

Sterilization and Disinfection

Sterilization:

- It is a process that kills all living microorganisms.

Disinfection:

It is a process that reduce the number of microorganisms (Unable to destroy spores and some could not kill non envelop viruses).

Sterilization

1. Heat (dry or moist heat).

Exposure of the objects to heat will kill microbes by coagulation of protein, denaturation of enzymes and oxidation.

2. Radiation.

Exposure to irradiation causes mutation and denaturation of proteins and enzymes.

3. Filtration.

Sterilization through removing of microbes from fluids by exposing to small size filter. Used for heat sensitive fluids like serum, antibiotic, sugar, and urea.

sterilization by heat

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graph TD; Heat[Heat] --> DryHeat[Dry heat]; Heat --> MoistHeat[Moist heat];
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Heat

Dry heat

Moist heat

Heat

A. Dry heat: by using high temperature (no water), Ex:

- **Incineration:**
 - It's a huge oven, temp. $>100^{\circ}\text{C}$.
 - Used to destroy dead animals and infectious items.
- **Bunsen burner (flame):**
 - Used for sterilization of loops, iron needles.
- **Oven:**
 - Temp. $160 - 180^{\circ}\text{C}$, Leave it for 1-2 hours.
 - Used to sterilize the metals, glass wares, powders, ointments (oil).
 - **Can not use it** for plastics, heat sensitive material, solutions.

B. Moist heat: by using high temperature and water, Ex:

- **Autoclave:**

- Temp. 121 °C under 15 atm pressure for 15-20 min.

- Use it for sterilization of glass wares, media, solutions.

- Can not use it** for metals, powders, heat sensitive material.

Indicators to check the efficiency of the autoclave and oven:

A. Chemical indicators:

- **Autoclave tape:** it turns from white to black if it is working good (use it to check the autoclave)
- **Brown's tube:** (use it to check the oven) Its color turns from white to red.

Autoclave tape



Before:



After:



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B. Biological indicator:

Use spore strip:

- It's a filter paper soaked with spores of *Bacillus stereothermophilus* (grow at 70 °C).
- Put the strip in broth, place it inside the autoclave, then put it in the incubator for 24 hours. The result:
- Turbidity ----> growth----> autoclave is not good
- Clear ----> no growth----> autoclave is good

Ionizing Radiation

- It is an electromagnetic waves (Ex. γ -rays, X-rays). It has short wave length with high energy and strong penetration.

Use it for sterilization of:

- 1) Plastic items like: petridish, syringes, pipettes.
- 2) Heat sensitive materials: antibiotics, drugs, vaccines).
- 3) Fresh meat, canned food.

Filtration

- Used for sterilization of liquid solutions which are sensitive to heat. Like: toxins, I.V fluids, protein, sugar.

Principle of this test:

- We use millipore filters: it's a thin membrane with a pore size 0.45 Mm or smaller 0.22 Mm.
- Fluid is allowed to pass through the filter with the help of the vacuum pump (it produce –ve pressure to force the fluid to pass through the filter).

Disinfection

- Disinfection is done by using disinfectant.
- **Disinfectant:** Is a chemical substance that kill or inhibit the growth of organisms.

Disinfectant can be:

A. Bactericidal: chemical substance that kill the organisms. Ex. : phenol (Detol), sodium hypochloride (Clorox).

B. Bacteriostatic: chemical substance that inhibit the growth of organisms. Ex. : 70% alcohol swap.

Factors affects disinfection action:

- Type of disinfectant.
- Concentration of disinfectant.
- Type of microorganism.
- Number of microorganism.
- Time of exposure.
- Temperature.

To test the efficiency of a disinfectant in the lab we do:

Minimum Inhibitory Concentration (MIC).

- The last tube which shows no growth is the MIC of that disinfection.
- or the MIC: is the least concentration that inhibit the growth of organism.

Procedure:

- A pure culture of a single microorganism is prepared.
- The antimicrobial agent is diluted in a number of times through a sterile diluent (usually Mueller-Hinton broth).
- Add 2 drops of the organism onto the antimicrobial dilution.

- Incubate 24 hr in the incubator.
- After incubation observe growth, The last tube in the dilution series that does not demonstrate growth corresponds with the minimum inhibitory concentration (MIC) of the antimicrobial agent.