

table 7.5

Physical Methods Used to Control Microbial Growth

Method	Mechanism of Action	Comment	Preferred Use
Heat			
1. Moist heat			
a. Boiling or flowing steam	Protein denaturation.	Kills vegetative bacterial and fungal pathogens and almost all viruses within 10 min; less effective on endospores.	Dishes, basins, pitchers, various equipment.
b. Autoclaving	Protein denaturation.	Very effective method of sterilization; at about 15 psi of pressure (121°C), all vegetative cells and their endospores are killed in about 15 min.	Microbiological media, solutions, linens, utensils, dressings, equipment, and other items that can withstand temperature and pressure.
2. Pasteurization	Protein denaturation.	Heat treatment for milk (72°C for about 15 sec) that kills all pathogens and most nonpathogens.	Milk, cream, and certain alcoholic beverages (beer and wine).
3. Dry heat			
a. Direct flaming	Burning contaminants to ashes.	Very effective method of sterilization.	Inoculating loops.
b. Incineration	Burning to ashes.	Very effective method of sterilization.	Paper cups, contaminated dressings, animal carcasses, bags, and wipes.
c. Hot-air sterilization	Oxidation.	Very effective method of sterilization, but requires temperature of 170°C for about 2 hr.	Empty glassware, instruments, needles, and glass syringes.
Filtration	Separation of bacteria from suspending liquid.	Removes microbes by passage of a liquid or gas through a screenlike material. Most filters in use consist of cellulose acetate or nitrocellulose.	Useful for sterilizing liquids (enzymes, vaccines) that are destroyed by heat.
Cold			
1. Refrigeration	Decreased chemical reactions and possible changes in proteins.	Has a bacteriostatic effect.	Food, drug, and culture preservation.
2. Deep-freezing (see Chapter 6, page 170)	Decreased chemical reactions and possible changes in proteins.	An effective method for preserving microbial cultures, in which cultures are quick-frozen between -50° and -95°C.	Food, drug, and culture preservation.
3. Lyophilization (see Chapter 6, page 170)	Decreased chemical reactions and possible changes in proteins.	Most effective method for long-term preservation of microbial cultures; water removed by high vacuum at low temperature.	Food, drug, and culture preservation.
Desiccation	Disruption of metabolism.	Involves removing water from microbes; primarily bacteriostatic.	Food preservation.
Osmotic Pressure	Plasmolysis.	Results in loss of water from microbial cells.	Food preservation.
Radiation			
1. Ionizing	Destruction of DNA.	Not widespread in routine sterilization.	Used for sterilizing pharmaceuticals and medical and dental supplies.
2. Nonionizing	Damage to DNA.	Radiation not very penetrating.	Control of closed environment with UV (germicidal) lamp.