Sterilization

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2 nd stage

Medical microbiology I

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Lecture topics

- Definitions
- Methods of Sterilization

A- Physical methods

1- Heat
2- Filtration
3- Low temperatures
4- Desiccation
5- Osmotic pressure
6- Radiation

B- Chemical methods

Definitions

Sterilization : destruction or removal of all forms of microbial life, including bacterial spores

Disinfection : killing or removing of harmful vegetative microorganisms

Disinfectant : chemical substance used to achieve disinfection

Rao,2008

Definitions

Antiseptic: disinfectant that can be safely used on living tissues

Degerming: removal of microbes from a limited area (Alcohol swab)

Sanitization: treatment intended to lower microbial counts on eating and drinking utensils to safe public health levels

Rao,2008

Definitions

- **cide**: causes death of organism (homicide ,virucide , fungicide and germicide or bacteriocide)

- **static**: prevents or stops microbial growth (bacteriostatic , fungistatic and virustatic)

Contamination: presence of living microbes on object

Rao,2008

Definitions

Sepsis: indicates bacterial contamination (septicemia)

Asepsis: absence of significant contamination

Infection: presence of living multiplying microbes in host tissues and often pathogenic

Rao,2008

Multiple Choice Questions

1- Identify the correct definition of an antiseptic:

A-Chemicals that kill or prevent infection and damage living tissues

B-Chemicals that kill or prevent infection without damaging living tissues

C-Chemicals that can only kill or prevent infection on non-living tissues

D-Chemicals that can only kill or prevent infection on animal housing

2-Identify the term that describes a disinfectant that can kill bacteria:

A-Bactericidal

B-Bacteriostatic

C-Pathogenic

D-Bacteriosis

Methods of Sterilization

A- Physical methods

B- Chemical methods

Methods of Sterilization

A- Physical methods of microbial control

1- Heat
2- Filtration
3- Low temperatures
4- Desiccation
5- Osmotic pressure
6- Radiation

Methods of Sterilization

A- Physical methods of microbial control

1- Heat

Most important should be used whenever possible could be ;

1-1 Dry heat

- Kills microorganisms by destroying their oxidative processes
- Simple method is exposing item to be sterilized to the naked flame (**Application:- Bunsen burner used for sterilizing bacteriological loops, knives and blades**)
- Hot air oven expose items to 160 °C for one hour :
  has electric element in chamber as source of heat plus a fan to circulate air for even distribution of heat in chamber , used to sterilize items that are lacking water such as Metals and glassware

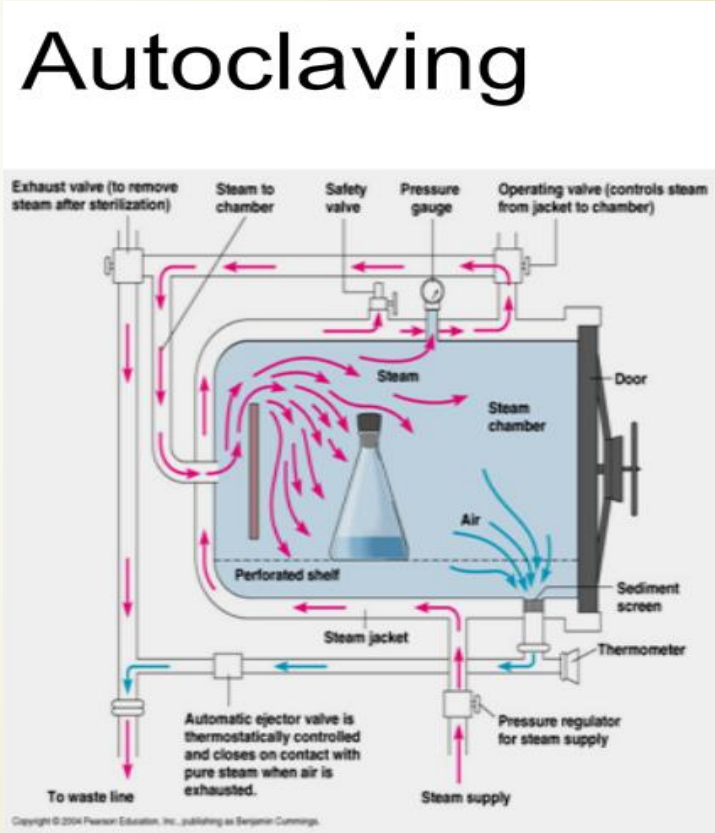
Methods of Sterilization

A- Physical methods of microbial control

1- Heat

1-2 Moist heat (e.g. in the autoclave at 121 or 134 °C for 10 or 15 minute

- Kills microorganisms by denaturating proteins
- The equipment is called **Autoclave** and it works under the same principle as the pressure cooker where water boils at increased atmospheric pressure
- The **Autoclave** is a tough double walled chamber in which air is replaced by pure saturated steam under pressure

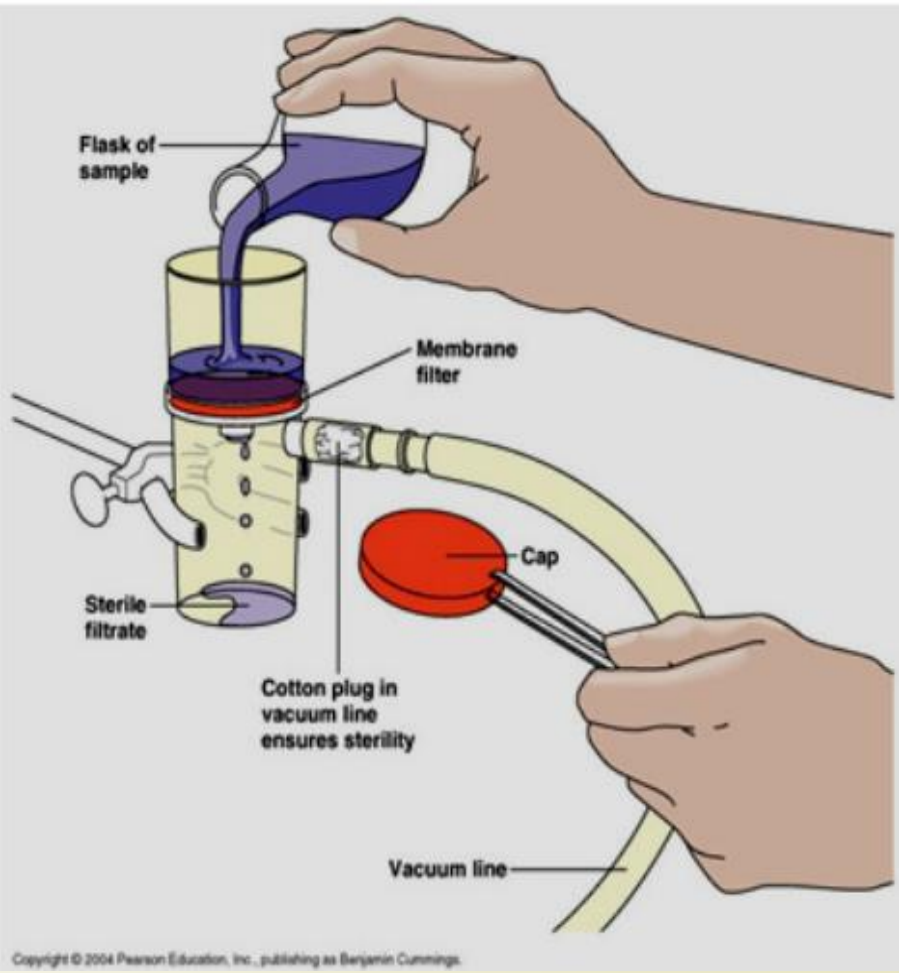


Methods of Sterilization

A- Physical methods of microbial control

2- Filtration

- May be done under either negative or positive pressure. Best known example is the membrane filter made from cellulose acetate (size of pores 0.01µm- 0.1 mm). Generally removes most bacteria but viruses and some small bacteria e.g. ***Chlamydias*** & ***Mycoplasmas*** may pass through.



Bacteria 0.22 µm- 0.45 µm

Methods of Sterilization

A- Physical methods of microbial control

3- Low temperature

- ❑ Refrigeration

✓ Bacteriostatic

✓ Slow freezing more harmful to bacteria than rapid

Methods of Sterilization

A- Physical methods of microbial control

4- Desiccation

- ✓ Absence of water
- ✓ Microorganisms cannot grow but still survive
- ✓ Re-introduce water microorganisms resume growth and division
- ✓ Effectiveness varies between organisms :-
- ***Neisseria*** withstand dryness for one hour
- ***Mycoplasma*** withstand dryness for months
- ***Endospores*** remain for centuries

Methods of Sterilization

A- Physical methods of microbial control

5- Osmotic pressure

- ✓ High concentration of salt and sugar
- ✓ Creates hypertonic environment
- ✓ Water leaves microbes
- ✓ Molds and yeasts can grow better than bacteria in high osmotic pressure or low moisture

Methods of Sterilization

A- Physical methods of microbial control

6- Radiation

- **U.V. light**

Has limited sterilizing power because of poor penetration into most materials. Generally used in irradiation of air in certain areas (operating rooms & tuberculosis labs)

- **Ionizing radiation**

e.g. Gamma radiation has greater energy than U.V. light, therefore more effective used mainly in industrial facilities , used for sterilization of disposable plastic syringes, gloves and petri dishes

Multiple Choice Questions

3- The absence of all forms of microbial life, including spores, is know as

A- Sanitization

B- Disinfection

C- Decontamination

D- sterility

4- The three parameters of steam sterilization are

A- Steam under pressure, time and temperature

B- Time, temperature, and concentration

C- Temperature, time, and humidity

Methods of Sterilization

B- Chemical methods of microbial control

Some strong chemical substance may be used to achieve sterilization in hospital used e.g. Gluteraldehyde , Ethylene Oxide (Eto) and formaldehyde

Factors influencing activity of disinfectants

1- Proper dilution

2- may be inactivated by :-

- Dirt
- Organic matter : proteins , pus, blood, mucus and feces
- non organic : Cork and some plastics

3- Time : disinfectants need time to work

Methods of Sterilization

B- Chemical methods of microbial control

Factors influencing activity of disinfectants

4- Range of Action : disinfectants not equally effective against the whole spectrum of microbes. e.g. **Chlorhexidine** less active against Gm –ve than Gm +ve cocci

Hypochlorites is more active against hepatitis viruses than most other disinfectants

What are the major methods of sterilization?

Summary

Sterilization method	Advantages	Disadvantages	Common uses
Steam(autoclave)	Cost effective Short cycle times	High temperature High moisture levels	Dental, medical, sterile processing, Laboratory, pharmaceutical, small clinics and more
Dry heat	Relatively low cost Ideal for moisture sensitive items	Long cycle duration	Small clinics, metals, ceramics
Filtration	Used for sterilizing gases and liquids	Does not differentiate between viable and non viable particles	Heat sensitive injections, solutions and air (venting systems)
Radiation	High penetration power	Expensive can produce undesirable changes in irradiated products	Industrial sterilization of heat sensitive products, biomedical devices

Summary

Sterilization method	Advantages	Disadvantages	Common uses
Eto	High efficiency Large sterilizing volume	Mutagenic carcinogenic excessively long cycle	Rubber and endoscopes
formaldehyde	After sterilization most loads are available for immediate use	Long cycle duration	Endoscopes

Thank you for your attention