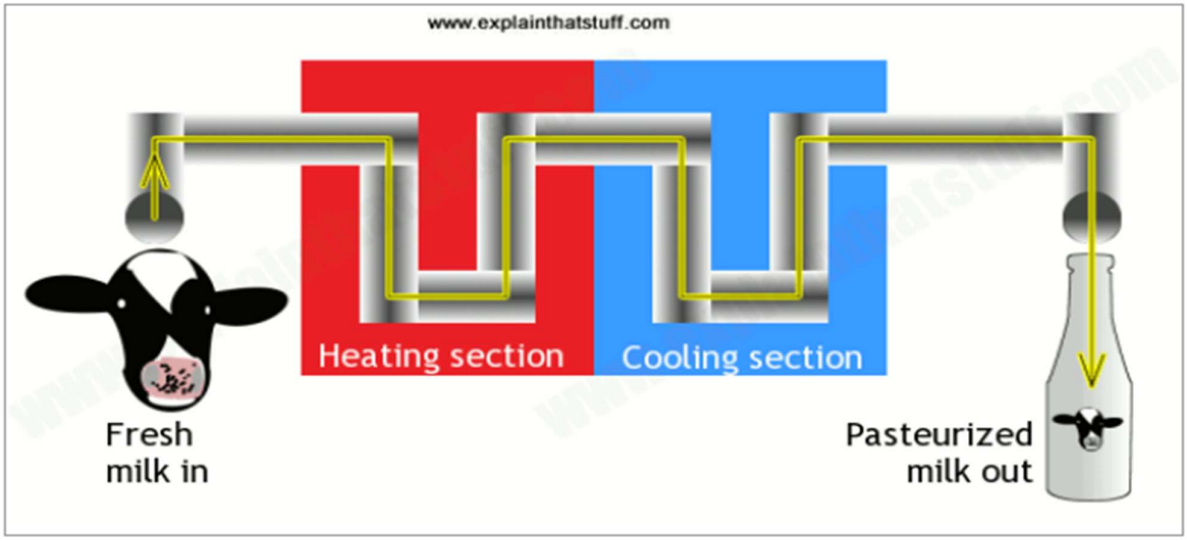
Pasteurization was invented by a French Scientist called Louis Pasteur during the nineteenth century.

Purpose of milk pasteurization:
There are two purposes for the process of milk pasteurization:

1. **Public Health Aspect:** to make milk and milk products safe for human consumption by destroying bacteria that may be harmful to health (pathogens).
2. **Keeping Quality Aspect:** to improve the keeping quality of milk and milk products. Pasteurization can **destroy** some **undesirable enzymes (Lipase and protease) and many spoilage bacteria.** Shelf life can be 7, 10, 16 or up to months.

Does pasteurization kill everything?
While pasteurization **doesn't kill all** the microorganisms in our food, it does **greatly reduce** the number of **pathogens** so that they are unlikely to cause disease.

How a pasteurizer works:
A typical pasteurizer is completely automatic. Pour milk in one end, and it flows between a set of **heating pipes or plates** for a set period of time (long enough to kill off most of the harmful bacteria), then between a set of cooling pipes, before emerging from an outlet pipe into the bottles. Heating and cooling times and temperatures vary according to the type of pasteurization process being used.



Methods of Pasteurization:

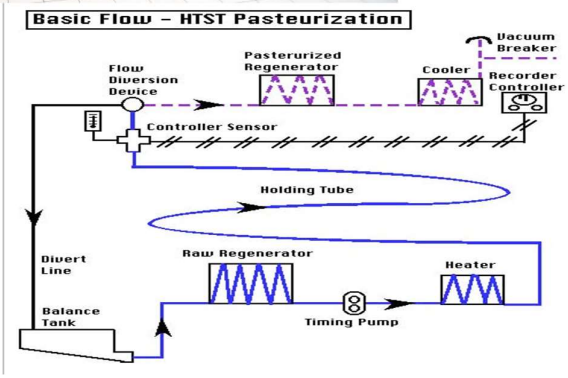
1. Low Temperature Long Time (LTLT) Pasteurization:
The LTLT pasteurization is also called as Batch Pasteurization or Vat Pasteurization. It involves heating the milk up to temperature **62.8-63°C** and holding at that temperature for minimum **30 minutes.** This was the first-time temperature treatment developed to render the milk free from active microbial pathogens. Immediate cooling by cold water which 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.

Advantages:
• Well suited for small plants, low volume products.
• Simple controls.
• Low installation cost.
Disadvantages:
• Slow process.
• As the controls are mostly manual, it requires constant attention.
• Pasteurized products need to store at refrigerator temperature 4°C.

2. High Temperature Short Time (HTST) Pasteurization:
High temperature-short time (HTST) pasteurization is a continuous flow process that heats the milk to **a high temperature**, holds it for the required time, followed by immediate cooling of the milk. The process provides **time and temperature parameters** for milk heating treatment that will ensure effective pasteurization. The regulated minimum heat process for the holding time and temperature combination of milk pasteurization is **72°C for 15 seconds.**

Alternative minimum HTST treatments

Min. holding time (Seconds)	Min. temperature (°C)
1	81.6
2	79.0
3	77.6
4	76.5
5	75.7
6	75.1
7	74.6
8	74.1
9	73.7
10	73.3
11	73.0
12	72.7
13	72.4
14	72.1
15	72.0



Advantages:

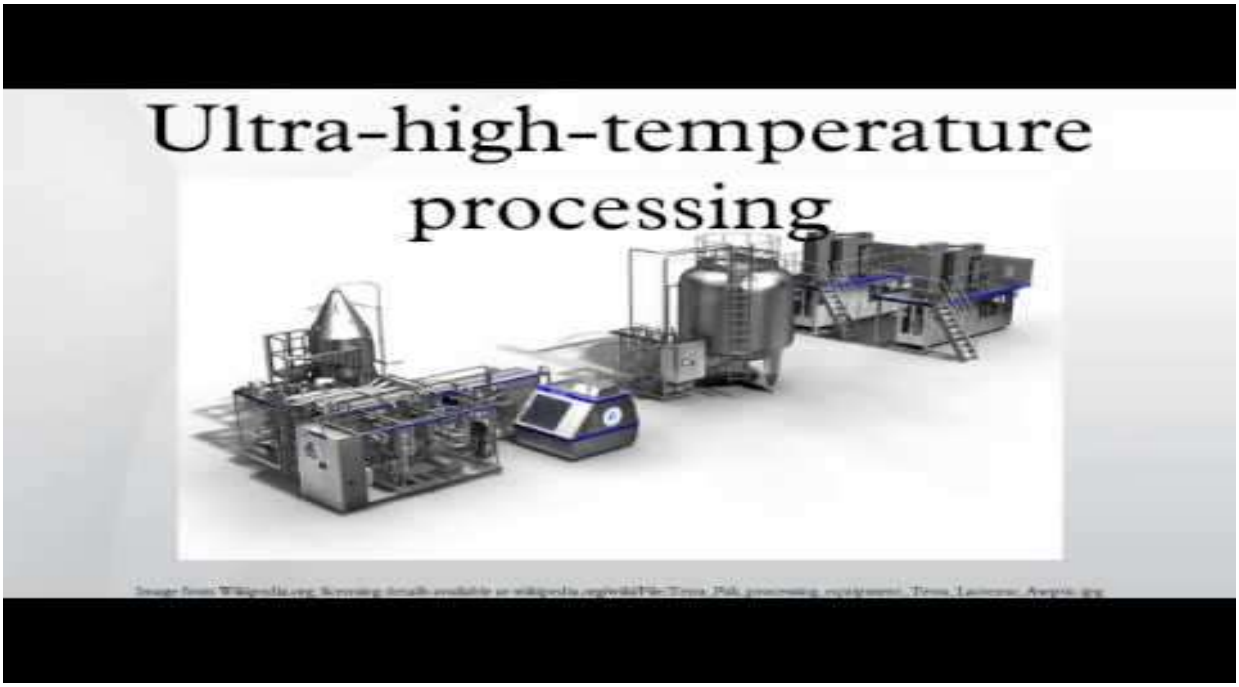
- Large equipment capacity allows large volumes at one time.
- Continuous process allows for bottling to begin when pasteurization begins.
- Highly energy efficient.
- Minimal chance of damage to milk product.

Disadvantages:

- The system is complicated.
- Not portable.
- Installation cost is more.

3. Ultra-High Temperature Pasteurization (UHT):

Another popular method of pasteurization is Ultra High Temperature (UHT). This process involves heating the milk using commercially sterile equipment and filling it under aseptic conditions into hermetically sealed packaging. The milk must be heated to **138 °C** for **2 seconds**, then rapidly cooling it down.



Advantages:
UHT kills more bacteria and gives it a much longer shelf life. UHT milk does not need refrigeration, until opened, and is shelf stable for at least six months.

Disadvantages:
Perhaps the biggest disadvantage of UHT pasteurization is its effect on the taste of milk. Many people agree that UHT-pasteurized milk exhibits an overly cooked, burnt taste.