

Sterilization and Disinfection

Sterilization: A physical or chemical process that completely destroys or removes all microbial life including spores.

Disinfection refers to those processes that result in the destruction of only the vegetative forms of microbial life, and not spores. Disinfectants can be sporostatic but are not sporicidal.

Advantages of sterilization:-

- 1- Prevent transmission of diseases
- 2- Prevent contamination and growth of undesirable bacteria
- 3- Prevent spoilage of material by microorganisms.

The processes of sterilization primarily use moist or dry heat and those of disinfection are often restricted to the use of chemicals.

There are 3 methods of Sterilization:

- A. Physical
- B. Mechanical
- C. Chemical

A. Physical:

1- **Heat**: the most practical and dependable methods of sterilization , these methods may divided into:

1. Dry heat:

a. Red heat or flaming (Incineration):- points of forceps, spatulas, wire loop, needles, mouth of culture tubes, glass slide. The temperature employed is about 160°C for 1 hour.

b. Hot air oven: (glass pet radishes, glass pipettes, glass flasks, dry glass ware, measuring cylinders, all glass syringes, metal instruments oils and grease can also sterilized by this method. The temp (160°C -180°C).

Conditions of sterilization by hot air oven:-

- 160°C for (2hrs) 120 minutes.
- 170°C for (1hr) 60 minutes.
- 180 °C for (1/2hr) 30 minutes.

2. Moist heat:

The most effective method, means the use moist heat in the form of steam under pressure. Heat transfer is rapid when moisture is present. The autoclave uses steam under pressure.

1.Boiling water: at 100°C for 30 min, boiling water will kill vegetative bacterial cells within 5 min or less but will not kill spores. *Mycobacterium tuberculosis* is killed at 58°C within 30 min and 100°C is recommended to destroy the hepatitis B virus which may contaminate in instruments through dental operations on carries of this virus or patient with unrecognized cases, boiling water destroys microorganisms by coagulated protein.

2.Pasteurization: it is a process used principally in food industries for the preservation of milk and other dairy products. This process consists of exposing the product to temperature of 62.8°C for 30 min. or 71.6°C for 15 min and then cooling it immediately.

Vegetative microbial forms such as beta hemolytic *streptococcus*, *Brucella*, and most virus are killed. Pasteurization does not kill thermophiles or spore formers.

3.Tyndallization:This involves steaming at 100°C for 30 min. This method need 3 days, at first day the vegetative microbial forms are killed, spores will killed by the second steaming, the third heating is a safety precaution.

4. Autoclaving: This method at the correct temperature is lethal to all bacteria, viruses, fungi and protozoa. The minimum values required for sterilization in an efficient autoclave are 15 pressure inh² at 121°C for 30 min.

2- Radiation:

The process of transmission of energy through space is done by UV light, X-ray and Gamma rays (X-ray and Gamma rays are very expensive , so it not available to used except in certain condition.

Ultra- Violet radiation:-

One component of sun light is (ultra- violet rays). It has a powerful bactericidal effect. This wave is not markedly bactericidal until (250nm), increased activity by decreased wave length. The shortened wave in sun light reached the earth in length(290nm) but even more effective radiation(240- 280nm) can produced by vapor lamp are used to lower the bacterial count in rooms and screens where aseptic handling of materials is undertaken. It has a little penetration power, they are only effective for surfaces where bacteria are not protected by other materials. Precaution should be taken to protect the skin and cornea from highly irritant rays. UV light causes the following changes in cell:

- 1- Denaturation of protein.
- 2- Damage of DNA.
- 3- Inhibition of DNA replication.

B. Mechanical methods (Filtration):

Microorganisms can be removed from solutions and fluids by filtration. These solutions are then sterile. This method is used for solutions and fluids that cannot be exposed to heat or chemicals without being chemically changed. Microorganisms are not killed by filtration but are physically separated from the fluid as it passes through the filter.

Filters with pore size of 0.2 μm in diameter will remove bacteria and Microorganisms other than viruses. Filters of porosity of 10 nm are recommended for the removed of viruses. Filtration is used to remove the Microorganisms from biologic fluid such as (normal sera, antisera, microbial toxins, enzymes containing solution, various sugar solution, and other materials put in solution that cannot be sterilized by other methods.

C. Chemical methods:

Chemical agent that kills pathogenic and non pathogenic microorganisms but not spores. Disinfection and antiseptic are generally applied to

different types of substance, it can not kill all types of microorganisms but reduce no.;

Disinfection: is reducing the number of bacteria to a level low enough that disease is unlikely to occur. Spores and some bacteria will survive. e.g]. ethyl alcohol is used in concentration (50-70)%, phenol group (2-5%), Chlorine compounds 5% (added to water), Formaldehyde (gas), 37% Detole or alcohol 70% are effective in vegetative cells (denaturation of protein and nucleic acids, solvents of lipid in cell membrane and active in reducing normal flora from the skin and clinical thermometers).

Antisepsis: is the destruction or inhibition of microorganisms in living tissues thereby preventing their harmful effect e.g] 2% Iodine, 3% H₂O₂, Potassium permanganate.

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