

# DISINFECTION

A hand wearing a yellow nitrile glove is shown from the left, holding a blue spray bottle. The hand is spraying a fine mist of blue liquid towards a large, dense cluster of blue, rod-shaped bacteria on the right side of the image. The background is a light, neutral color.

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## Definition

- It is the process of killing of infectious agent outside the body by direct exposure to chemical or physical agent.
- or
- Disinfection means Killing the germs of infection and the insects or organism carrying infection.

## Disinfectants:

- It is a substance which destroys harmful microbes (not usually the spores) with the object of preventing transmission of disease. These are suitable for application only to inanimate objects.
- Objective of using Disinfectant: Preventing the transmission of disease
- Also known as Germicide

# Detergent

- It is a surface cleaning agent which acts by lowering surface tension.

Example- soap which removes bacteria along dirt.

## Antiseptic

- It is a substance which destroys or inhibits the growth of microorganisms. Antiseptics are suitable for application to living tissues.

# Deodorant

- It is a substance which suppresses or neutralizes bad odors.
- E.g. lime and bleaching powder.

# Sterilization

- It is the process of destroying all life including spores. This is widely used in medical practice.
- Joseph Lister first used carbolic acid as an antiseptic in 1865 and published his work in 1867, which considered as the Antiseptic era. This resulted in aseptic practices in patient care. Joseph Lister is called as Father of Antiseptic surgery.

# Types of Disinfection

- There three types of disinfection
  1. Precurrent Disinfection/ Prophylactic Disinfection
  2. Concurrent Disinfection
  3. Terminal Disinfection



## Precurrent Disinfection/ Prophylactic Disinfection

- Example –

1. chlorination of water,
2. pasteurization of milk ,
3. sterilization of vaccines,
4. scrubbing and washing hands before surgery and after examination the patient, sterilization of the instruments before using for surgery.

## Precurrent Disinfection/ Prophylactic Disinfection

- This is carried out as preventive measure, to prevent the onset of disease.
- The ultimate objective of the disinfection procedure is to prevent the onset of the disease and to prevent its further spread among the subsequent occupants.

## Concurrent Disinfection/ Concomitant disinfection

- The application of disinfective measures as soon as possible after the discharge of infectious materials from the body of an infectious person.
- Disinfection is done when a person is ill is known as Concurrent Disinfection.
- Aim: To prevent the spread of infection.
- or this disinfection is done after the soiling of articles with infectious discharges

## Concurrent Disinfection/ Concomitant disinfection

- Example: Disinfection of urine, feces, vomit, contaminated linen, clothes, hands, dressings, aprons, gloves etc throughout the course of an illness.
- Disinfection of all the objects used by the person throughout the course of an illness.

## Terminal Disinfection

- It is the application of disinfective measures after patient has been removed by death or to a hospital or has ceased to be source of an infection.
- Terminal disinfection is done after death, recovery or removal of a patient.
- This includes not only all the articles left behind in the ward by the patient, but also includes disinfection of walls, furniture, curtains, etc. of the ward, so that no germs of infection remains.

# Methods of Disinfection

- Mainly three methods or agents used
  - ❖ Natural methods
  - ❖ Physical Methods
  - ❖ Chemical Methods

## Natural methods/ Agents of Disinfection

- a) **Sunlight**: - The UV rays of sunlight are particularly lethal to bacteria and some virus. Articles such as linen, bedding, and furniture may disinfect by exposure to direct sunlight for several hours.
- b) **Air**: - Exposure to open air acts by drying or evaporation of moisture which is lethal to most bacteria.

# Physical Methods/ Agents of Disinfection

- Burning
- Hot air
- Boiling
- Autoclaving
- Radiation



# 1. Burning

- It is an excellent method of disinfection articles like dressings, rags, swabs, faces, can be disposed by burning.
- Sawdust, paper, kerosene, or other combustible material, can be used as aids in burning.
- Burning should not be done in open air; it is best done in the incinerator.

## 2. Hot air

- Glassware, syringe, swabs, dressings, French chalk, oils, Vaseline and sharp instruments can sterilize by using hot air.
- The temperature should maintain in hot air oven is in between 160 – 180 0C.

### 3. Boiling

- Boiling is an effective method of Disinfection. Boiling for 5-10 minutes (rolling boil), kill the bacteria, but not spores or virus. Boiling is useful for disinfection of small instruments; tools which are not used for subcutaneous insertion, linen, and rubber goose such gloves.
- Drawback:- It is a slow process and unsuitable for thick and woolen material as they shrink.

## 4. Autoclaving

- Sterilizers which operates at high temperatures ( in excess of 100 degree) and pressure are called Autoclaves. They generate steam under pressure, which is the most effective sterilizing agent.
- Autoclaves fall in to two categories -
  1. Single chambered
  2. Double chambered.
- Autoclaves work on the same principle as the domestic pressure cooker.
- Autoclaving is widely used in hospital and laboratory practice. It destroys all forms of life, including spores. Autoclaving is most effective method for sterilization of linen, dressing, gloves, springs, certain

## 5. Radiation

- Ionizing radiation is being increasingly used for sterilization of bandages, dressing, catgut, and surgical instruments.
- The objects to be sterilized are placed in plastic bags before radiation. Ionizing radiation has great penetrating powers with little or no heating effect.
- This method is most effective but very costly.

# Chemical Methods/ Agents of Disinfection

- Articles which cannot be sterilized by boiling or autoclaving may be immersed in disinfectants.
- Chemical disinfectants can be grouped as follows:
  1. Phenol and related compounds (liquid disinfectants)
  2. Quaternary ammonia compounds
  3. Halogens and their compounds (solid disinfectants)
  4. Alcohols
  5. Formaldehyde
  6. Oxidizing agents
  7. Metals as microbicides
  8. Lime

## 1. Phenol and related compounds (liquid disinfectants)

- **a. Phenol:**- pure phenol or carbolic acid is the best known member of this group. It is having germicidal effect.
- **b. Crude phenol:** - commonly used phenol is known as 'Crude phenol', which is a mixture of phenol and cresol. It is dark oily liquid. It is effective against gram negative and gram positive bacteria, but only slowly effective against spores and acid fast bacteria. In 5 percent strength, it may be used for mopping floors and cleaning drains. Aqueous solution of 0.2

- **c. Cresol:** - It is an excellent coal- tar disinfectant. It is 3 to 10 times as powerful as phenols, yet no more toxic. Cresol is best used in 5 – 10 % strength for disinfection of faeces and urine. Cresol is an all purpose general disinfectant.
- **d. Cresol emulsions** - Cresol emulsifies with soap is known as "Saponified cresol" Lysol, izal and cyllin are cresol emulsions. Lysol contains 50.60.1 Cresol. They are very powerful disinfectants.



- **e. Chlorhexidine:-** This is one of the most useful skin antiseptics. It is soluble water and alcohol. Creams and lotions containing 1 percent chlorhexidine recommended for burns and hand disinfection. It is highly active against Gram + organism.
- **f. Hexachlorophene:-** This antiseptic is highly effective against Gram positive organisms. It is Slow in action, but shows a cumulative effect on the skin and is compatible with soaps, it may be incorporated in soap preparations without loss of activity.

- **g. Dettol:-** chemically known as chloroxylenol. It is a relatively non-toxic antiseptic and can be used safely in high concentrations. It is most easily inactivated by organic matter than many other phenolic disinfectants.
- It is active against Streptococci, but worthless against some Gram negative organisms.
- Dettol .5% is suitable for disinfection of instruments, and plastic equipments, a contact of at least 15 minutes will be required for disinfection.

## 2. Quaternary ammonia compounds

- **1. Cetrимide** :- It is used in the name of 'cetavlon'. It is soluble in water, it has a soapy feel. It may be used in 1-2 percent strength. It is actively bactericidal against gram negative organisms.
- **2. Salvon** :- It is a combination of cetavlon and hibitane (chlorhexidine). Plastic appliances like Lippes loop may be disinfected by keeping them in normal strength savlon for 20 min. clinical thermometer may be best disinfected in savlon in 0.5% concentration for 20 minutes.

### 3. Halogens and their compounds (solid disinfectants)

- 1) Bleaching powder ( $\text{CaOCl}_2$ ): - A 5 percent solution (3 or 4 table spoon to 1 liter of water) is suitable for disinfection of faeces and urine allowing a period of one hour for disinfection. It is used to disinfect of water, as a deodorant in bath rooms, and latrines, because of chlorine smell. It is also used as bleaching agent in paper and textile industries due to  $\text{CaO}$ .
- 2) Sodium hypochlorite: - A freshly prepared hypo solution containing (100-200 ppm of available chlorine has been

- **3) Chlorine tables:** These are containing 25% available chlorine. These are available in market in the names of halogen tablets. These are quite good in disinfecting small quantities of water. One tablet containing 4mg of chlorine is sufficient to disinfect about 1 liter of water in 30-60 minutes.
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- **4) Iodine:** - Plastic appliances like lippies loop may be sterilized by keeping in 1/25000 aqueous solution of iodine. Iodine is cheap, readily available and quick in action.
- **5) Iodophors:** - These are complexes of iodine and a

## 4. Alcohols

- Ethyl and isopropyl alcohols are commonly used as antiseptic and disinfectants. Ethyl alcohol in the form of industrial methylated spirit is the alcohol most commonly used for skin disinfection and hand washing. Pure alcohol has no power of disinfection but when diluted to 70% strength, it is a gross antiseptic.

## 5. Formaldehyde

- It is commonly known as Formalin, it is a highly toxic and irritant and gas which precipitates and destroys protein. It may be used as a 2-3 percent solution for spraying rooms, walls and furniture. Formaldehyde gas is most commonly used for disinfection of rooms, blankets, beds, books, and other valuable articles which cannot be boiled. The gas is most effective at a high temperature and relative humidity of 80-90 percent.

## 6. Oxidizing agents

- These includes Potassium permanganate, Hydrogen peroxide and Paracetic acid



## 7. Metals as microbicides:

- Heavy metals such as silver have been used for prophylaxis of conjunctivitis of the new-born, topical therapy for burn wounds and bonding to indwelling catheters. Metals such as silver, iron, and copper could be used for environmental control, disinfection of water or reusable medical devices or incorporated into medical devices.

## 8. Lime

- It is cheapest amongst all disinfectants. It is used in the form of fresh quick lime or 10 -23 % aqueous suspension known as 'milk of lime'.
- Faeces and urine can be disinfected by mixing of 10 -20 % aqueous suspension of lime and allowing the disinfectant to act for 2 hours.
- As lime wash as it is used for treating walls. As a deodorant, lime is sprinkled in cattle sheds and stables and in public places where urinals and latrines are located.

## 9. Ethylene oxide

- It is used to sterilize fabrics, plastic equipments, cardiac caterers, books etc, it is used for heat – sensitive articles at 55-60degree Celsius.
- Drawback of this is the process is difficult to control.

## 10. Miscellaneous inactivating agents

- This group includes Pasteurization, Microwave, Flushing and Washer disinfectors, Ultra violet radiation and Ozone.

## The ideal disinfectant should have following criteria

- Should be safe, cheap and effective
- Should kill pathogens but not harmful to man
- Should be readily soluble, highly penetrable, consistently reliable, low in toxicity, rapid in its action.
- Should neither corrode metals nor bleach or stain the articles
- Should be stable and not have unpleasant smell
- Should act in both acid and alkaline media
- Should not be influenced by the organic matter.
- The action of a disinfectant depends upon its strength, nature of the solvent, nature and number of organisms, presence of organic matter,

## Recommended disinfection procedures

- 1. Faeces and urine: Faeces and urine should be collected in impervious vessels and disinfected by any one of the following disinfectant

Disinfectant	Amount required	Percent
Bleaching powder	50gm	5
Crude phenol	100ml	10
Cresol	50ml	5
Formalin	100ml	10

- 2. Sputum: This can be collected in gauze or paper or handkerchiefs and disinfected by burning.
- 3. Room: Floors and hard surfaces should be sprayed or mopped with chemical disinfectant such as chlorine preparations or formaldehyde solution or cresol and leave contact period of minimum four hours before final washing.
- When fumigation is required, formaldehyde gas can be used, it may be generated by boiling commercial formalin in 2 volumes of water in a stainless steel vessel, over an electric hot plate or by adding potassium permanganate to commercial formalin in large jars. There is vigorous boiling and liberation of formaldehyde gas. The room is kept closed for 6-12 hours to allow disinfection. Formaldehyde disinfection is most effective at a high temperature and a relative

## Disinfectors

- 1) Washington Lyon's High pressure Disinfectant
- 2) Thrash's current Disinfector.
- 3) Lelean 'sack' Disinfector
- 4) Clayton's Apparatus.



