



SNS COLLEGE OF ALLIED HEALTH SCIENCES

SNS Kalvi Nagar, Coimbatore - 35

Affiliated to Dr MGR Medical University, Chennai



DEPARTMENT OF PHYSICIAN ASSISTANT

COURSE NAME : CLINICAL MICROBIOLOGY

TOPIC : STERILIZATION AND DISINFECTION



CHEMICAL METHODS OF DISINFECTION



- Disinfectants - chemicals that destroy pathogenic bacteria from inanimate surfaces.
- Some chemical have very narrow spectrum of activity and some have very wide.
- **ALCOHOLS:**
- **Mode of action:** Dehydrate cells, disrupt membranes and cause coagulation of protein.
- **Examples:** Ethyl alcohol, isopropyl alcohol and methyl alcohol
- **Application:** A 70% aqueous solution is more effective at killing microbes than absolute alcohols. 70% ethyl alcohol (spirit) is used as antiseptic on skin.
- Isopropyl alcohol is preferred to ethanol. It can also be used to disinfect surfaces. It is used to disinfect clinical thermometers.
- Methyl alcohol kills fungal spores, hence is useful in disinfecting inoculation hoods.
- **Disadvantages:** Skin irritant, volatile (evaporates rapidly), inflammable



ALDEHYDES



- **Mode of action:** Acts through alkylation of amino-, carboxyl- or hydroxyl group, and probably damages nucleic acids. It kills all microorganisms, including spores.
- **Examples:** Formaldehyde, Gluteraldehyde
- **Application:** 40% Formaldehyde (formalin) is used for surface disinfection and fumigation of rooms, chambers, operation theatres, biological safety cabinets, wards.
- Achieved by boiling formalin with paraformaldehyde or potassium permanganate.
- 2% gluteraldehyde - sterilize thermometers, cystoscopes, bronchoscopes, centrifuges, anesthetic equipments etc.
- 2% formaldehyde at 40oC for 20 minutes is used to disinfect wool.
- **Disadvantages:** Vapors are irritating (must be neutralized by ammonia), has poor penetration, leaves non-volatile.



PHENOL



- **Mode of action:** Act by disruption of membranes, precipitation of proteins and inactivation of enzymes.
- **Examples:** 5% phenol, 1-5% Cresol, 5% Lysol, chlorhexidine, chloroxylenol - Dettol
- **Applications:** Act as disinfectants at high concentration and as antiseptics at low concentrations. They are bactericidal, fungicidal, mycobactericidal but are inactive against spores and most viruses.
- Chlorhexidine can be used in an isopropanol solution for skin disinfection, or as an aqueous solution for wound irrigation. It is often used as an antiseptic hand wash.
- 20% Chlorhexidine gluconate solution is used for pre-operative hand and skin preparation and for general skin disinfection.
- **Disadvantages:** It is toxic, corrosive and skin irritant. Chlorhexidine is inactivated by anionic soaps.



HALOGENS

- **Mode of action:** They are oxidizing agents and cause damage by oxidation of essential sulfydryl groups of enzymes.
- Chlorine reacts with water to form hypochlorous acid, which is microbicidal.
- **Examples:** Chlorine (chlorine, hypochlorite) and iodine (tincture iodine, iodophores)
- **Applications:** Tincture of iodine (2% iodine in 70% alcohol) is an antiseptic.
- For hand washing iodophores are diluted in 50% alcohol.
- 10% Povidone Iodine is used undiluted in pre and postoperative skin disinfection.
- Chlorine - used to bleach water, conc. chlorine - used to disinfect swimming pools.
- 0.5% sodium hypochlorite is used in serology and virology.
- **Disadvantages:** They are rapidly inactivated in the presence of organic matter. Iodine is corrosive and staining.



HEAVY METALS



- **Mode of action:** Act by precipitation of proteins and oxidation of sulfydryl groups.
- They are bacteriostatic.
- **Examples:** Mercuric chloride, silver nitrate, copper sulfate, organic mercury salts
- **Applications:** 1% silver nitrate solution can be applied on eyes as treatment for ophthalmia neonatorum or neonatal conjunctivitis
- Copper salts are used as a fungicide.
- **Disadvantages:**
- Mercuric chloride is highly toxic, are readily inactivated by organic matter.



SURFACE ACTIVE AGENTS



- **Mode of actions:** These compounds have long chain hydrocarbons that are fat soluble and charged ions that are water-soluble
- They disrupt membrane resulting in leakage of cell constituents.
- **Examples:** These are soaps or detergents. Detergents can be anionic or cationic. Detergents containing negatively charged long chain hydrocarbon are called anionic detergents. These include soaps and bile salts.
- If the fat-soluble part is made to have a positive charge by combining with a quaternary nitrogen atom, it is called cationic detergents - Cetrimide and benzalkonium chloride
- **Application:** They are active against vegetative cells, Mycobacteria and enveloped viruses.
- **Disadvantages:** Their activity is reduced by hard water, anionic detergents and organic matter.



DYES



- **Mode of action:** Acridine dyes are bactericidal.
- **Examples:** Aniline dyes such as crystal violet, malachite green and brilliant green.
Acridine dyes such as acriflavin and aminacrine.
- A related dye, ethidium bromide, is also germicidal. It intercalates between base pairs in DNA. They are more effective against gram positive bacteria than gram negative bacteria.
- **Applications:** They may be used topically as antiseptics to treat mild burns.
- They are used as paint on the skin to treat bacterial skin infections.



HEAVY METAL IONS



- **Mode of action:** Used as preservation for sera, bacterial and viral vaccine
- **Examples:** Metallic salts – Mercury and silver nitrate
- **Applications:**
- Mercuric salt e.g. Mercuric iodine.
- Silver salt e.g. AgNO_3 (1%) used as eye drop for newborn infants to prevent infections by *Neisseria gonorrhoea*.



HYDROGEN PEROXIDE



- **Mode of action:** It acts on the microorganisms through its release of hydroxyl-free radical that damages proteins and DNA.
- **Application:** It is used at 6% concentration to decontaminate the instruments, equipments such as ventilators.
- 3% Hydrogen Peroxide Solution is used for skin disinfection and deodorising wounds and ulcers.
- **Disadvantages:** Decomposes in light, broken down by catalase, proteinaceous organic matter drastically reduces its activity.



ETHYLENE OXIDE (EO)

- **Mode of action:** It is an alkylating agent. It acts by alkylating sulfydryl-, amino-, carboxyl- and hydroxyl- groups.
- **Properties:** It is a cyclic molecule, which is a colorless liquid at room temperature. It has a sweet ethereal odor, readily polymerizes and is flammable.
- **Application:** It is a highly effective chemosterilant, capable of killing spores rapidly. Since it is highly flammable.
- It is used to sterilize heat labile articles such as bedding, textiles, rubber, plastics, syringes, disposable petri dishes, complex apparatus like heart-lung machine, respiratory and dental equipments.
- **Disadvantages:** It is highly toxic, irritating to eyes, skin, highly flammable, mutagenic and carcinogenic.



Assessment



1. List of chemicals used for sterilization?
2. Role of Alcohol as disinfectants?
3. Applications of Aldehydes?
4. Mode of action of H_2O_2 ?
5. Mention the names of the dyes used for sterilization?



Thank You