



疾病管制局

巴斯德消毒法

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Sterilization (滅菌)

- The process of **destroying all forms of microbial life** on an object or in a material. This includes the destruction of **endospores**. Sterilization is **absolute**; there are no degrees of sterilization.



Sterilization

- Typical requirement for sterilization are:
 - Moist heat 121° C for 15 minutes
 - Dry heat, 170° C for 120 minutes
 - Ionizing radiation
 - Gases, such as ethylene oxide
- Prions not destroyed by standard treatment



Effective Processes for Prion

- Autoclave
 - 134°C-138°C for 18m (prevacuum)
 - 132°C for 60m (gravity)
- Combination (chemical exposure then steam autoclave, potentially deleterious to staff, instruments, sterilizer)
 - Soak in 1N NaOH, autoclave 134°C for 18m
 - Soak in 1N NaOH, autoclave 121°C for 30m



Disinfection (消毒)

- The process of destroying vegetative pathogens, but not necessarily endospores or viruses.



Disinfectant

- A chemical applied to an object or a material which tends to reduce or inhibit growth. Disinfectants usually do not sterilize.



Antiseptic

- Chemical disinfection of the skin, mucous membranes, or other living tissues. This term is especially applied to treatment of wounds. Antisepsis is a specific kind of disinfection.



Moist heat

Moist heat destroys microorganisms by denaturing their proteins. Examples of moist heat treatments include boiling, pasteurization, and pressurized steam.



Boiling

- One type of moist heat sterilization is boiling, which kills vegetative forms of **bacterial** pathogens, many **viruses**, and **fungi** and their **spores** within about **10 minutes**. However, **endospores and some viruses**, are not destroyed so quickly. Boiling destroys microorganisms by irreversibly coagulating their proteins.



Use of Heat

- Effectiveness known prior to discovery of microbes
 - Alexander the Great's army boiled water to prevent disease
 - Aristotle was a good teacher





Pasteurization

- Pasteurization uses a brief heat treatment to reduce the number of spoilage organisms and kill pathogens. Foods and inanimate objects can be pasturized.



Pasteurization

- Pasteurization was developed by **Louis Pasteur** to prevent the spoilage of **beer and wine**. Pasteur used mild heating, which was sufficient to kill the organisms that caused the particular spoilage problem without seriously damaging the taste of the product.



Autoclaving

- Reliable sterilization with moist heat requires temperatures above that of boiling water. These high temperatures are most commonly achieved by steam under pressure in an autoclave. Autoclaving is used unless the material to be sterilized can be damaged by heat or moisture. The higher the pressure in the autoclave, the higher the temperature.



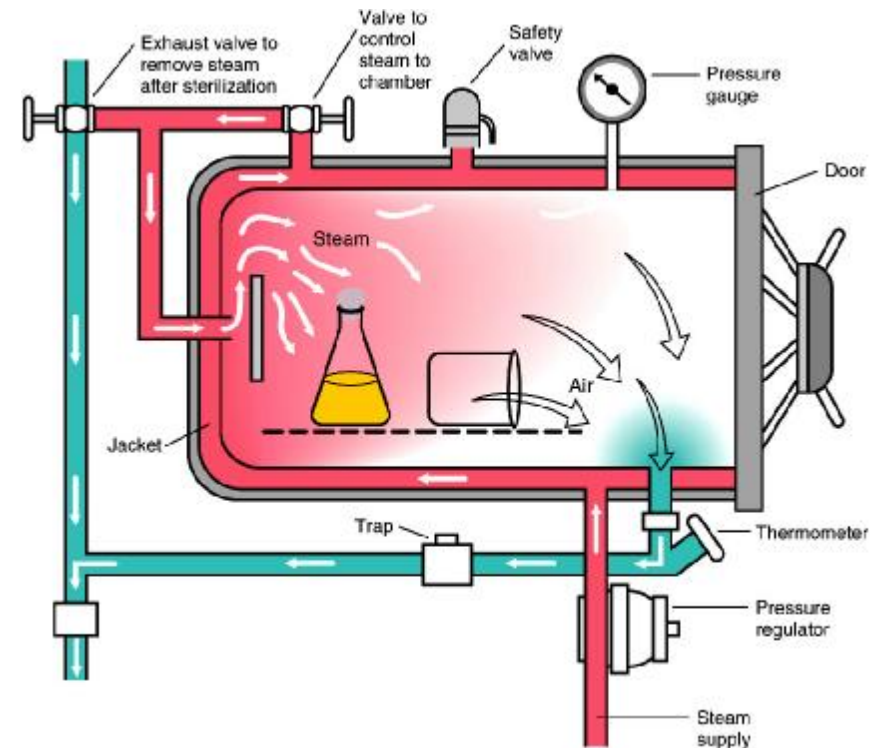
Autoclaving

- In an autoclave, steam at a pressure of about 15 psi (121°C) will kill all organisms and their endospores in about 15 minutes.

15 psi (磅/in²)=1.02 atm

Autoclaving

- Autoclave used to sterilize using pressurized steam
 - Heated water → steam → increased pressure
 - Preferred method of sterilization
- Achieves sterilization at 121°C and 15psi in 15 minutes
 - Effective against endospores
 - Flash autoclaving sterilizes at 135°C and 15psi in 3 minutes





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Autoclaving



(a)



(b)



Raw Milk Use: Historical

- Milk primarily used to make cultured dairy products [cheese, cottage cheese, buttermilk, yogurt].
 - Prior to refrigeration, **milk 'soured' in a few hours**
 - Cultured dairy products have lower pH because of conversion of lactose to lactic acid.
 - Lactose intolerance is prevalent in most populations; Northern European populations typically can consume lactose.
 - Cultured dairy products are the only type that the majority of humans can tolerate.



Cultured Dairy Products: Lower risk of foodborne illnesses

- Lowered pH reduces/prevents growth of microorganisms.
- Heat treatments kill pathogenic and spoilage bacteria.
- Aging kills most bacteria.



Raw Fluid Milk Use: Historical

- Adult use of fluid milk was relatively low
- Some children were fed fluid milk
 - Rural areas: milk from the **family cow** (or a small dairy herd in the neighborhood)
 - City areas: milk from **larger herds**; pooled from many different animals



Pathogen Risk: Greater from Large Herds

- Family Cow/Small Herd: Exposed to pathogens from small number of animals.
 - Develop immunity to pathogens carried by those animals (unless there is introduction of new animals)
- Large Herd: Exposed to pathogens from many animals.
 - Typically, new animals are frequently added to herd
 - Introduction of new animals may bring in new pathogens



Illnesses Associated with Raw Milk

- Zoonotic illnesses that were historically common; **now rare**
 - Undulant fever
 - Infection in livestock is Brucellosis
 - Bovine Tuberculosis
- Zoonotic illnesses that have not been controlled
 - Salmonellosis
 - Listeriosis
 - *E. coli* infections
 - Campylobacteriosis
 - Yersiniosis



Pasteurization

- In the classic pasteurization treatment of milk, the milk was exposed to a temperature of about **63°C for 30 minutes**. Most milk pasteurization today uses high temperatures, at least **72° C, but for only about 15 seconds**. This treatment is known as **high temperature short time pasteurization**. The higher temperature kill more pathogens, lowers total bacterial counts so that milk **keeps well under refrigeration**.



Pasteurization

- Pasteurization
 - Louis Pasteur
 - Mild heating
 - Kills most pathogens
 - Kills bacteria that cause spoilage
 - Preserves taste of product
 - Lowers bacterial numbers
 - Phosphatase test
 - Enzyme inactivated if properly pasteurized



Pasteurization

- Pasteurization
 - Initially 63° C for 30 minutes
 - High – temperature short – time pasteurization (HTST)
 - Kills pathogens
 - Lowers bacterial numbers, milk keeps while refrigerated
 - **Ultra – high – temperature pasteurization (UHT)**
 - Milk can be stored with no refrigeration
 - Super heated steam (temp goes 74° to 140° to 74° in 5 sec)



Pasteurization

- Equivalent treatments
 - Different time and temperature combination end with same results
 - I.e. endospores killed at
 - 70 minutes of 115° C = 7 minutes at 125° C
 - Classic pasteurization = HTST = UHT



History of Pasteurization (US)

- Efforts to promote pasteurized milk began in 1890s.
 - By 1917, milk pasteurization was required in 46 of 52 largest U.S. cities
 - 1987: FDA banned interstate distribution of unpasteurized milk and milk products.
 - Sale of raw milk is banned in about 50% of states.
- Use of raw milk was common in rural areas until mid to late 1900s.



Milkborne illnesses

- 1938: 25% of all reported foodborne illness
- Currently: >1% of reported outbreaks
- 2005-06: >10 outbreaks from raw milk or raw milk cheese reported to FDA



Illnesses Associated with Pasteurized Milk

- From inadequate pasteurization or recontamination
 - Listeriosis
 - Salmonellosis
- Outbreaks may be very large



Nutrient Quality: Pasteurized vs Raw Milk

- **Pasteurized** (per 100 gm)
 - Vitamin C – 0.94 mg
 - Thiamin - .04 mg (≈10%)
 - Folate – 5 mcg (≈12%)
 - Vitamin D – 40 IU (added)
- **Raw** (per 100 gm); limited data
 - Vitamin C – 2 mg
 - Thiamin – <.05 mg
 - Folate – <6 mcg
 - Vitamin D – very little
- **Orange J.** (per 100 gm)
 - Vitamin C – 50 mg
 - Thiamin - .09 mg
 - Folate – 30 mcg
 - Vitamin D - 0
- **White Bread** (per 100 gm) (enriched)
 - Vitamin C – 0
 - Thiamin - .46 mg
 - Folate – 111 mcg
 - Vitamin D - 0



Benefits of Raw Milk

(from RawMilk.org & Raw-milk-facts.com)

- Higher nutrient content
- Biological antibodies
- Enzymes
 - Some prevent a large variety of diseases, including cancer
 - Help body assimilate all bodybuilding factors, including calcium
 - Lipase helps body digest and utilize butterfat.
- Lactic acid producing bacteria protect against pathogens



Pasteurized Milk: Negative Factors

- Transitional lipid oxides are produced
- Lipids become rancid
- Protein toxins are produced
- Homogenization is linked to heart disease
- Synthetic vitamin D is toxic
- Protein is less available
- Wulzen (anti-stiffness factor) is destroyed
- Minerals are less well-absorbed
- Lactose is better absorbed
- Results in a strain on the pancreas to produce digestive enzymes



Why Consume Raw Milk?

(summarized from a variety of sources)

- Belief that pathogens can be controlled
 - Milking machines/stainless steel milk tanks make pasteurization totally unnecessary
- Interest in eating locally produced foods
 - Interest in natural, unprocessed foods
- Negative feelings about large dairy farms and processing plants
 - desire to avoid rBST and other animal drugs
- Interest in stimulating immune system by 'beneficial bacteria'



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懇請賜教