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Sterilization & Disinfection

Sterilization: the process use to kill all kinds of living bacteria (pathogenic and non-pathogenic) by physical or chemical agents .

Disinfection: The process or act of destroying or kill pathogenic bacteria.

Antiseptic: Chemicals applied used for topical or external use of chemical agents to inhibit or kill pathogenic bacteria .

Sterilization is done either by physical or chemical agnts:

1-Physical agents.

2-Chemical agents.

I-The classification of physical agents into:

A-Heat B- Irradiation C-Filtration

Different types of heat sterilization :

1-Dry heat

2-Moist heat

The classification of dry heat into:

A- Direct flaming

B- Hot air oven

1-Dry heat

Direct Flaming: used for quick method of sterilization as loops and straight-wires in microbiology labs. Leaving the loop in the flame of a Bunsen burner or alcohol lamp until give red color indicating sterilized instrument means inactivated infectious agents.

Hot air oven: it is heat by electricity to 180 °C for 2 hours . A rapid method heats air to 190 °C (374 °F) for 6 minutes and 12 minutes. It used for sterilize glassware ,test tubes , surgical instruments .the principle for dry heat sterilization is destructive oxidation of the cell cytoplasm.

2-Moist heat

Is more effective in sterilization and it could be one of the following methods:

A-Autoclave: widely-used method for moist heat sterilization is the autoclave. Autoclaves commonly use steam heated to 121–134 °C (250–273 °F). To achieve sterility, a holding time of at least 15 minutes at 121 °C (250 °F) or 3 minutes at 134 °C (273 °F) is required.

The principle is that water boil when its vapour pressure is equal to the pressures of surrounding atmosphere. If the pressure raised inside a closed vessel the temperature which water boils will rise above 100°C at 15 lbs (pound /inch²). Pressure water boils at 120°C and is used to sterilize such as culture media , that would be damage by autoclave this effective technique to destroy all bacteria and spores , surgical instruments and cotton.

B-Boiling in water :for fifteen minutes will kill most vegetative bacteria and inactivate viruses, but boiling is ineffective against prions and many bacterial and fungal spores; therefore boiling is unsuitable for sterilization. However, since boiling does kill most vegetative microbes and viruses, it is useful for reducing viable levels if no better method is available. Boiling is a simple process, and is an option available to most people, requiring only water, enough heat.

C-Tindalization is a lengthy process designed to reduce the level of activity of sporulating bacteria that are left by a simple boiling water method. The process involves boiling for a period (typically 20 minutes) at atmospheric pressure, cooling, incubating for a day, boiling, cooling, incubating for a day, boiling, cooling, incubating for a day, and finally boiling again. The three incubation periods are to allow heat-resistant spores surviving the previous boiling period to germinate to form the heat-sensitive vegetative (growing) stage, which can be killed by the next boiling step.

C Pasteurization is a method where we raise the temperature of liquid up to 60n- 65 °C between 15 – 30 minutes is enough to kill bacteria in liquid . Louis Pasteur introduced it . Used to sterilize the liquid from

materials and destroyed by high temperature for milk as example is the common material which use pasteurization for it milk contain different types of organisms that taken from cattle to man as *Mycobacterium tuberculosis* , *Brucella* , *Salmonella* these four organisms when worm to the milk from 62-65°C usually 62°C within 20-30 minutes enough to kill these organisms .

How moist heat affect bacteria

1-Denaturation bacterial protein by extraction of water from protein so break H – bound between peptides.

2-Dissolve lipid content of cell membrane so break the bipolar structure of the lipid so the organisms will lysis and die.

B- Irradiation :among other physical agents ultra – violet which has extension absorption of 60 nm which is very near to the absorption of nucleic acid so cause mutation and breakage of nucleotides finally we have broken DNA .So there is activity in the cell and death of bacteria soon after that .Use to sterilize disposable instruments .

C-Filtration: we use filter paper with different size of pores in filter even for the small bacteria not pass through the filter while the material contaminated pass through without bacteria . This method used to sterilize different types of solution as antibiotic, sugar, and serum.

II- Chemical agents :

Include large number of chemical which may be used for disinfection or sterilization .

The classification of chemical agents

1-Heavy metals: organic metals as(Hg ,Ag) organic Hg as mecrochrom Ag as silver nitrate used to kill certain bacteria in eye (e.g. *Nisseria gonorrhoea*).

2-phenol and phenol derivatives :phenol compounds are widely used disinfectants although phenol itself seldom if ever now used because of its irritant effect . They are widely used disinfecting floor of hospital like detol , cresol . Act as protein denaturation.

3-Alcohol: like ethanol , methanol , also causes protein deneaturation , and extract water from the proteins of bacterial cell (dehydration of protein) .They are manly used 70 percent concentration diluted with water and useful as skin disinfectants before injections .

4-Halogens: Chlorine is an effective disinfectant of water . it added in small amounts usually points or part / million (P.P.m)very low concentration of chlorine in water so will from chloride to kill pathogenic bacteria and protozoa it dose once put in water we will hypochloric acid which is very strong oxidizing agent power full and could kill most of microorganisms .Iodine with alcohol is a powerful skin disinfectant which is recommended for use on patients before surgery .

5-Detergent :widely used as antimicrobial agents e.g. soap act as :

- a- Forms layer between the skin and organisms.
- b- As detergents it will extract lipid from bacterial cell membrane then cause lyses of bacterial cells.

6-Aldehyde:formaldehyde this gas is also highly lethal to organisms and spores and can be caused in aqueous or gaseous forms. It is used for fumigating rooms and for disinfecting mattresses and bedding.

The advantage of sterilization by gas lie in the fact that most articles are not damaged in the process and that penetrating into porous materials is usually good.