

Sterilization

Sterilization is the killing or removal of all microorganisms, including bacterial spores which are highly resistant. Sterilization is an absolute term, meaning the absence of all microorganisms.

Disinfection is the killing of many, but not all microorganisms. It is a process of reduction of number of contaminating organisms to a level that cannot cause infection, Some organisms and bacterial spores may survive.

Disinfectants are chemicals that are used for disinfection. Disinfectants should be used only on inanimate objects.

Antiseptics are mild forms of disinfectants that are used externally on living tissues to kill microorganisms, on the surface of skin and mucous membranes.

CLASSIFICATION OF METHODS

Sterilization and disinfection are done by :

(A). Physical methods

1. Heat
2. Radiation
3. Filtration

1. Heat :-

A. Sterilization by Dry Heat

Mechanisms. (1) Protein denaturation, (2) Oxidative damage, (3) Toxic effect of elevated electrolyte (in absence of water).|

1- Flaming. The article is passed through flame without allowing it to become red hot, e.g. scalpel. Temperature is not high to cause sterilization.

2- Incineration. Wire loops used in microbiology laboratory are sterilized by heating to 'red' in bunsen burner.

3- Hot Air Oven . It Is one of the most common method used for sterilization. Glass wares, swab sticks, all-glass syringes, powder and oily substances are sterilized in hot air oven. For sterilization, a temperature of 160°C is maintained (holding) for one hour. Spores are killed at this temperature. It leads to sterilization

B. Sterilization by Moist Heat:

Moist heat acts by denaturation and coagulation of protein, breakage of DNA strands, and loss of functional integrity of cell membrane.

- Sterilization at 100°C

1. Boiling. Boiling at 100°C for 30 minutes is done in a water bath.

Syringes, rubber goods and surgical instruments may be sterilized by this method. All bacteria and certain spores are killed. It leads to disinfection.

2. Tyndallization (Fractional Sterilization). Heat labile media like those containing sugar, milk, gelatin can be sterilized by this method. Steaming at 100°C is done in steam sterilizer for 20 minutes followed by incubation at 37°C overnight. This procedure is repeated for another 2 successive days. That is 'steaming' is done for 3 successive days. Spores, if any, germinate to vegetative bacteria during incubation and are destroyed during steaming on second and third day. It leads to sterilization.

Sterilization above 100°C: Autoclaving

3. Autoclaving : is one of the most common methods of sterilization.

Principle: In this method sterilization is done by steam under pressure.

Steaming at temperature higher than 100°C is used in autoclaving. The temperature of boiling depends on the surrounding atmospheric pressure. A higher temperature of steaming is obtained by employing a higher pressure.

When the autoclave is closed and made air-tight, and water starts boiling, the inside pressures increases and now the water boils above 100°C. At 15 lb per sq. inch pressure, 121°C temperatures is obtained. This is kept for 15 minutes for sterilization to kill spores. It works like a pressure cooker.

Sterilization below 100°C

4. Pasteurization. Pasteurization is heating of milk to such temperature and for such a period of time so as to kill pathogenic bacteria that may be present in milk by heating at 63°C for 30 minutes or at 72°C for 15 minutes without changing color, flavor and nutritive value of the milk. *Mycobacterium bovis*, *Salmonella* species, *Escherichia coli* and *Brucella* species may be present in milk. It does not sterilize the milk as many living organisms including spores are not destroyed..

5. Inspissation. Inspissation is done between 75°C to 80°C. Inspissation means stiffening of protein without coagulation as the temperature is below coagulation temperature. Media containing serum or egg is sterilized by heating for 3 successive days. It is done in 'Serum Inspissator'.

2. Radiation : Sterilization of certain active ingredients, drug products, and medical devices in their final container or package may be achieved by exposure to ionizing radiation in the form of gamma radiation, and the non ionizing radiation in the form of ultra violet light use to sterilize hospitals and operating rooms as well as biological liquids such as blood plasma and vaccines .
3. Filtration: Sterilization by filtration is employed mainly for thermolabile solutions such as serum and antibiotics. These may be sterilized by passage through sterile bacteria-retaining filters, e.g. membrane filters (cellulose derivatives, etc.) .

(B). Chemical methods

The chemical materials used to disinfect the rooms and the floors ,the degree of the effect of these chemical materials depend on many factors :-

- 1- The concentration of chemical materials.
- 2- The density of microorganisms .
- 3- The duration during which the microorganisms exposed to the chemical materials.

- 4- The nature of microorganisms .

One of the chemical materials that used in disinfection :

- 1- **The Halogens** : these are an anti-oxidant materials like chlorine (Cl) also the Iodine and its compounds can be in the disinfection of wounds .
- 2- **Heavy metals compound** :like mercury that use in the form of mercuric chloride HgCl_2 , they act by inactivating cellular protein and it is cytotoxic .
- 3- **Phenol compounds** : like Lysol, they act by a number of mechanisms such as disruption of cells and inhibit the activity of enzymes and proteins .
- 4- **Alcohols** : like Ethanol and it is used at a concentration 70 % .
- 5- **Synthetic detergent**: like sodium lauryl sulfate , they help in mechanical removal of microorganisms .
- 6- **Gases** : like formaldehyde with a concentration 80 % and hydrogen sulfide H_2S .