

STERILIZATION



IMPORTANCE OF STERILIZATION

- To prevent contamination in sterile products
- To prevent transmission of pathogenic microorganisms which are responsible for causing disease in plants, animals and human beings
- To prevent decomposition and spoilage of food and food products
- To prevent the contamination of unwanted microbes in pure cultures and other microbiology experiments performed for research studies
- To prevent unwanted microbial contamination in antibiotic, enzyme, vitamins, fermentation and other industries process
- To prevent contamination in aseptic areas/instruments which are used for the preparation of sterile dosage forms and sterility testing.

DEFINITION OF IMPORTANT TERMS

- ❖ **Sterilization** : It is a process by which an article, surface or medium is made free of all microorganisms either in vegetative or spore form.
- ❖ **Disinfection** : It is a process of destruction of all pathogens or organisms capable of producing infections in living cells but not necessarily spores. All organisms may not be killed but the number is reduced to a level that is no longer harmful to health.
- ❖ **Disinfectants**: these are antimicrobial agents that are applied to the surface of non-living objects to destroy microorganisms that are living on the objects.
- ❖ **Antiseptics** : Chemicals which can safely be applied to living tissues and are used to prevent infection by inhibiting the growth of microorganisms.
- ❖ **Asepsis** : Technique by which the occurrence of infection into an uninfected tissue is prevented.
- ❖ **Bactericidal agents/germicides**: These are the chemical substances which are able to kill bacteria/germs.

DIFFERENTIATE BETWEEN ANTISEPTICS AND DISINFECTANTS

Antiseptic

Used for humans and animals

Commonly found in healthcare centers or hospitals

Cleanses wounds and surgical sites to prevent infection and other complications

Includes mouthwash and cold sore and yeast infection treatment creams

Transports through the lymphatic system and destroys bacteria within the human body

Not harmful to humans and animals

Disinfectant

Used for non-living things like furniture and other household items

Commonly found in homes or public places

Kills microorganisms on the surface of non-living things

Includes cleaning products for houses and public places

Destroys the cell wall of microorganisms or interferes with the metabolism of microbes thriving on the surface of tangible objects

Harmful to humans and animals

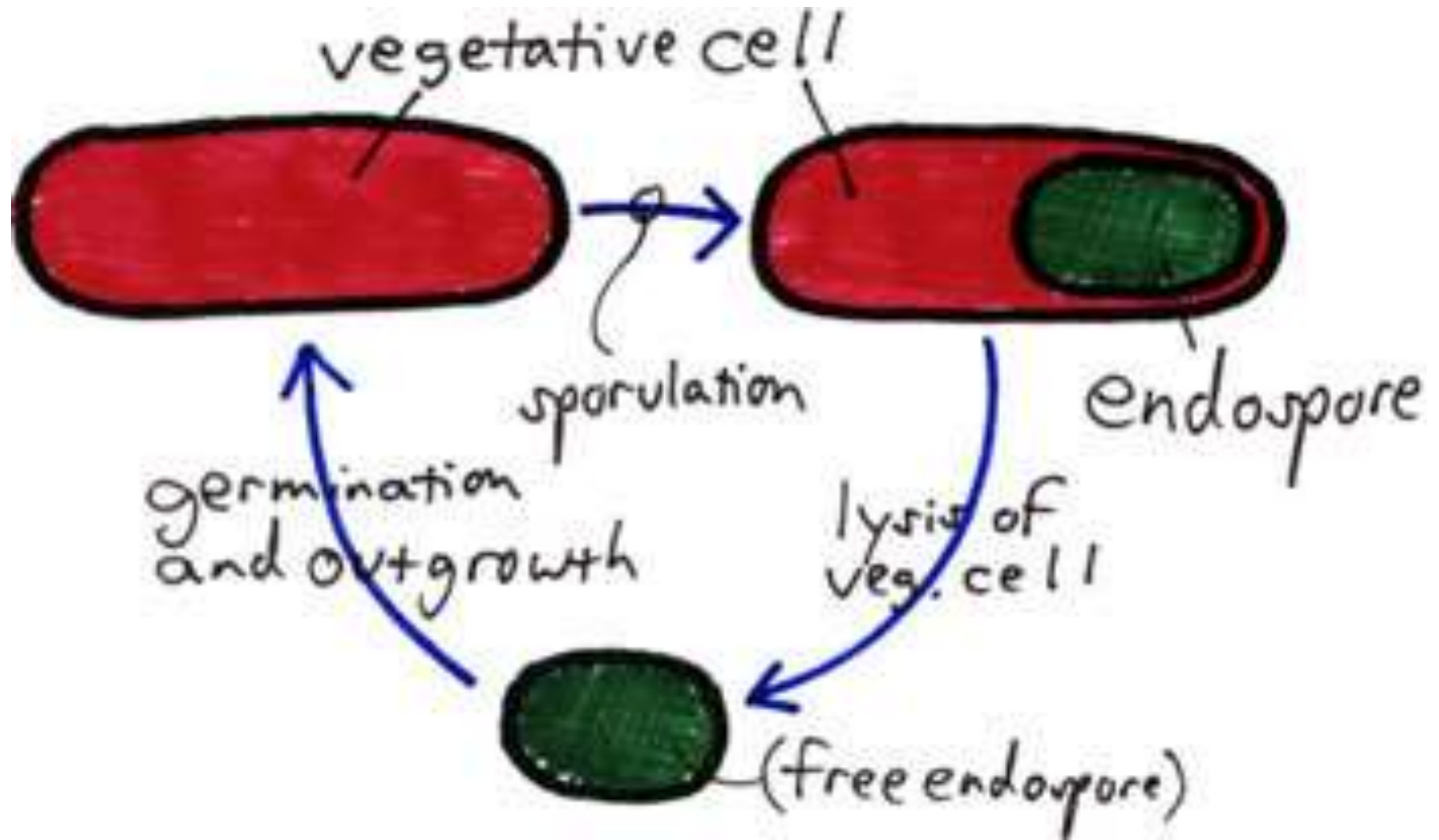
Difference between Bacterial Endospores and Vegetative Cells

Characteristics	Vegetative Cells	Bacterial Endospores
Appearance under Microscope	Non refractive	Refractive
Structure	Typical Gram Positive or Negative bacterial Cell	Thick spore like structure with exosporium, spore coat, cortex and core wall
Level of Calcium	Low level in vegetative cells	High calcium level in endospores
Dipicolinic acid	Absent in vegetative cells	Present in endospores
Activity of Enzymes	High enzymatic activity	Very low enzymatic activity

Staining properties	Stainable with common bacterial dyes	Un-stainable with common dyes, requires special stains
Effect of lysozyme enzyme	Vegetative cells are sensitive to the activity of lysozyme	Endospores are resistant to the action of lysozyme
Level of water content	High (80 – 90% of the cell)	Very low (10 – 20%)
pH of Cytoplasm	Always maintained above pH 7.0	About 5.5 to 6 in the core of the spore
Small Acid Soluble Proteins (SASPs)	SASPs absent in vegetative cells	SASPs Present in vegetative cells
Conformation of DNA	Usually B-form of DNA	Usually A-form of DNA

Respiration rate	Respiration rate high	Usually respiration absent, very less if present
Macromolecule Synthesis	Occurs	Not Occurs
Presence of mRNA	mRNA present in the vegetative cells	mRNA absent in the endospores
Heat resistance capacity	Very low heat resistance capacity	Very high heat resistance capacity
Resistance to Radiations	Very low	Very high resistance
Resistance to chemicals such as H₂O₂ or Acids	Very low	Very high resistance

Vegetative Vs spore

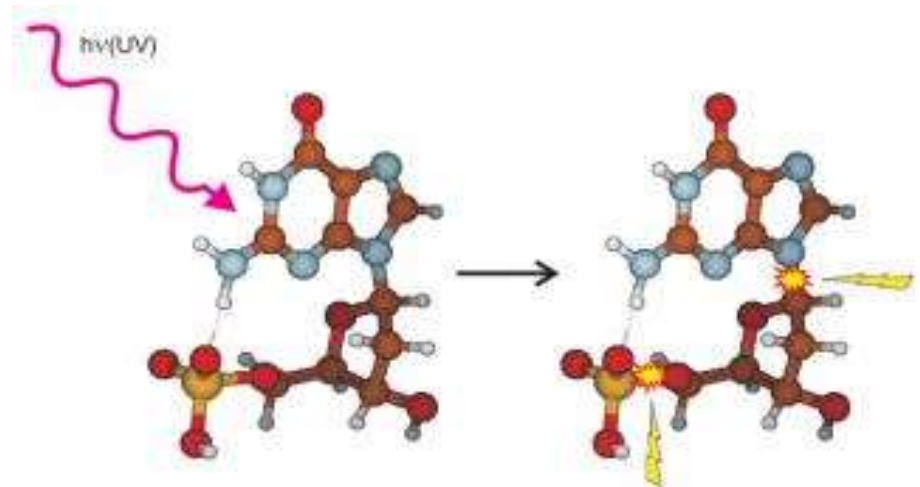
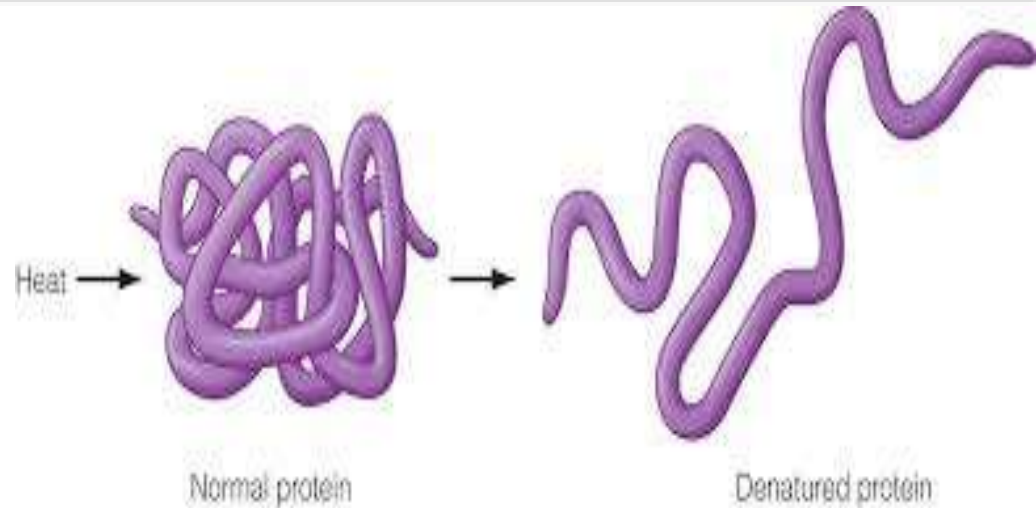


Why we need Sterilization

- Microorganisms capable of causing infection are constantly present in the external environment and on the human body.
- Microorganisms are responsible for contamination and infection.
- ❑ The aim of sterilization is to remove or destroy the microorganisms from materials or from surfaces.

How can microorganisms be killed?

- ✓ Denaturation of proteins
- ✓ Interference with protein synthesis
- ✓ Interruption of DNA synthesis/repair
- ✓ Oxidative damage of cell
- ✓ Disruption of cell membranes



Factors that influence efficacy of disinfection/sterilization

- **Contact time**
- **Physico-chemical environment (e.g. pH)**
- **Presence of organic material**
- **Temperature**
- **Type of microorganism**
- **Number of microorganisms**
- **Material composition**

What to sterilize?

- All instruments that penetrate soft tissues and bone.
- Instruments that are not intended to penetrate the tissues, but that may come into contact with oral tissues.
- If the sterilization procedure may damage the instruments, then sterilization can be replaced by Disinfection procedure.