Sterilization

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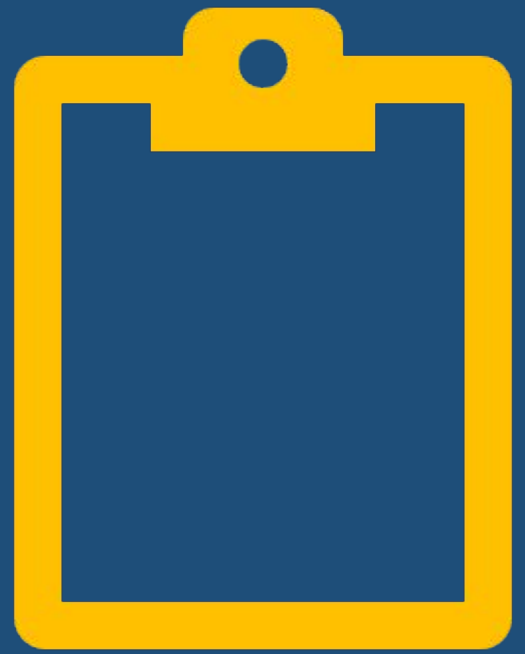
What is Disinfection & Sterilization

- Sterilization: A physical or chemical process that completely destroys or removes all microbial life, including spores.
- Disinfection: Products used to kill microorganisms on inanimate objects or surfaces. Disinfectants are not necessarily sporicidal, but may be sporostatic, inhibiting germination or outgrowth
- Antiseptic: A product that destroys or inhibits the growth of microorganisms in or on living tissue.
- Aseptic : Characterized by the absence of pathogenic microbes.



METHODS OF STERILIZATION and DISINFECTION

- Physical method
- Chemical method
- Mechanical methods

Physical method

Heat	Radiation	Filtration
• Dry • Moist	• U.V. light • Ionizing radiation	

Dry Heat:

- 1. Direct flaming: Simplest method is exposing the item to be sterilized to the naked flame e.g. Bunsen burner- for sterilizing bacteriological loops, knives, blades.

- 2. Hot air oven expose items to 160°- 1800C for 1- 1/2 hour. It has a fan to circulate air for even distribution of heat in chamber. Used for Metals, Glassware, Ointment, Oils, Waxes, Powders i.e. items that are lacking water.

- 3. Incineration: This is an excellent method of destroying materials such as contaminated cloth, animal carcasses and pathological materials.

Moist Heat

- 1. Boiling : quite common especially in domestic circumstances.

- 2. Tyndallization: ✓ The process involves exposure of material to hot steam (1000C) for a period (typically 20 minutes) at atmospheric pressure, cooling, incubating for a day, This is repeated for 3 successive days.

✓ 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.

- 3. Pasteurization : 62°C for 30 minutes. It aims to reduce the number of viable pathogens in liquids so they are unlikely to cause disease.

- 4. Autoclave: ✓ The Autoclave works under the same principle as the pressure cooker where water boils at increased atmospheric pressure i.e. because of increased pressure the boiling point of water is >100°C. The autoclave is a tough double walled chamber in which air is replaced by pure saturated steam under pressure.

- ✓ The chamber is closed tightly the steam keeps on filling into it and the pressure gradually increases.

- ✓ The usual temperature achieved is 121 °C at a pressure of 15 ppsi. at exposure time of only 15-20 mins . By increasing the temperature, the time for sterilizing is further reduced.

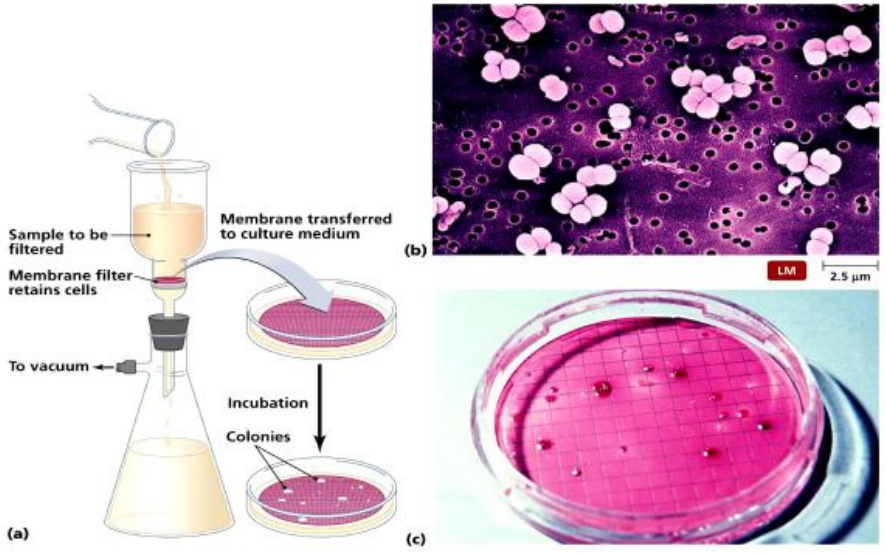
Radiation

- : A. U.V. light- Has limited sterilizing power because of poor penetration into most materials. Generally used in irradiation of air in certain areas ex: Operating Rooms and T.B. Laboratories.

- B. Ionizing radiation- e.g. Gamma radiation: Source Cobalt60 has greater energy than U.V. light, therefore more effective. Used mainly in industrial facilities e.g. sterilization of disposable plastic syringes, gloves, specimens containers and Petri Dishes.

Filtration

- Best known example is the membrane filter made from cellulose acetate. Generally removes most bacteria but viruses and some small bacteria e.g. Chlamydias & Mycoplasmas may pass through. Thus filtration does not technically sterilize items but it is adequate for circumstances under which it is used.



Sterilization by Chemical Methods

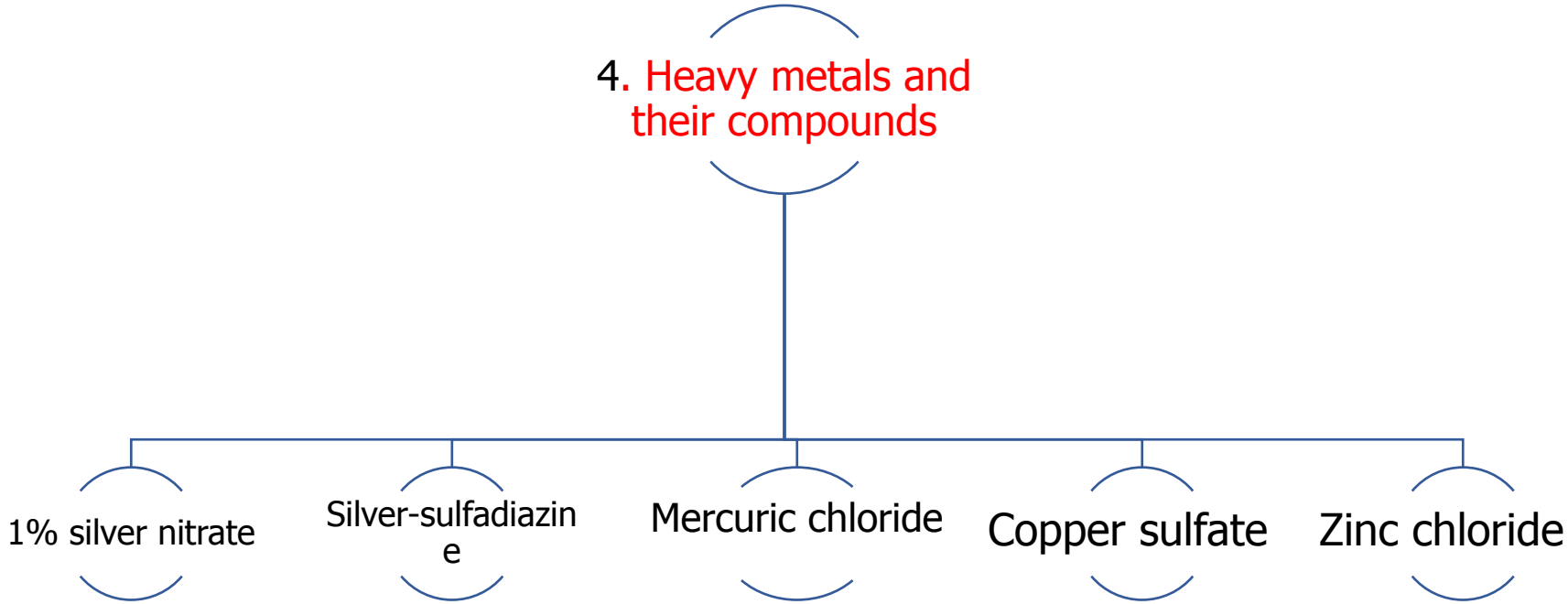
1. Ethylene Oxide Chamber:

- Ethylene oxide alkylates DNA molecules and thereby inactivates microorganisms.
- Ethylene oxide may cause explosion if used pure so it is mixed with an inert gas e.g. Neon, Freon at a ratio of 10:90

2. Glutaraldehyde 2%:

Immerse item in solution for about 20 minutes if organism is TB. In case of spores, the immersion period is extended to 2-3 hours.

3. Alcohols


4. Heavy metals and their compounds
1% silver nitrate
Silver-sulfadiazine
Mercuric chloride
Copper sulfate
Zinc chloride

5- Halogens

- o Iodine is effective against all kinds of bacteria, many endospores, fungi, and some viruses. Its mechanism of activity may be its combination with the amino acid tyrosine in enzyme and cellular proteins.

- o An iodophore is a combination of iodine and an organic molecule. Iodophores do not stain and are less irritating than iodine. Examples are Isodine and Betadine.

- o Chlorine is used as a gas or in combination with other chemicals. Chlorine gas is used for disinfecting municipal water supplies, swimming pools, and sewage. Sodium hypochlorite – ordinary household bleach- is a good disinfectant.

- o Chlorine dioxide in gaseous form is used for area disinfection, most notably to kill endospores of anthrax bacteria. Halogens

Safety first, science always!