DISINFECTANTS

A disinfectant is a chemical agent, which destroys or inhibits growth of pathogenic microorganisms in the non-sporing or vegetative state.

Disinfectants do not necessarily kill all organisms but reduce them to a level, which does not harm health or the quality of perishable goods.

Disinfectants are **applied** to inanimate objects and materials such as instruments and surfaces to control and prevent infection.

They may also be used to disinfect skin and other tissues,are called as ANTISEPTICS

ANTISEPTICS -An antiseptic is a type of disinfectant, which destroys or inhibits growth of micro-organisms on living tissues without causing injurious effects when applied to surfaces of the body or to exposed tissues.

Some antiseptics are applied to the unbroken skin or mucous membranes, to burns and to open wounds to prevent sepsis by removing or excluding microbes from these areas.

Example :- Iodine has been modified for use as an antiseptic.

1. The iodophore, polyvidone-iodine , is effective against bacteria, fungi, viruses, protozoa, cysts and spores and significantly reduces surgical wound infections.
2. The solution of polyvidone-iodine releases iodine on contact with the skin.
3. Chlorhexidine has a wide spectrum of bactericidal and bacteriostatic activity and is effective against both Grampositive and Gram-negative bacteria although it is less effective against some species of Pseudomonas and Proteus and relatively inactive against mycobacteria.

Types of Disinfectants:-

1. Air disinfectants
2. Alcohols
3. Aldehydes
4. Oxidizing agents
5. Peroxy and peroxo acids
6. Phenolics
7. Quaternary ammonium compounds
8. Inorganic compounds
9. Terpenes
10. Other- non- chemical or herbal agents.

Air disinfectants- chemical substance capable of disinfecting microorganism suspended (flooting) in air, use to control aseptic like laboratory

Alcohols

Ethyl or isopropyl at a concentration of 50-70% are used for some surfaces where a rapid evaporation of the chemical and leaving no residue may be important, such as on laboratory equipment, etc. Alcohols are low in sporocidal activity and must remain wet on the surface for several minutes to achieve any reasonable disinfection.

Additionally, high-concentration mixtures(80% ethanol+5%isopropanol) are required to effectively inactivate lipid-enveloped viruses(such as HIV, hepatitis B, hepatitis C).

Aldehydes

Glutaraldehyde.

Glutaraldehyde is an important dialdehyde that has found usage as a disinfectant and sterilant, in particular for low-temperature disinfection and sterilization of endoscopes and surgical equipment and as a fixative in electron icroscopy.

Glutaraldehyde has a broad spectrum of activity against bacteria and their spores, fungi, and viruses. But Glutaraldehyde can increase the chance of asthma hence, Ortho-phthalaldehyde is replacing glutaraldehyde.

Formaldehyde is an extremely reactive chemical that interacts with protein DNA and RNA in vitro. It has long been considered to be sporicidal by virtue of its ability to penetrate into the interior of bacterial spores The interaction with protein results from a combination with the primary amide as well as with the amino groups, although phenol groups bind little formaldehyde It has been proposed that formaldehyde acts as a mutagenic agent and as an alkylating agent by reaction with carboxyl, sulfhydryl, and hydroxyl groups

Oxidizing agents-

1. Oxidizing Agents by oxidizing the cell membrane the of microorganism,which results in aloss of structure and leads to cell lysis and death. Chlorine and oxygenare strong oxidizers.
2. Electrolyzed Water or Anolyte
3. Hydrogen peroxide
4. Hydrogen peroxide vapour
5. Ozone
6. Potassium permanganate

This group includes: halogens like iodine and oxidising agents like peracetic acid, such as schülke's sporicidal perform Concentrate PAA, chemical containing oxygen deposits like

perform® Concentrate OXY (available in single-use sachets) and hydrogen peroxide. Concentrate OXY has an excellent material compatibility and does not damage most surfaces.

Ozone-. Ozone can be used as a chemical disinfectant to kill bacteria and viruses with low ozone concentrations**.**

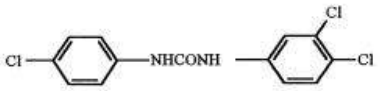
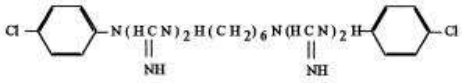
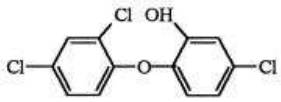
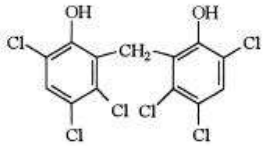
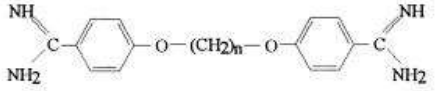
Ozone Generator- Ozone and ozone generators are used in a wide range of air treatment.

Ozone Benefits

1. Over 50% more efficient at breaking through bacteria membranes compared to chlorine
2. Eliminates a wide range of bacteria over 3000 times faster than chlorine
3. Potent disinfectant at low concentrations
4. Decomposes into oxygen gas leaving no by-products
5. FDA-approved for direct contact with food
6. Extends shelf life of most food products
7. Efficient odor, taste and color remover
8. Easily and economically produced at point of use
9. Easily detectable at low concentrations by humans, thereby safe to manage.

Peroxy and peroxo acids- inorganic peroxo acids

Peroxyformic acids
Peracetic acids
Peroxypropionic acids
Monoperoxyglutaric acid
Monoperoxysuccinic acid
Peroxybenzoic acid.

Alcohols	Ethanol	$CH_3 — CHOH$	Antisepsis
	Isopropanol	$CH_3 \diagdown \diagup CHOH$ $CH_3 \diagup$	Disinfection
			Preservation
Aldehydes	Glutaraldehyde	$OH — CCH_2CH_2CH_2C — HO$	Disinfection
	Formaldehyde	$H — C — HO$	Sterilization
			Preservation
Anilides	General structure	$C_6H_5.NH.COR$	Antisepsis
	Triclocarban		
Biguanides	Chlorhexidine		Antisepsis
			Antiplaque agents
	Alexidine, polymeric biguanides		Preservation
			Disinfection
Bisphenols	Triclosan		Antisepsis
			Antiplaque agents
	Hexachlorophene		Deodorants
			Preservation
Diamidines	Propamidine		Antisepsis
			Preservation
	Dibromopropamidine		

Summary of mechanisms of antibacterial action of antiseptics and disinfectants

Cell envelope (cell wall, outer membrane)	Glutaraldehyde	Cross-linking of proteins
	EDTA, other permeabilizers	Gram-negative bacteria: removal of Mg^{2+}, release of some LPS
Cytoplasmic (inner) membrane	QACs	Generalized membrane damage involving phospholipid bilayers
	Chlorhexidine	Low concentrations affect membrane integrity, high concentrations cause congealing of cytoplasm
	Diamines	Induction of leakage of amino acids
	PHMB, alexidine	Phase separation and domain formation of membrane lipids
	Phenols	Leakage; some cause uncoupling
Cross-linking of macromolecules	Formaldehyde	Cross-linking of proteins, RNA, and DNA

Phenolics-

O-phenylphenol less corrosive he phenol

Chlorhexidine.agent used in dettol

Chlorhexidine is probably the most widely used biocide in antiseptic products, in particular in handwashing and oral products but also as a disinfectant and preservative. This is due in particular to its broad-spectrum efficacy, substantivity for the skin, and low irritation. Of note, irritability has been described and in many cases may be product specific.

Quaternary ammonium compound- BenzalKonium chloride are a large group of related compounds

Ammonium at or above 200ppm plus Alcohol solution exhibit efficancy against difficult to kill non-enveloped viruses such as norovirus,or Polio virus.

Inorganic compound

Chlorine – hypochlorite or hypochlorous acid, chloramines,chlorine dioxide.

Iodine

Acids – Sulfurous acids,sulfur dioxide

Bases –Potassium hydroxide **,**Sodium hydroxide

Terpenes

Thymol

Pine oil

Type of antiseptics:-

1. **Alcohol Antiseptics**

   Alcohol antiseptics are generally composed of isopropyl or methyl alcohols. They are commonly used to sterilize hard surfaces such as medical tools at hospitals. Medical personnel also use alcohol gels as hand sanitizers in order to prevent the spread of disease.

2. ***Chlorhexidine Antiseptics***

   Chlorhexidine is used in both oral and skin cleansing products. According to the FDA Professional Drug Information database, chlorhexidine is the active ingredient in prescription mouthwashes such as Peridex. Chlorhexidine antiseptics can be used as a topical treatment applied either directly onto wounds or to unbroken skin before surgery in order to proactively prevent infection.

3. **Idophor Antiseptics**

   Idophor antiseptics are usually applied as a topical treatment to unbroken skin or mucus membranes in order to prevent infection before surgery. The Infection Control Services website lists the most well known idophor product as Betadine.

4. **Peroxygen Antiseptics**

   A common peroxygen antiseptic, hydrogen peroxide, can be found in many households. Known for its trademark bubbling reaction to blood and damaged cells, hydrogen peroxide is used to cleanse wounds and disinfect skin. It can also be used as a gargle or mouthwash.

Phenol Antiseptics

Phenol antiseptics are used primarily as skin disinfectants and can be found in medicated soaps and scrubs. In addition, phenol can also be used in mouthwashes and throat lozenges.

Quaternary Ammonium Compound Antiseptics

"Quats," as they are commonly abbreviated, are a group of chemicals used in antiseptics commonly used to sterilize the skin before surgery. They can also be used for irrigation or as a preservative in eye drops.

Table ... Mechanisms, Active Chemical Composition, and Antimicrobial Action of antiseptics/disinfectants

Target	Disinfectant/Antiseptic	Mechanism (s) of Action
Cell envelope (cell wall, outer membrane)	Glutaraldehyde	Cross-linking of proteins
	EDTA, other permeabilizers	Gram-negative bacteria: Removal of Mg^{2+}, release of some LPS
Cytoplasmic (inner) membrane	Quaternary ammonium compounds (QAC's)	Generalized membrane damage involving phospholipid bilayers
	Chlorhexidine	Low concentrations affect membrane integrity, high concentrations cause congealing of cytoplasm
	Diamines	Induction of leakage of amino acids
	Polyhexanide (polyhexamethylene biguanide PHMB), Alexidine	Phase separation and domain formation of membrane lipids
	Phenols	Leakage; some cause uncoupling
Cross-linking of macromolecules	Formaldehyde	Cross-linking of proteins, RNA and DNA
	Glutaraldehyde	Cross-linking of proteins in cell envelope and elsewhere in the cell
DNA intercalation	Acridines	Intercalation of an acridine molecule between two layers of base pairs in DNA
Interaction with thiol groups	Silver Compounds	Membrane-bound enzymes (interaction with thiol groups)
Effects on DNA	Halogens Hydrogen peroxide, silver ions	Inhibition of DNA synthesis DNA strand breakage
Oxidizing agent	Halogens	Oxidation of thiol groups to disulfides, sulfoxides, or disulfoxides
	Peroxygens	Hydrogen peroxide; Activity due to from formation of free hydroxyl radicals (OH), which oxidize thiol groups in enzymes and proteins; PAA: Disruption of thiol groups in proteins and enzymes.