Methods of sterilization

A) Physical methods

Sr.	Method	Mechanism	Conditions	Uses
1.	**Dry heat sterilization (hot air oven)**	Oxidation	Requires 170˚c temperature for 2 hr.	Oily materials, powders, glass syringes, needles
2. (A)	**Moist heat sterilization** Autoclave	Protein denaturation	At 15psi of pressure(121˚c) for 15 min.	Surgical dressing, surgical instruments, containers and closures
(B)	Tyndallization	Protein denaturation	Solutions are packed & sealed in final containers and heated at 80˚c for 1 hr on each of 3 successive days.	Culture media
(C)	Pasteurization i) holder method	Protein denaturation	62.8˚c for 30 min in steam jacketed stainless steel tank containing agitators.	Milk, cream, certain alcoholic beverages and kills all types of bacteria includes M.tuberculosis

	ii) flash method		Heat at 71.6˚c for 15 sec and then quickly cooled.	Milk, cream & certain alcoholic beverages.
3. (A)	**Radiation sterilization** By UV light	Damage to DNA	265 nm	Thermo labile substances, surface of working rooms & tables
(B)	By ionizing radiation	Destruction of DNA	Gamma rays from radio-isotonic source such as cobalt-60 or cesium-137 and dose of 2.5 Mrads	Plastic syringes, hypodermic needles, surgical blades, scalpels, catheters & sutures, bone & tissue transplant plastic tubing

B) Chemical methods

Sr.	Method	Mechanism	Condition	Use
1.	**Sterilization by heating with bactericide**	Protein denaturation	98 -100 c for 30 mins	Injections, eye drops
2.	**Gaseous sterilization**	Protein denaturation	a) formaldehyde	Catheters, syringes, thermolabile hospital equipments and for fumigation of empty rooms after infectious

			b) Ethylene oxide at 40˚c and 200mg to 1g/litre conc. c) β-propiolactone at 25˚c anfd 2-4 mg/litre conc.	diseases. Thermolabile materials, packed powers, metallic equipments Operation theatres and aseptic rooms

C) Mechanical methods

Sr.	Method	Mehcanism	Use
1.	**Ceramic filters**	Sieving	Useful for sterilizing liquids (enzymes, vaccines) that are destroyed by heat.
2.	**Seitz filter**	Adsobtion	
3.	**Sintered glass filters**	Sieving	
4.	**Sintered metal filters**	Sieving	
5.	**Membrane filter**	Sieving	

Rideal walker test:

- This uses a strain of Salmonella typhi that is prepared for the test in a specified way, using a standard broth.

- Serial dilutions of phenol and disinfectant under test are inoculated with 0.2 cm^3 of the culture and standard loop full are removed into 5cm^3 volumes of broth 2.5, 5, 7.5 and 10 minutes later incubated at 37˚c for 48 hours.

- The phenol coefficient is obtained by dividing the lowest concentration of phenol giving the same result.

Chick martin test:

- This test is more realistic because the reaction takes place in the presence of a controlled amount of organic matter in the form of standardized suspension of yeast cells.
- Organic matter, which is often present under condition of use, reduces the activity of many disinfectants.
- The test organism and the incubation conditions are as for the Ridal Walker test but the reaction temperature is 20˚c(instead of 17-18), the exposure time is 30 minutes, and duplicate samples are taken.
- The chick martin coefficient is the mean of the highest concentration preventing growth, dividing by the same mean for the disinfectant under test.

D-value refers to **decimal reduction time** is the time required at a certain temperature to kill 90% of the organisms being studied. Thus after a colony is reduced by 1 D, only 10% of the original organisms remain. When referring to D values it is proper to give the temperature as a subscript to the D. For example, a hypothetical organism is reduced by 90% after exposure to temperatures of 300 degrees Fahrenheit for 2 minutes, thus the D-value would be written as D_{300F} = 2 minutes.

Z-value : The z-value of an organism is the temperature, in degrees Fahrenheit or Celsius, that is required for the thermal destruction curve to move one log cycle. It is the reciprocal of the slope resulting from the plot of the logarithm of the D-value versus the temperature at which the D-value was obtained. It may be simplified as the temperature required for one log reduction in the D-value. While the D-value gives the time needed at a certain temperature to kill an organism, the z-value relates the resistance of an organism to differing temperatures.

Biological indicators:

Types of Sterilization	Types of Micro organism
Radiation sterilization	B. pumillus
Dry heat sterilization	B.subtilis (nigar)
Ethylene oxide	B. subtilis (globiggi)
Moist heat sterilization	B. stereothermophyllus clostridium sporogenus
Filtration (membrane)	Serratia marscenes (0.45 µm pore size) Pseudomonas dimunata (0.22 µm pore size) Vibrio percolans