

Microbiology Chapter 6

Controlling Microbes and Antimicrobial Agents

6:1 Physical Methods for Controlling Microbes

DISINFECTION: the process of destroying disease-causing microorganisms

STERILIZATION: the process of killing all microorganisms in a given area

Physical Methods

- A. Heat
- B. Pasteurization
- C. Desiccation
- D. Radiation
- E. Filtration
- F. Low temperature

A. Heat Sterilization

- Heat kills microbes by inactivation of essential proteins
- Endospores hamper heat sterilization

Methods of Heat Sterilization



1. MOIST HEAT: steam under pressure, at 15 lb./inch² above normal air pressure the boiling point of water is raised to 121°C.



AUTOCLAVE: steam pressure sterilizer



2. BOILING WATER

- Will kill all vegetative cells, ineffective on endospores (resistant to 110°C)
- Addition of 2% sodium carbonate to water will raise boiling point and kill endospores

3. DRY HEAT STERILIZATION

- Effectiveness depends on penetration of heat through object to be sterilized
- Requires much higher heat than moist heat sterilization or boiling water
- Used to sterilize items which would be damaged by water



B. PASTEURIZATION: heating a beverage or other food to a specific temperature (less than the boiling point) for a period of time in order to kill microorganisms that could cause disease, spoilage, or undesired fermentation. **Pasteurization will NOT sterilize!**

C. DESICCATION: drying or removal of water
Lack of moisture prevents bacteria reproduction, but many vegetative cells and most endospores may survive long periods of dryness. Most bacteria can survive desiccation if embedded in mucus, pus, or feces.



D. RADIATION: the transmission of energy through space, used to kill microbes by destroying nucleic acids

Types of Radiation Used to Kill Microbes

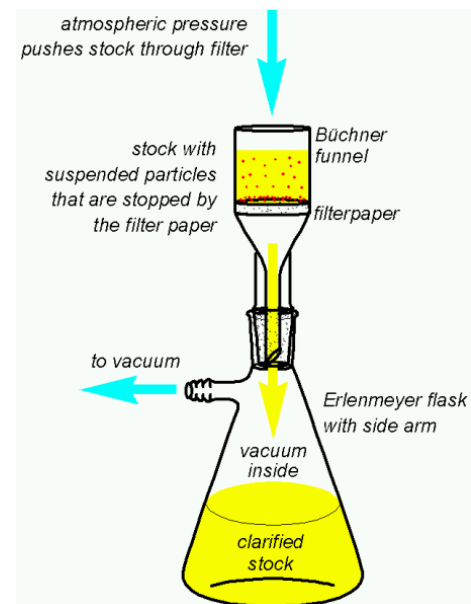
1. Ionizing radiation (x-rays, gamma rays)
2. Ultraviolet light

E. FILTRATION: the removal of bacteria from a liquid by passing it through a filter with pores smaller than bacteria

➤ If liquids would be destroyed by heat or radiation they must be sterilized by filtration.

F. Low Temperatures **Low temperatures will prevent bacterial reproduction, but will not sterilize and may preserve bacteria.**

LYOPHILIZATION: freeze-drying for preserving microorganisms; freeze organisms rapidly, then dehydrate with vacuum while frozen



6:2 Chemical Methods for Controlling Microbes

ANTISEPTIC: a chemical substance that inhibits or destroys disease-causing microbes, applied to living tissue

DISINFECTANT: a chemical substance that destroys disease-causing microbes, applied to inanimate objects

Neither antiseptics nor disinfectants will sterilize.

BACTERIOSTATIC: inhibits bacterial growth

BACTERIOCIDAL: kills bacteria

Common Disinfectants and Antiseptics

1. ALCOHOLS: ethyl, isopropyl, and benzyl

- Kill microbes by protein denaturation.
- Most effective concentration is 70%.



2. SOAPS AND DETERGENTS

- Both are surface active agents, mechanically remove bacteria
- Mildly bacteriocidal due to brief contact

3. HYDROGEN PEROXIDE

- Mildly antiseptic due to oxidizing ability
- Used for cleaning wounds



19	F
9	
35	Cl
17	
80	Br
35	
127	I
53	
210	At
85	

4. HALOGENS: chlorine and iodine

- Chlorine used on drinking water, pools, etc.
- Iodine used for skin antiseptics.

6:3 Fighting Disease Causing Microbes

CHEMOTHERAPY: treatment of a disease or symptoms with a chemical compound



SULFONAMIDES: (sulfa drugs) antibacterial compounds containing sulfur; were the first widely used chemotherapeutic agents

ANTIBIOTIC: a product of one microorganism that is detrimental or inhibitory to other microorganisms in very small amounts.

ANTIBIOTICS HAVE NO EFFECT ON VIRUSES!

Mechanisms of Antibiotics

1. Inhibition of cell wall synthesis
 - penicillin, cephalosporin, vancomycin,
2. Inhibition of protein synthesis
 - chloramphenicol, tetracycline
3. Injury to cell membranes
 - polymyxin, nystatin
4. Inhibition of nucleic acid synthesis
 - mitomycin, novobiacin



6:4 Drug Resistance

DRUG RESISTANT: a disease-causing microorganism that has developed resistance to a particular chemotherapeutic agent

How do microbes become drug resistant?

1. Drug or antimicrobial agent kills susceptible microbes easily.
2. Resistant microbes survive drug treatment and are able to proliferate.



Rules for Antibiotics

1. Take antibiotics only when prescribed for YOU by your doctor.
2. Take antibiotics for FULL length of time recommended. You should have none left over.
3. If you have left over antibiotics DO NOT save them for future use.



INDISCRIMINATE or IMPROPER use of antibiotics will lead to drug resistant bacteria.

