

Sterilization and Disinfection

Sterilization:- a physical or chemical process that completely destroys or removes all microbial life, including spore.

Disinfection:- The process or act of destroying pathogenic microorganisms. Reducing the number of viable microorganisms present in a sample. does not necessarily kill all microorganisms, especially resistant bacterial spores.

Disinfectant:- A chemical substances used to kill microorganisms on surfaces but too toxic to be applied directly to tissues e.g alcohol , dettol in high level.

Methods used for sterilization or disinfection:-

Physical Agents:-

A- Application of heat:-

***Autoclaving (moist heat):**

Autoclaving is the most effective and most efficient means of sterilization. All autoclaves operate on a time/temperature relationship. These two variables are extremely important. Higher temperatures ensure more rapid killing. The usual standard temperature/pressure employed is 121°C/15 psi for 15 minutes. Autoclaving is ideal for sterilizing bio hazardous waste, surgical dressings, glassware, many types of microbiologic media, liquids, and many other things. However, certain items, such as plastics and certain medical instruments (e.g. fiber optic endoscopes), cannot withstand autoclaving and should be sterilized with chemical or gas sterilants. kills all forms of life including bacterial endospores.

Moist heat not under pressure:-*1- Boiling:**

Most of vegetative form of bacteria and fungi are killed at 50-70°C for short time. 100°C for 30 minutes (more time at high altitude). Kills everything except some endospores. It also inactivates viruses. At this degree is sterilize needle and instrument and boiling of water.

2- Pasteurization:-

is the use of mild heat to reduce the number of microorganisms in a product or food. Pasteurization does not sterilize, but does kill disease producing bacteria. In the case of pasteurization of milk, the time and temperature depend on killing potential pathogens that are transmitted in milk, i.e., *staphylococci*, *streptococci*, *Brucella abortus* and *Mycobacterium tuberculosis*. Pasteurization occurs via either of two **procedure:-**

a- holding method:- the liquid is heated to 62°C for 30 minutes.

b- flash method:- the liquid is heated to 71°C for 15 to 20 second.

Dry heat:-*1- Hot air oven:-**

Basically the cooking oven. The rules of relating time and temperature apply, but dry heat is not as effective as moist heat (i.e., higher temperatures are needed for longer periods of time). For example 160 °C /2hours or 170 °C /1hour is necessary for sterilization. The dry heat oven is used for glassware, metal, and objects that won't melt.

2- Flaming:-

Is the direct exposure of instruments or inoculating loops to open flames for brief period.

3- Incineration:

Rapidly destroying any material and contaminating microorganisms that may be present.

B- Radiation:

Usually destroys or distorts nucleic acids. Ultraviolet light is commonly used to sterilize the surfaces of objects, although x-rays, gamma radiation and electron beam radiation are also used.

a-Ultraviolet:-

possess bactericidal or bacteriostatic properties. The maximum killing effect is 260nm. Isolation room or laboratory can be exposed to UV light to prevent the spread of disease producing microorganism. UV light is damaging to human tissue and direct exposure must be avoided UV light causes following change in cell:-

- 1- damage of DNA
- 2- denaturation of protein
- 3- inhibition of DNA replication
- 4- formation of H₂O₂ and organic peroxidase in culture media

b- X-ray and other ionizing radiation:-

ionizing radiation have great capacity to induce lethal change in DNA of cell by break one or both DNA strands and interfere with DNA replication. Ionizing radiation is used to sterilize product like surgical instrument and disposable plastic items as well as heat processed canned meat.

C- Filtration:-

involves the physical removal (exclusion) of all cells in a liquid or gas. It is especially important for sterilization of solutions which would be denatured by heat (e.g. antibiotics, injectable drugs, amino acids, vitamins, etc.). Essentially, solutions or gases are passed through a filter of sufficient pore diameter (generally 0.22 micron) to remove the smallest known bacterial cells.

 Chemical agents:-

Chemical agents act primarily by one of three mechanism:-

- 1- Disruption of the lipid-containing cell membrane
 - 2- Modification of proteins
 - 3- Modification of DNA
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The commonly used chemical agents are:-

1. Phenol:-

Is antibacterial agent at high concentration employed (2% aqueous solution). denature proteins and disrupt cell membranes excellent for surfaces, but can cause skin irritation

2. Alcohols and isopropyl:-

Is bactericidal and fungicidal, but not sporicidal, concentration generally employed (70% aqueous solution), denature proteins and dissolve membrane lipids.

3. Halogens

Iodine most common used chiefly in skin. Chlorine combine with water to form hydrochloric acid which in bactericidal

4. Heavy metals

like Hg, Ag, As, Zn, Cu used to be common germicides, most heavy metals are bacteriostatic, not bactericidal, that is used in very low concentration because it is dangerous to the tissue.

5. Detergents:-

They are bactericidal and bacteriostatic detergent, disrupt membranes and may denature proteins, kill most cells, but not endospores or *M. tuberculosis*

6. Alkylating agents like:-

a- formaldehyde:- is used as disinfectant in (37% aqueous solution)

b- ethylene oxide:- useful for disinfection of surgical instruments and materials which must be placed in special vacuum chambers for this purpose.

