

# Chapter 8: Sterilization and Disinfection

## Definitions

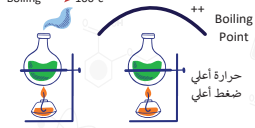

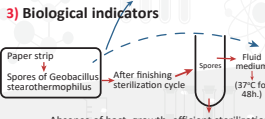
- Sterilization**
  - Process used to kill all M.O.s including bact. spores
  - Used for
    - Culture media
    - Critical items entering Vascular system and sterile tissues
- Disinfection**
  - Process used to kill M.O.s # spores (Not sporicidal)
  - Used for devices not penetrating tissues, but used in contact with
    - Skin: stethoscope diaphragm (Alcohol 70%)
    - M.M: endoscope ( 2% OPA for 12 min.)
- Sterilant**
  - Chemical germicide that achieves sterilization
- Disinfectant**
  - Chemical agent (or physical agent) that achieves disinfection
  - Refers to substances applied to inanimate objects
- Antiseptic**
  - Chemical disinfectant Safely applied to skin and m.m., but not suitable for Systemic use (preparation applied topically)
  - e.g.
    - 70% isopropyl alcohol to prepare skin for injection
    - Pre-operative skin preparation (with Alcohol-based iodine Compounds)
- Germicide**
  - Agent that destroy M.O. (Virucide, bactericide, Fungicide, sporicide, Tuberculocide)
  - Include disinfectants and antiseptics

	High level	intermediate level	Low level
<b>Vegetative bact.</b>	Kill	Kill	Kill most vegetative bact.
<b>T.B.</b>	Kill	Kill	No effect on T.B.
<b>Viruses</b>	Kill	Kill	Kill lipid enveloped and medium sized Viruses (HIV, HBV)
<b>Fungi</b>	Kill	Kill	Kill some fungi
<b>Spores</b>	Large number of Spores aren't affected	All spores aren't affected	No effect on Spores
<b>e.g.</b>	<ol style="list-style-type: none"> <li>OPA for endoscope</li> <li>H<sub>2</sub>O<sub>2</sub> for contact lens.</li> <li>Chlorine for blood spills.</li> </ol>	<ol style="list-style-type: none"> <li>Iodophores</li> <li>Isopropyl alcohol</li> </ol>	4ry NH <sub>4</sub> components ↓ Floor disinfection and food preparation areas

- Decontamination**
  - Reduction of pathogenic M.O.s to a level at which items are safe to handle
  - Include sterilization and all disinfection levels.
- Cleaning**
  - Removal of foreign material (organic or inorganic) from medical devices
  - Done with H<sub>2</sub>O and soap, detergents or enz. products
  - Must precede sterilization and disinfection

## Main methods of Disinfection

- 1 Chemical Disinfectants**
- 2 Boiling H<sub>2</sub>O**
  - 100°C for 20 min.
  - In emergencies if no sterilizer is available
- 3 Pasteurization (Of milk)**
  - 63°C for 30 min. or 72°C for 20sec
  - Followed by rapid cooling
  - Destroy imp. pathogens (Mycobacterium T.B., Brucella, Salmonella Coxiella)
- 4 Thermal disinfection**
  - Hot H<sub>2</sub>O & in special washing machines.
  - For linen, dishes, devices (can't withstand high temp.)
- 5 U.V. rays**
  - Artificially produced by mercury lamps
  - Have weak penetration power → used only for air and surface disinfection (GR)
  - Lab. Safety Cabinets

	1 Moist Heat (Steam) Sterilization	2 Dry Heat Sterilization	3 Low temp. sterilization methods	B) H <sub>2</sub> O <sub>2</sub> gas plasma	C) Peracetic acid sterilization XXXXX	(4 other sterilization methods)	A) Ionizing radiation	B) Filtration	C) Ozone XXXXX	D) formaldehyde Steam XXXXX	E) Infrared radiation
<b>N.B.</b>	Most Safe and Commonly used sterilization method ↓ Most widely used and most reliable	<b>3 forms</b> 1) Incineration → Dead animal bodies and inf. hospital wastes 2) Red heat → Wires, loops, forceps (Holding them in flame) 3) Hot air sterilizers (hot air oven)		Gas plasma is the 4 <sup>th</sup> state of matter (liquids, solids, gases, gas plasma)							
<b>Device</b>	<b>Autoclave</b> Boiling → 100°C 	• Hot air sterilizers (hot air oven)									
<b>Sterilizing Agent</b>	• Saturated (dry) steam under high pressure → Saturated = free of any residual air (acts as insulator and hinders penetration)	• Dry hot air									
<b>Principle</b>	• Saturated steam under pressure for specified exposure time and at specified temp. • 4 parameters → Steam Pressure, Time, Temp. • pressure → to high temp. needed to kill M.O.			• Gas plasma generated in closed chamber under deep vacuum using radio frequency or microwave E → excite gas molecules → Produce charged particles → FR			• By cobalt 60 (γ-rays) or e <sup>-</sup> accelerators (B rays)	1- Remove bact. from thermolabile pharmaceutical fluids (AB solutions, hormones, vitamins) → by passage through bact. memb. filters with pore size as small as 0.22 μm 2- Remove M.Os from Air supplied to critical areas as operating rooms, drug factories & lab. Safety Cabinet → Such filters are known as HEPA filters	• O <sub>3</sub> (ozone) Consists of O <sub>2</sub> + loosely bonded 3rd O atom → make ozone powerful oxidant → Destroy M.O.	• Low temp. Sterilization method → use of formalin which is vaporized to formaldehyde gas	
<b>Mechanism of killing</b>	• Moist heat → Coagulation + Denaturation of M.O. enz and structure ptns	• oxidation of microbial cell constituents.		1) FR interacts with cell components (enz., N.acids → disrupts metabolism of M.O.) 2) Direct inactivation by H <sub>2</sub> O <sub>2</sub>	• PAA: 1- Denature ptns wall 2- Disrupt cell wall 3- oxidizes ptns and enz. of microbes						
<b>Types, Time</b>	1) 121°C for 30 min. 2) 132°C for 4 min.	170°C for 60 min. 160°C for 120 min. 150°C for 150 min.	• Exposure time for 3-6 hours	• Total time 50 min.							
<b>Advantages</b>	1) Non Toxic 2) Inexpensive 3) Penetrates fabrics 4) rapidly heats	1) Non Toxic 2) Inexpensive 3) Used for materials damaged by moist heat (powders, petroleum products, Sharp instruments) 4) Non corrosive for metal and sharp instruments	• Used for items that can't be subjected to steam sterilization or dry heat sterilization.	• Used for medical materials and devices that can't tolerate high temp. and humidity → as: 1) Some plastics 2) Electrical devices 3) Corrosion susceptible metals	• Used to sterilize medical, surgical and dental instruments endoscopes, arthroscopes	• High penetration power → used for Sterilization of pre-packed heat sensitive items as: 1) Bone graft 2) Surgical Sutures 3) Disposable plastic syringes 4) gloves 5) Catheters 6) plastic petri-dishes	• Used for sterilization of items that can't be sterilized by other methods	• Used for years as drinking H <sub>2</sub> O disinfectant	• Used in health care facilities to sterilize heat sensitive medical equipments as: Mechanical ventilators & Incubators for neonates		
<b>Dis-advantages</b>	• Some items Can't withstand high temp. or humidity	1) Time Consuming 2) slow, and unequal rate of heat penetration 3) High temp. not suitable for most materials.	1) Expensive 2) Toxicity of the EO gas								
<b>Monitoring</b>	1) Mechanical indicators to monitor time, temp. and Pressure 2) Chemical indicators (integrators)  3) Biological indicators  Absence of bact. growth = efficient sterilization	• Biological indicators ↓ <b>Bacillus atrophaeus</b> (formerly B.subtilis)	• Biological indicators ↓ Bacillus atrophaeus (formerly B.subtilis)	• Biological indicators ↓ Geobacillus stearothermophilus (formerly Bacillus stearothermophilus)		• Biological indicators ↓ Bacillus pumilus	1- Serratia marcescens (endopigment producer) → test efficiency of bact. memb. filter 2- Spores of Aspergillus → test efficiency of HEPA filters				

Methods of sterilization

General Micro (15)  
The last board

