

STERILIZATION

Sterilization is a term referring to any process that eliminates (removes) 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, or filtration.

DISINFECTION

Reducing the number of pathogenic microorganisms to the point where they no longer cause diseases or is the process of elimination of most pathogenic microorganisms (excluding bacterial spores) on inanimate objects.

Bacteriostatic Agent :An agent that inhibits the growth of bacteria, but does not necessarily kill them.

Bactericide :An agent that kills bacteria. Most do not kill Endospores.

Sporicide :An agent that kills spores

Antibiotics

are substances produced by one microbe that inhibits or kills another microbe. Often the term is used more generally to include synthetic and semi-synthetic antimicrobial agents

PHYSICAL METHODS:

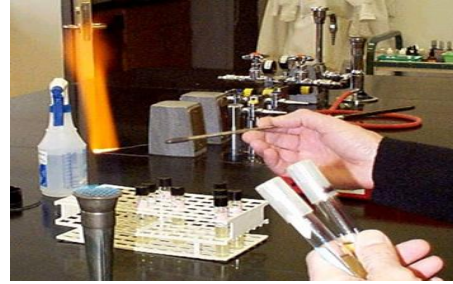
1. Heat (Dry and moist)

Heat is considered to be most reliable method of sterilization of objects that can withstand heat.

A. Dry Heat:

Causes *denaturation* of proteins and oxidative damage. Techniques include:

- **Flaming** *Common uses:* bacterial loops, wires and spatula's.



- **Hot Air oven** (160°C/2hrs or 170°C/1hrs) *common uses:* glassware and metallic instruments.

B. Moist Heat:

Moist heat is more efficient in contrast to dry heat; it causes *coagulation* and *denaturation* of proteins.

- **Pasteurization** (At temperature 63°C/30 minutes or 72/15 minutes): Food(dairy) Industry. Kills most vegetative bacterial cells including pathogens such as *Staphylococci* , *streptococci* and *Mycobacterium tuberculosis*.
- **Boiling** (At temperature 100°C): 30 minutes of boiling kills microbial pathogens and vegetative forms of bacteria but may not kill bacterial endospores.
- **Intermittent boiling** (At temperature 100°C): three 30 minutes intervals of boiling, followed by periods of cooling kill bacterial endospores.
- **Autoclave** (At temperature 121°C and 15 bar pressure for 15 minutes): kills all forms of life including bacterial endospores.



Autoclave

2. Radiation

There are 2 types of Radiation:

A. Non-ionizing: wavelength longer than visible light.

- **UV Radiation** has a wavelength of 200-280nm; it has a germicidal effect on microorganisms.
- *Common uses:* Surface disinfection, in hospitals, operating theatre and laboratories.

B. Ionizing: 2 types:

- **Particulate** (Electron beam): *Common uses:* sterilization of instruments such as syringes, gloves, dressing packs, foods and pharmaceuticals.
- **Electromagnetic** (Gamma rays): *Common uses:* sterilization of disposable petri dishes, plastic syringes, antibiotics, vitamins, hormones and fabrics.

CHEMICAL METHODS:

❖ **Ethylene oxide:** is the most commonly used gas vapor sterility method. However it has limited use due to its harmful properties. The gas is **flammable** and **explosive**.

- *Common uses:* medical and pharmaceutical products, plastic containers

❖ **Formaldehyde:** is a water-soluble gas. Formalin is a 35% solution of this gas in water. Formaldehyde irritates mucosa; skin contact may result in inflammations or allergic eczemas. Formaldehyde is a broad-spectrum germicide for bacteria, fungi, and viruses. The mechanism of action of formaldehyde is based on protein denaturation.

- *Common uses:* Sterilization of instruments.

❖ **Alcohols.** The types of alcohol used in disinfection are ethanol (80%), propanol (60%), and isopropanol (70%). Alcohols are quite effective against bacteria and fungi, less so against viruses. They do not kill bacterial spores.

- *Common uses:* surgical and hygienic disinfection of the skin and hands.

- ❖ **Halogens.** Chlorine, iodine, and derivatives of these halogens are suitable for use as disinfectants. Chlorine and iodine show a generalized microbicidal effect and also kill spores. halogens denatures proteins by binding to free amino groups.
 - Common uses: Chlorine is used to disinfect drinking water and swimming-pool water (up to 0.5mg/l). Iodine used to disinfect skin and small wounds.

- ❖ **Oxidants.** This group includes ozone, hydrogen peroxide, potassium permanganate, and peracetic acid. Their relevant chemical activity is based on the splitting off of oxygen.
 - Common uses: Most are used as mild antiseptics to disinfect mucosa, skin, or wounds.

- ❖ **Phenols:** Synthetic phenolic compounds are disinfectants with broad-spectrum disinfecting action including a tuberculosis kill.
 - Common uses: phenols may be used for surface disinfection.

FILTRATION

Fluids that would be damaged by heat irradiation or chemical sterilization, can be only sterilized by Microfiltration using membrane filters

- commonly uses: for heat labile pharmaceuticals and protein solutions in medicinal drug processing (such as those containing proteins like large molecule drug products, serum, enzymes, sugars, toxins).

