

Sterilization

Sterilisation importance and methods:

What is Sterilisation

- Sterilisation is a process in which **all the living microorganisms**, including **bacterial spores** are killed.
- Sterilisation can be achieved by **physical** and **chemical methods**.

Importance of Sterilisation

A method employed to minimize the growth of organisms and transmission of disease from one individual to another. In the environment the use of disinfection techniques decreases the growth of bacteria on surfaces, which leads to the decrease in transmission of organisms amongst the population. These techniques are commonly used today in medical care and food industry.

Figure 1: on the right illustrating all the techniques used. Figure 1

Physical methods:

- Heat (Dry and moist)
- Sunlight
- Vibration
- Radiation
- Filtration

Heat is considered to be most reliable method of sterilization of objects that can withstand heat.

Heat as **Moist** and **Dry heat** are the most common sterilizing methods used in hospitals and are indicated for most materials.

Dry Heat:

Causes *denaturation* of proteins and oxidative damage.

Techniques include:

- **Red Heat** (*common uses:* straight wires, bacterial loops and spatulas)
- **Flaming** (*Common uses:* bacterial loops, wires and spatula's)
- **Incineration** (*common uses:* soil dressing, pathological bedding)
- **Hot Air oven** (discovered by Louis Pasteur, *common uses:* in dairy industry)
- **Infra red rays** (*common uses:* heat glassware and metallic instruments)

Moist Heat:

Moist heat is more efficient in contrast to dry heat; it causes *coagulation* and *denaturation* of proteins.

At temperature below 100°C:

- Pasteurisation: Food(dairy) Industry
- Vaccine bath: (vaccine sterilisation)
- Serum bath: (serum contaminants, does not kill spores survive)
- Inspissation: (egg and serum containing media, can kill spores)

At temperature 100°C:

- Boiling: Boiling water (100°C)
- Steam (100°C)

At temperature above 100°C:

- Autoclave

The temperature used in each method and effectiveness is clearly summarized in the table **below**.

Figure 2: illustrating the different methods used and the relative effectiveness.

Figure 2 Radiation

There are 2 types of Radiation:

Non-ionizing: wavelength longer than visible light.

- **UV Radiation** has a wavelength of 200-280nm; it has a germicidal effect on microorganisms.
- *Common uses:* Surface disinfection, in hospitals, operating theatre and laboratories.

Ionising: 2 types:

- **Particulate** (Electron beam)
- *Common uses:* sterilisation of instruments such as syringes, gloves, dressing packs, foods and pharmaceuticals.
- **Electromagnetic** (Gamma rays)
- *Common uses:* sterilisation of disposable petri dishes, plastic syringes, antibiotics, vitamins, hormones and fabrics.

The Other physical methods used in sterilisation do not kill all the organisms hence considered to be a form of disinfection. Refer to the disinfection question.

Chemical Methods:

• **Ethylene oxide:** is the most commonly used gas vapor sterility method. However it has limited use due to its harmful properties. The gas is **flammable** and **explosive**.

• *Common uses:* cellulose and plastic irradiation

• **Formaldehyde gas:** is also limited because the chemical is carcinogenic. Its use is restricted primarily to sterilization of HEPA filters.

• Alternative to Ethylene oxide is **Hydrogen peroxide vapors**, which are effective at sterilization due to the oxidizing power of the gas.

Common uses: Sterilization of instruments.

• **Peracetic acid:** a bright colourless liquid, which has a piercing odor and a pH of 2.8. Produced by the reaction of hydrogen peroxide and acetic acid.

Common uses: In the food industry as a cleanser and disinfectant.

• **Glutaraldehyde:** a colourless, pungent liquid produced industrially by the oxidation of cyclopentene.

Common uses: sterilisation of medical and dental equipment, a chemical preservative in water treatment and used in treatment of plantar warts.

External links/References:

- Todar K. Lectures in Microbiology university of Wisconsin-Madison, Department of Bacteriology. Website <http://www.textbookofbacteriology.net/themicrobialworld/control.html> Last accessed 2009
- Sridhar Rao P.N sterilization and disinfection Website <http://www.microrao.com/micronotes/sterilization.pdf> Last updated june 2008
- Pacific BioLabs (PBL) LEARNING CENTER STERILIZATION VALIDATIONS: Chemical Sterilization website http://www.pacificbiolabs.com/ster_chemical.asp Last updated 2009
- Murray R. Patrick PhD, Rosenthal Ken S. PhD, Pfaller Micheal A. MD sterilization and disinfections methods, Medical Microbiology: with STUDENT CONSULT Online Access, 6ed. Website <http://www.studentconsult.com/> Updated 2008

