

## Antiseptic and Disinfectant

**Germicide:** the chemical used for the purpose of non-selective killing or inhibiting growth of microbes (bacteria, virus, fungi and protozoa) on contact are called germicide.

Germicides are of two types:

- a. Antiseptic: are the germicide applied on living surface
- b. Disinfectant: are usually applied to the surface of inanimate objects and eliminate all pathogenic microorganisms excluding spores.

### **Properties of Ideal disinfectant:**

1. It should be chemically stable, cheap, and readily available.
2. It should have antibacterial activity (preferable cidel) against all pathogen.
3. It should be effective against spores.
4. It should be active in the present of blood, pus, tissue exudates.
5. It should be non-irritating, non-allergic, non-staining and noncorrosive.
6. It should be compatible with water.
7. it should be able to penetrate crevices, cavities and film of organic matter.

### **Mechanism of action of disinfectants**

- a. Oxidation of microbial protoplasm: oxidizing agents: halogen and halogen derivative.
- b. De-naturation of microbial protein or enzyme: phenol derivatives, metal and alcohol.
- c. Interfere in permeability of microbial membrane: detergents.

### **Classification of antiseptic/ disinfectant:**

1. Phenol derivatives: phenol, cresol, resorcinol.
2. Oxidizing agents: pott. Permagnate, hydrogen peroxide.
3. Halogen: iodide, iodophore, chlorine, chloride.
4. Biguanides: chlorhexidine(savlon)
5. Soap (anionic detergent): sodium and potassium salts
6. Alcohol: ethanol, isopropanol.
7. Aldehyde: formaldehyde, glutaraldehyde.
8. Acid: boric and acetic acid
9. Dye: gentian violet, acriflavin, proflavin, gentian volet, scarlet red, brilliant green.
10. Furan derivative: nitrofurazone

**Phenol derivative:** used as antiseptic and disinfectant. In 2-5% of aqueous solution phenol is used as antibacterial and antiviral and antifungal disinfectant. This can be enough to kill microbacterium and anthrax spores. They are mainly used as disinfectant of equipment or organic matter. It is irritating, corrosive and cause systemic toxicity.

Phenol is first disinfectant and antiseptic used by Joseph Lister. Phenol and its derivative are active against cytoplasmic membrane of bacteria. They denature protein and act as cytoplasmic poison. In viruses they damage viral lipid. Phenol and cresol is toxic to dog and cat so should not be used to disinfect kennel and cat cages. Chloroxylenol (Dettol) is phenolic compound highly toxic to cat. They should not used for disinfection of objects coming in contact to cats.

**Oxidizing agents:** they are short acting germicide acts by releasing nascent oxygen which oxidized bacterial protoplasm. Three percent solution of hydrogen peroxide used to clear the pus and debris from wounds. It is also used for sterilization of dental and surgical instrument. Potassium permagnate has broad spectrum antimicrobial action against (bacteria, fungus, and virus). A 1:5000 solution is used as antiseptic for irrigation of mucous membrane and wound. It stains the tissue and promotes rusting.

**Halogen:** these are used as topical antimicrobial agent. They bind with protoplasm and oxidize protein and interfere with vital metabolic function of microbe. Iodine is effective in present of organic matter; it can kill vegetative and sporulating bacteria. It is highly active when dissolved in alcohol to produce tincture. Weak solution of iodine or tincture iodine (2% iodine and 2.5% pott. Iodide in water or alcohol) is extensively used as skin antiseptic or disinfectant in conditions like dressing of umbilical cord, dressing of excised wound and pre and post operative sterilization of site. A weak solution (0.25%) of iodine used as a urine and vaginal douche in metritis and vaginitis in cattle. Chlorine is potent broad spectrum antimicrobial agent kills most pathogen including bacteria, virus, or protozoa. Chlorine is effective against most organisms at the concentration of 0.1 to 0.25 ppm. It is generally used as disinfectant for water supply. Acid fast microorganism and spores are resistant for chlorine.

**Biguanides:** chlorhexidine is a non irritating, powerful antiseptic synthetic cationic biguanide which is widely used as topical antiseptic and wound cleansing agent. It kills bacteria by disrupting the cell membrane and precipitating cell contents. It has sustained residual effect and efficacy is not much affected by blood, pus, necrotic tissue, and other organic matter.

**Soap:** are anionic detergents with general formula  $R-COO-Na/K$ , where R is the fatty acid such as oleate. Soaps are generally used to scrub hands and operation sites. Soaps are effective against gram positive organism and acid fast organism. Soaps are generally used to scrub hands and operation sites and re effective in acidic conditions. Quarternary ammonium compounds are example of cationic surfactants with germicidal activity

**Alcohol:** these are common antiseptic and disinfectant. They cause coagulation of protein and reduction of surface tension and also act as dehydrating agent. Alcohols are used in 50-70% concentration for skin antiseptic and disinfection for clinical thermometer. It is poor disinfectant of instrument and promotes rusting. Ethyl alcohol is more effective as an antiseptic agent than disinfectant agent. On open wound it causes burning sensation. Ethyl alcohol is most effective when diluted with water to a final concentration of 70% by weight. Solutions of greater or lesser concentration have less antiseptic activity. Its activity has reduces in the presence of organic matter and ineffective on spores.

**Aldehyde:** formaldehyde is used in solution or gaseous form. Aqueous 38-40% (W/V) formaldehyde containing 10% methanol is known as formaline. Formaldehyde is potent disinfectant when used in 4-10% aqueous solution, generally 3-8% aqueous solution of formaldehyde is commonly used as disinfectant. . Its action is not affected by organic matter. It can kill almost all bacteria, spore and virus. it denatures the protein and a general protoplasmic poison. Commercially available formaldehyde solution called formaline, contains app 37% formaldehyde gas in water usually with 10-15% methanol

added to prevent polymerization. Glutaraldehyde show action similar to that of formaldehyde is less pungent and irritating is used to sterilize surgical instrument, endoscopic instrument and plastic and rubber apparatus.

**Acid:** Inorganic acids are potent bacteriocides. They destroy microorganisms mainly by liberating H<sup>+</sup> ion. H<sup>+</sup> ion is bacteriostatic at pH 3-6 and bactericidal at pH <3. Strong acids have corrosive action that limits their usefulness. Boric acid is a weak antiseptic and nonirritating to delicate tissues. Its 2-4% aqueous solution is used as a topical antiseptic in the eye infection and as mouth wash. In the form of boroglycerine (31%W/V) is used for treating FMD lesions. The systemic absorption of boric acid can cause vomiting diarrhea and kidney damage.

Organic acid like acetic acid are used in surgical dressing (1%), irrigation of urinary tract (0.25%), treat otitis externa (2-5%) and to treat burn wounds (5%). Benzoic and salicylic acid are used in dermatological preparations (as whitefield ointment) as fungicidal and keratolytic agents.

**Dye :** Acriflavine, proflavine belongs to the category of acridine dyes. They are more commonly used as antiseptic and more effective against gram positive bacteria. Acriflavin exists as an orange red crystalline powder that is soluble in water. The bandage and gauze are impregnated with acriflavine jelly are extensively used for the treatment of chronic ulcers and burn dressing.

Azo dyes like scarlet red, phenozopyridium HCl are effective against gram negative organisms particularly in acidic medium. Scarlet red is commonly used as 5% ointment on sores, chronic ulcers and wounds.

Gentian violet and brilliant green are the example of Rosaniline dyes. Gentian violets possess antiseptic and antifungal activities. It is more active against gram positive bacteria including staphylococci; acid fast bacteria and gram negative organisms are resistant.

**Nitrofurazone:** a nitrofuran derivative is bacteriocidal to both gram positive and gram negative, aerobic and anaerobic bacteria; acts by inhibiting enzyme of carbohydrate metabolism in bacteria. Its activity is reduced in the presence of serum. It is highly efficacious topically as 0.2% cream in burns and skin infections.