

Methods of preservation of milk and milk products



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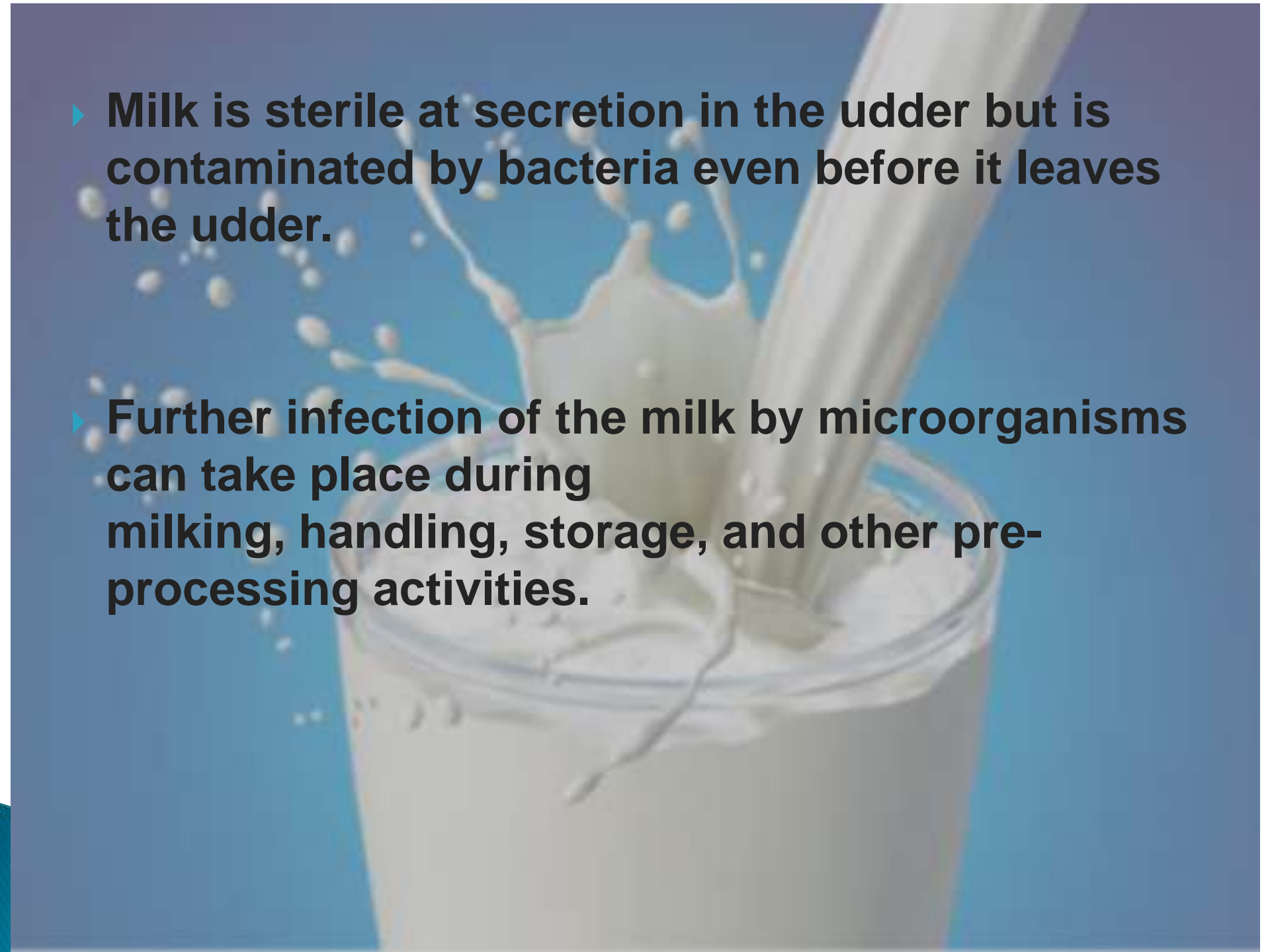
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Definitions

- Raw milk: The lacteal secretion , practically free from colostrum, obtained by the complete milking of one or more healthy cows (PMO).
- “Consumer Milk” products:
 - Homogenized milk: $\geq 3.25\%$ fat
 - Reduced fat milk: 2% fat
 - Low fat milk: 1% fat
 - Fat-free milk: skim milk, $< 0.5\%$ fat
(all with 8.25% solids-non-fat)
- Other “milk products”: lactose reduced milks, heavy cream, cultured milks, yogurt, cottage cheese.

Contamination of milk and milk products



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- A glass of milk with a splash of milk being poured into it. The background is a solid blue color. The milk is white and the splash is dynamic, with droplets in the air.
- ▶ **Milk is sterile at secretion in the udder but is contaminated by bacteria even before it leaves the udder.**
 - ▶ **Further infection of the milk by microorganisms can take place during milking, handling, storage, and other pre-processing activities.**

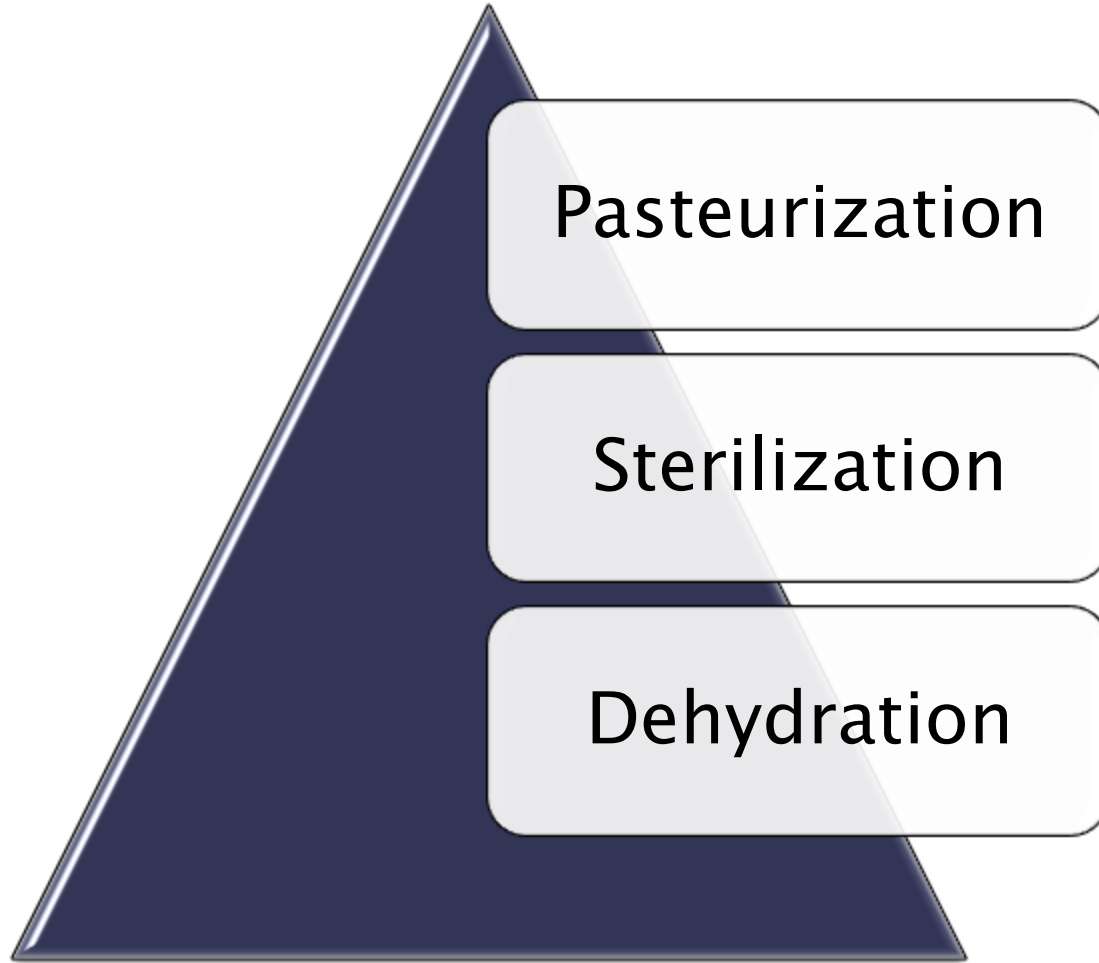
Few types of micro organisms found in milk.



Preservation of milk




Methods of preservation



Pasteurization

- Purpose: Inactivation of bacterial pathogens (target organisms *Coxiella burnettii*)
 - assurance of longer shelf life (inactivation of most spoilage organisms and of many enzymes)
- Pasteurization
 - Heat treatment of 72°C (161 F) for 15 sec (HTST) or 63°C (145 F) for 30 min (or equivalent)
 - does not kill all vegetative bacterial cells or spores (*Bacillus* spp. and *Clostridium* spp.)
 - Pasteurization temperature is continuously recorded

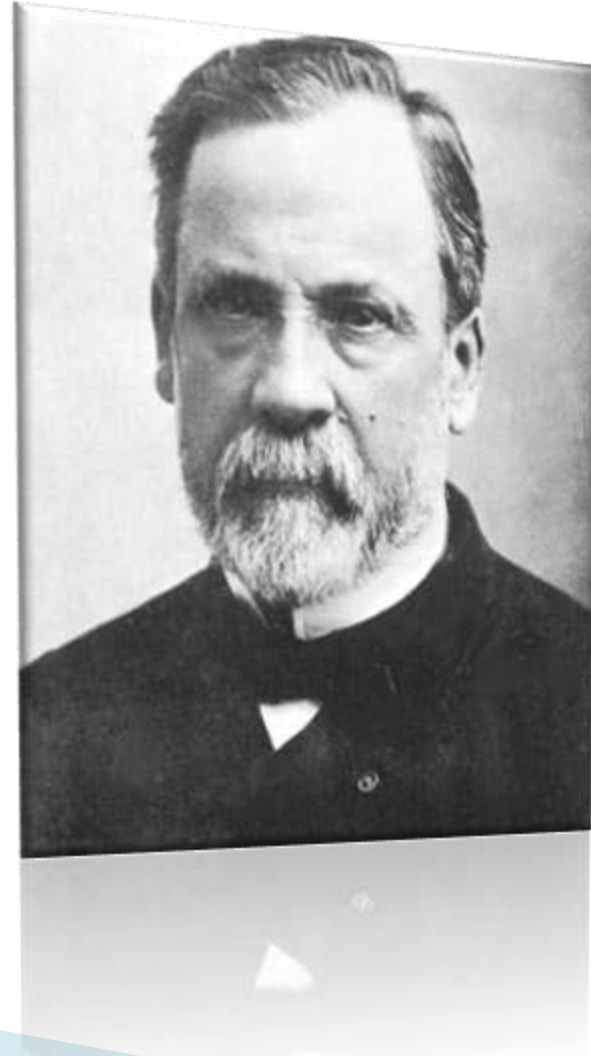
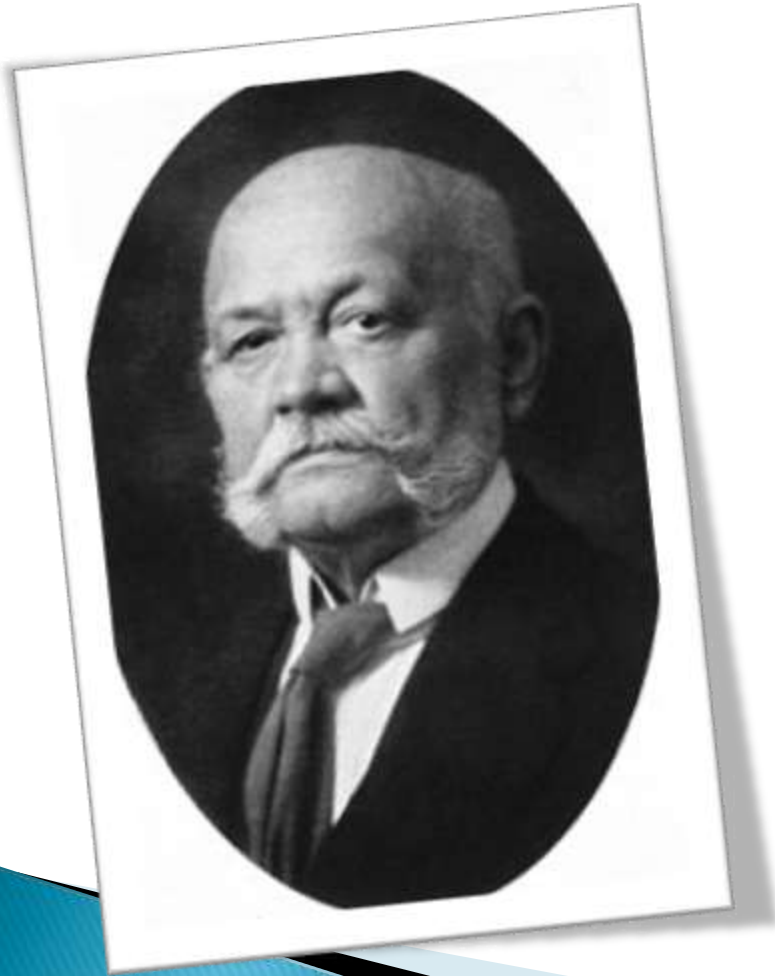
Pasteurization- Defination

- **Pasteurization** is a process of heating a food, which is usually a liquid(milk), to a specific temperature for a predefined length of time and then immediately cooling it after it is removed from the heat.
 - This process slows spoilage caused by microbial growth in the food.
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History of pasteurization

- ▶ The French scientist Louis Pasteur invented pasteurization.
- ▶ To remedy the frequent acidity of the local wines he found out experimentally that it is sufficient to heat a young wine to only about 50–60 °C (122–140 °F) for a brief time to kill the microbes.
- ▶ Pasteurization was originally used as a way of preventing wine and beer from souring, and it would be many years before milk was pasteurized.
- ▶ Pasteurization of milk was suggested by Franz von Soxhlet in 1886.

Franz von Soxhlet and Louis Pasteur



Types of Pasteurization

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- High Temperature, Short Time(HTST method)

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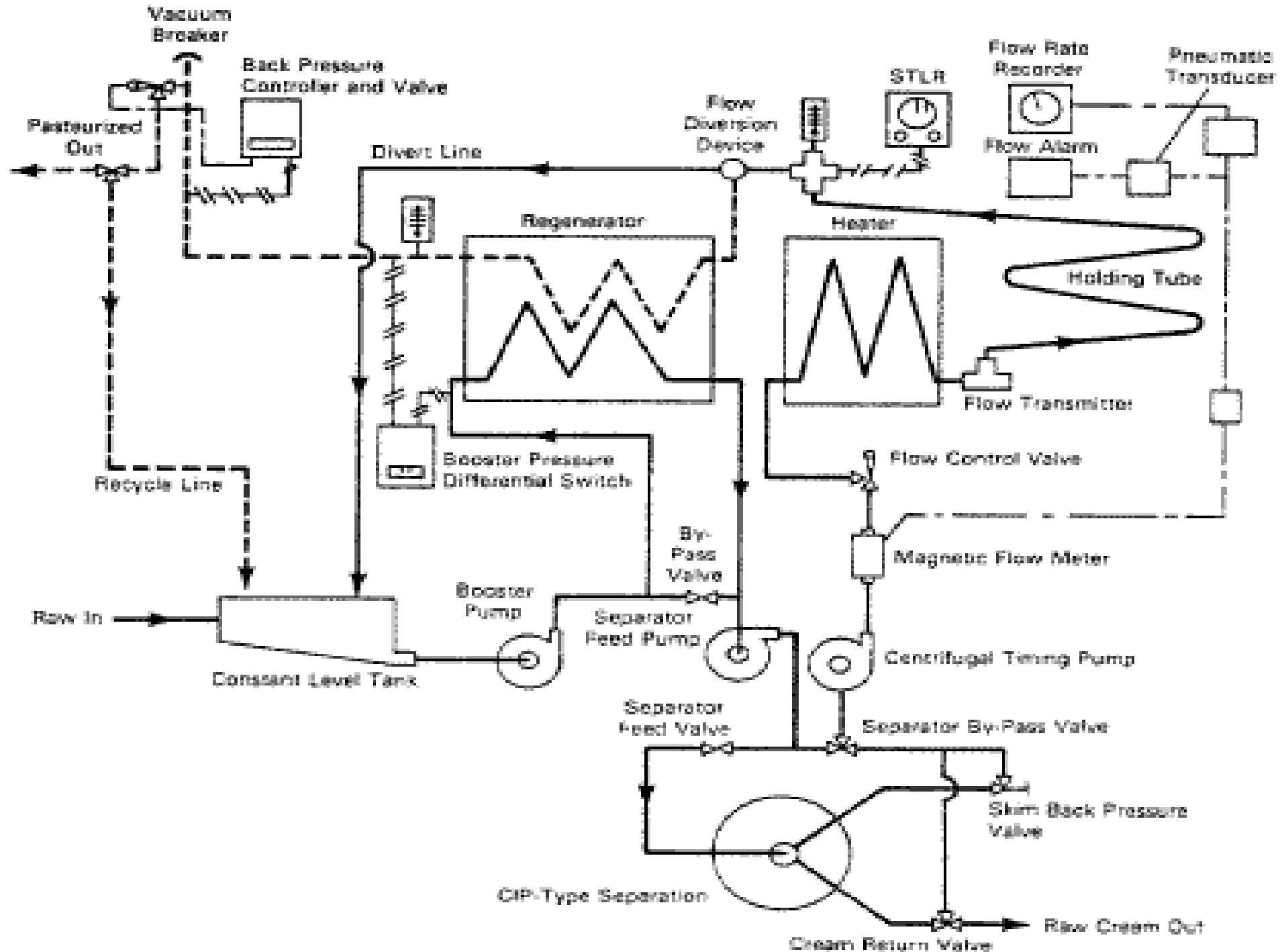
- Ultra High Temperature Pasteurization(UHT method)

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- Vat Pasteurization

HTST

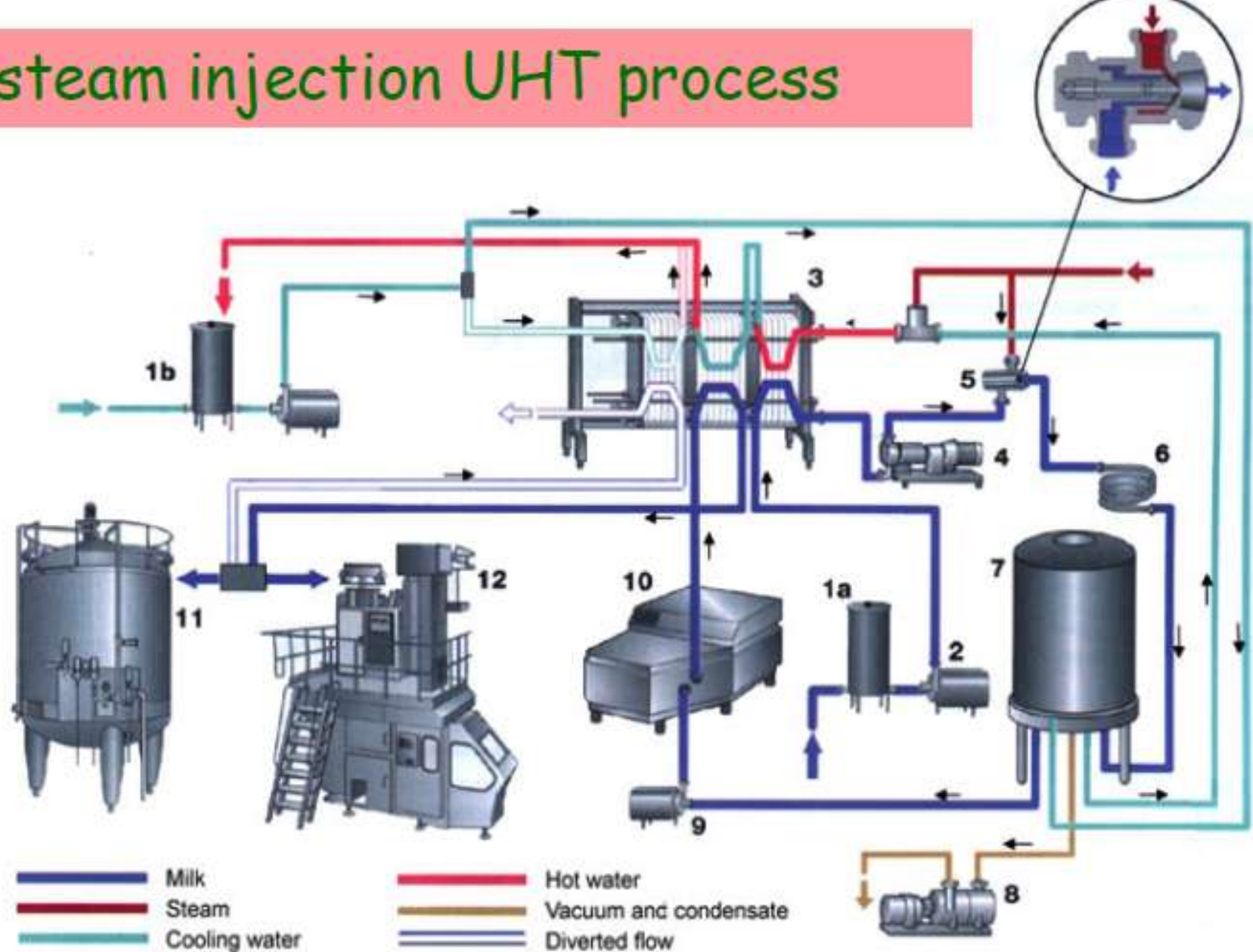
- ▶ *The HTST pasteurization standard was designed to achieve a five-log reduction, killing 99.999% of the number of viable micro-organisms in milk.*
- ▶ *This method requires that the milk be held at 161 degrees for 16 seconds. This process, also referred to as continuous flow pasteurization, requires the milk to be forced through metal pipes that are heated from the outside.*



UHT

- ▶ It produces a product that has a stable shelf life of up to two months.
 - ▶ UHT processing holds the milk at a temperature of 138°C (280°F) for a minimum of two seconds.
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Direct steam injection UHT process



- 1a Balance tank milk
- 1b Balance tank water
- 2 Feed pump
- 3 Plate heat exchanger
- 4 Positive pump

- 5 Steam injection head
- 6 Holding tube
- 7 Expansion chamber
- 8 Vacuum pump
- 9 Centrifugal pump


- 10 Aseptic homogenizer
- 11 Aseptic tank
- 12 Aseptic filling

VAT

- ▶ Vat Pasteurization is the most gentle type of pasteurization.
- ▶ The milk is held in a heated vat at 145 degrees for 30 minutes. It is then quickly cooled to 39 degrees.

Sterilization

*Sterilization

- ▶ **Sterilization** is a term referring to any process that eliminates or kills all forms of microbial life, including transmissible agents (such as fungi, bacteria, viruses, spore forms, etc.) present on a surface, contained in a fluid, in medication, or in a compound such as biological culture media.
 - ▶ Sterilization can be achieved by applying heat, chemicals, irradiation, high pressure, and filtration or combinations thereof.
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Tyndalization-

Named after John Tyndall is a lengthy process designed to reduce the level of activity of sporulating bacteria that are left by a simple boiling water method.

It involves boiling for a period (typically 20 minutes) at atmospheric pressure, cooling, incubating for a day, boiling, cooling, incubating for a day, boiling, cooling, incubating for a day, and finally boiling again.

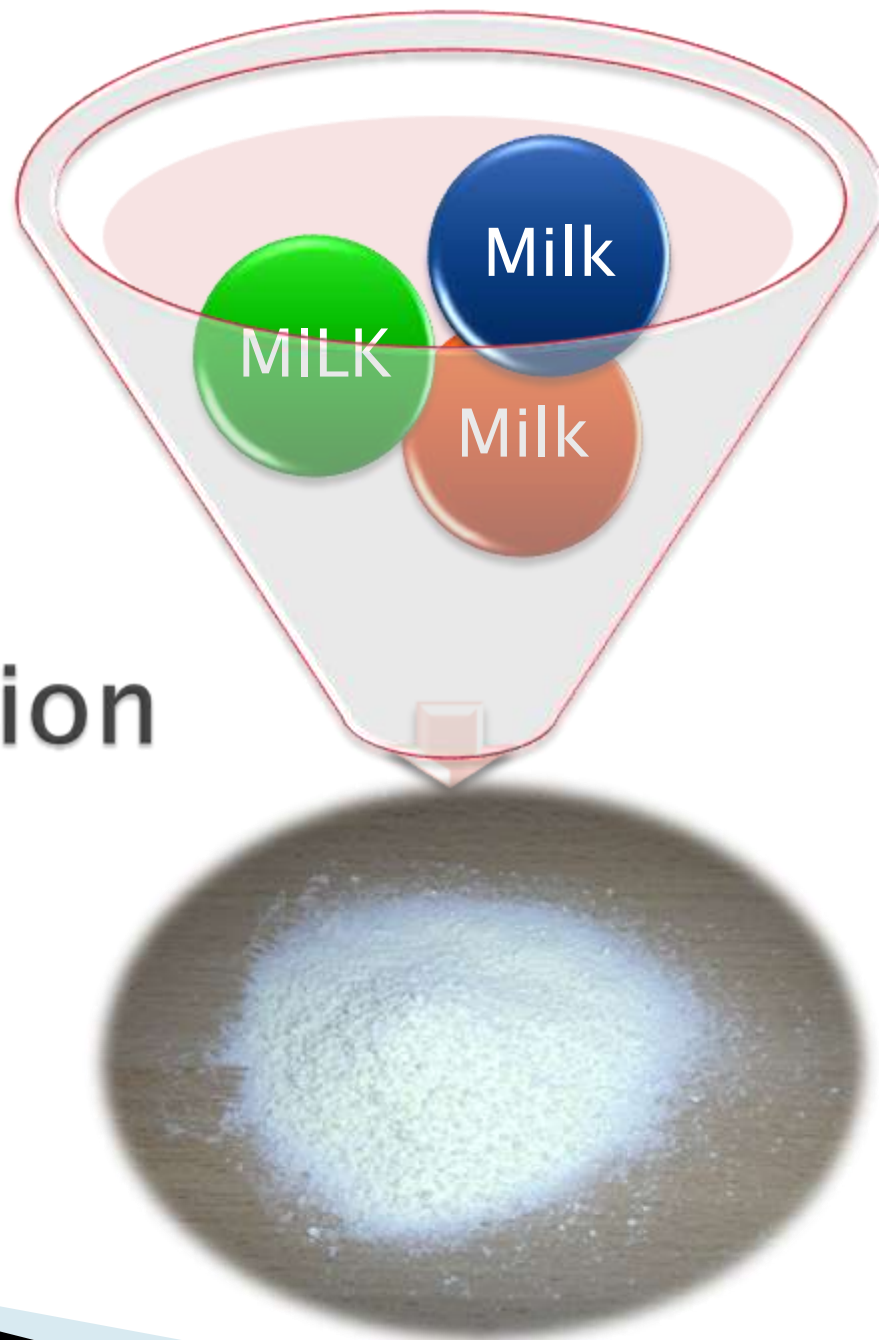
The three incubation periods are to allow heat-resistant spores surviving the previous boiling period to germinate to form the heat-sensitive vegetative (growing) stage, which can be killed by the next boiling step.

This is effective because many spores are stimulated to grow by the heat shock. The procedure only works for media that can support bacterial growth - it will not sterilize plain water.

Membrane filtration(microfiltration)

- ▶ Microfiltration is the process of filtration with a micrometre sized filter.
- ▶ **Microfiltration** is a membrane technical filtration process which removes contaminants from a fluid by passage through a microporous membrane. A typical microfiltration membrane pore size range is 0.1 to 10 micrometres (μm).



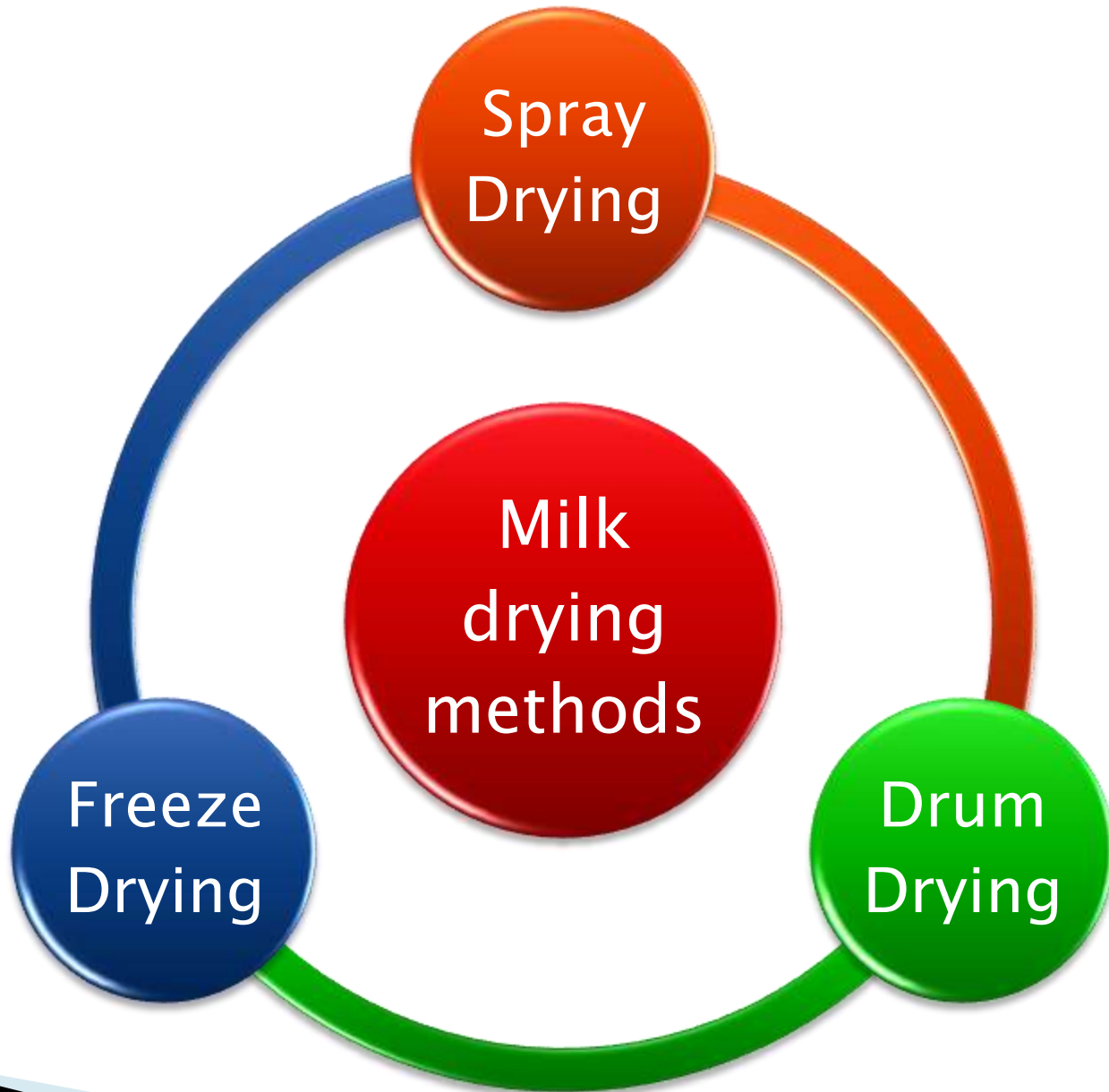


Dehydration
of milk

Regular Powdered Milk

- ▶ Dehydrated milk is manufactured dairy product made by evaporating milk to dryness.
- ▶ **Purpose-** to preserve it; milk powder has a far longer shelf life than liquid milk and does not need to be refrigerated, due to its low moisture content.
- ▶ Dry milk is also easy to transport.
- ▶ First invented by Russian physician Osip Krichevsky in 1802.
- ▶ Commercially available in 1832 by Russian chemist M. Dirchoff.





Spray Drying

- Pasteurized milk is first concentrated in an evaporator to approximately 50% milk solids. The resulting concentrated milk is then sprayed into a heated chamber where the water almost instantly evaporates, leaving fine particles of powdered milk solids.

Drum Drying

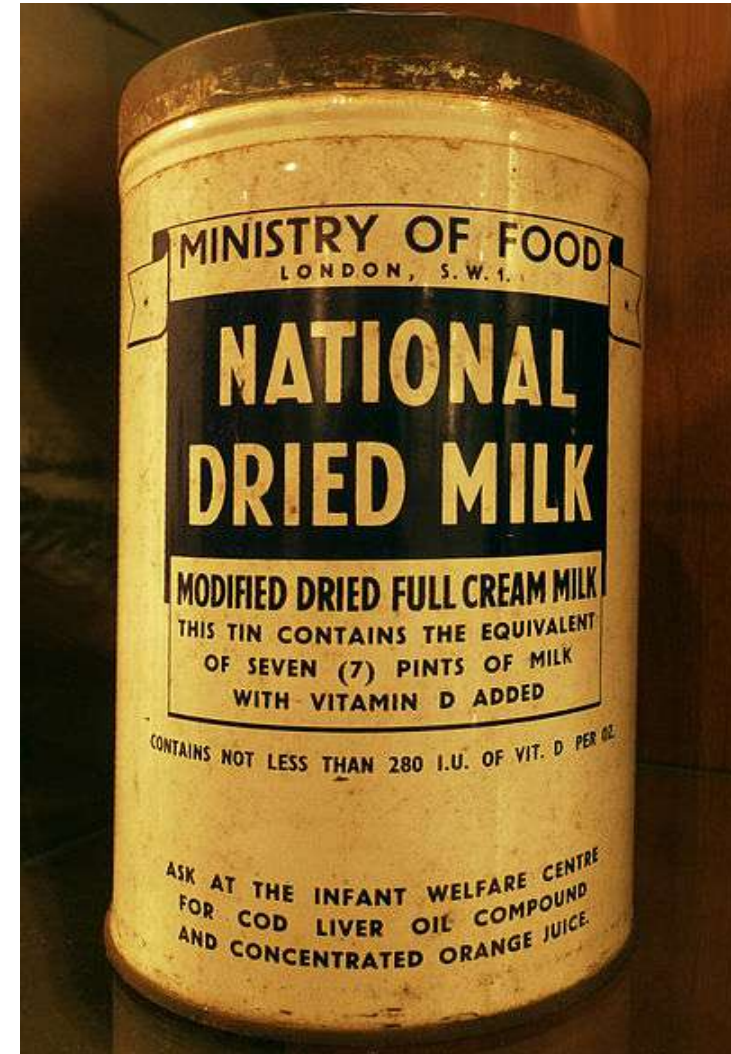
- Milk is applied as a thin film to the surface of a heated drum, and the dried milk solids are then scraped off. However, powdered milk made this way tends to have a cooked flavor, due to caramelization caused by greater heat exposure.

Freeze Drying

- Same as drum drying but involves freezing which retains more amount of nutrition.

Uses

- ▶ used in the manufacture of infant formula, confectionery such as chocolate and in recipes for baked goods where adding liquid milk would render the product too thin.
- ▶ used in various sweets such as the famous Indian milk balls known as *Rasgulla* and popular Indian sweet delicacy.
- ▶ common item in UN food aid supplies, fallout shelters and is favored by survivalists, hikers, and others requiring nonperishable, easy-to-prepare food.
- ▶ Reconstruction-one cup of potable fluid milk from powdered milk requires one cup of potable water and one-third cup of powdered milk.



This is the original container from 1947, provided by the Ministry of Food in London, England

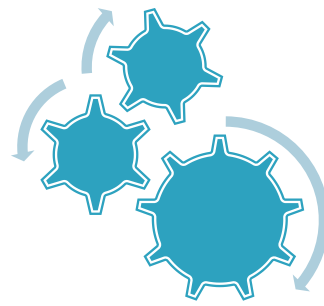


Condensed Milk

- ▶ Condensed milk is cow's milk from which water has been removed. It is most often found in the form of sweetened condensed milk, with sugar added.
- ▶ Sweetened condensed milk is a very thick, sweet product which when canned can last for years without refrigeration if unopened.



Production



- ▶ Raw milk is clarified and standardised, and then is heated to 85-90 C for several seconds.
- ▶ This heating destroys some microorganisms, decreases fat separation and inhibits oxidation.
- ▶ Some water is evaporated from the milk and sugar is added to approximately 45%. This sugar extends the shelf life of sweetened condensed milk.
- ▶ Sucrose increases the liquid's osmotic pressure, which prevents microorganism growth.
- ▶ The sweetened evaporated milk is cooled and lactose crystallization is induced.

Uses

- ▶ sweetened condensed milk is the preferred milk to be added to coffee or tea.
- ▶ Many countries in Southeast Asia, use condensed milk to flavor their coffee.
- ▶ A popular treat in Asia is to put condensed milk on toast and eat it in a similar way as jam and toast.
- ▶ Condensed milk is an alternative to jam.
- ▶ It is a major ingredient in many Indian desserts and sweets. While most Indians start with normal milk to reduce and sweeten it, packaged condensed milk has also become popular.



THANK YOU.