

MICROBIAL CONTROL (Chapter 7)

Terms:

Bacteriostatic: Inhibits growth/multiplication of bacteria (resumes when agent removed)

Bacteriocidal: Kills all bacteria (fungicide, algacide, etc)

Sterilization: Removal/destruction of all forms of microbes (including endospores)

Disinfectants: Agent used to inhibit/kill vegetative forms of pathogens
Used to treat inert, inanimate (non-living) surfaces and substances

Antiseptic: Agent used to inhibit/kill bacterial growth on skin and mucus membranes

Degerming: Mechanical removal (not killing) of bacteria (alcohol swab before injection)

Sanitization: Lower microbial counts to safe public health standards

Sepsis: bacterial contamination (also blood infection=septicemia/sepsis)

Aseptic: Lack of contamination

History:

Joseph Lister: 1860s First to use carbolic acid to reduce infections in hosps.

Ignatz Semmelweis: 1850s “Father of Infection Control” physicians used chlorinated lime to cleanse hands

Rate of death constant during log phase

Factors that influence effectiveness of microbial control:

Type and number of organisms

Time of exposure: extended time for more resistant microbes and endospores

Longer time at lower temperatures

Environmental factors: a.) organic matter may inhibit action of agent

b.) warm conditions help action

c.) if suspended in media, protects microbes

Parts of Cells sensitive to physical treatments and chemicals:

Plasma membrane

DNA and proteins

Physical Methods of Control:

Heat:

Terms: **Thermal Death Point/TDP:** lowest temp where all microbes in solution killed within 10 min.
Thermal death time/TDT: minimum length of time needed to kill all organisms at specific temperature

Dry: kills by oxidation,(Incineration)

Thermal Death Point/TDP: lowest temp where all microbes in solution killed within 10 min.

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Moist: kills by coagulation of proteins

Boiling (100 C)

Autoclave (121 c, psi=15lbs/sq inch)

Pasteurization

Classic 63 c for 30 min.

HTST 72 C for 15 seconds

UHT 140 C for 3 seconds

What if substance is heat labile? Enzymes, antibiotics, vaccines?

Filtration:

Pores sizes can be .45um or .22 um

Low Temperature:

Refrigerator 0-7C; reduces metabolic rate

Freezing does not kill organisms/

High Pressure: apply to liquids such as fruit juices

Dessication: remove water/bacteria not grow but remain viable

High Osmotic Pressure: high concentration of salts and sugars

Radiation:

Ionizing radiation (gamma rays, x-rays)

Non-ionizing radiation (UV rays)

Microwaves

Chemical Methods:

Most are only able to reduce the numbers of organisms, not Achieve sterility

Types of Chemical Control

Tests for Effectiveness of chemical agents

- 1. use dilution tests**
- 2. disk diffusion test**

Phenols and phenolics

Injures plasma membrane

Stable, long lasting, and active in presence of organic matter (pus, saliva, etc.)

Cresols (derived from coal tar)

Eg. O-phenylphenol (Lysol) good surface disinfectant

Biphenols

Hexachlorophene (pHisoHex)

Triclosan

Biguanides

Injures plasma membrane

Microbial control on skin/Used for surgical hand scrubs

Chlorhexidine/biocidal against most bacteria (not TB, endospores, cysts)

Halogens

Iodine

Tincture: in solution in aqueous alcohol

Iodophore: combine iodine and organic molecule

released slowly; less irritation; not stain

combines with amino acids of enzymes and proteins

Chlorine (Cl₂)

Gas form or in combination

Germicidal—hypochlorous acid forms when Cl₂ added to

H₂O

drinking water, pools, sewage treatment

Sodium hypochlorite (Chlorox)

Alcohols:

Dissolves lipids and denatures proteins

Kill bacteria and fungi (not endospores or viruses)

Most common: ethanol and isopropanol

Heavy Metals: oligodynamic action

denature proteins/extremely small amounts used

Silver, Copper and mercury

1% silver nitrate—NBs eyes

Silvadine—burns

Surface Active agents (surfactants)

Soaps—degerming agents/removes microbes

Acid-anionic surfactants—cleaning of dairy equipment and utensils

Quaternary Ammonium Compounds (Quats)

Bactericidal against gram pos (not gram neg); kills fungi, amoebas, viruses)/affects plasma membrane

Cepacol (mouthwash)—if foams, contains quats

Aldehydes: most effective

Formaldehyde

Glutaraldehyde: sterilizing agent/less irritating/used on hospital equipment

Gaseous Chemosterilizers:

Ethylene oxide: kills all organisms by denaturing proteins

Requires 4-18 hours in closed chamber

Used to sterilize spacecraft

Peroxygens

Hydrogen peroxide

Benzoyl peroxide (acne)

Peracetic acid: considered sterilized/food processors

Biocides:

More effective against gram positive

Pseudomonas and Burkholderia: unusually resistant to biocides

