

# UNIT-II

# EVALUATION OF STERILIZATION



**CENTURION**  
**UNIVERSITY**  
*Shaping Lives...  
Empowering Communities!*

**RASMITA JENA**  
**ASSISTANT PROFESSOR**  
**SoPLS, CUTM, BBSR**

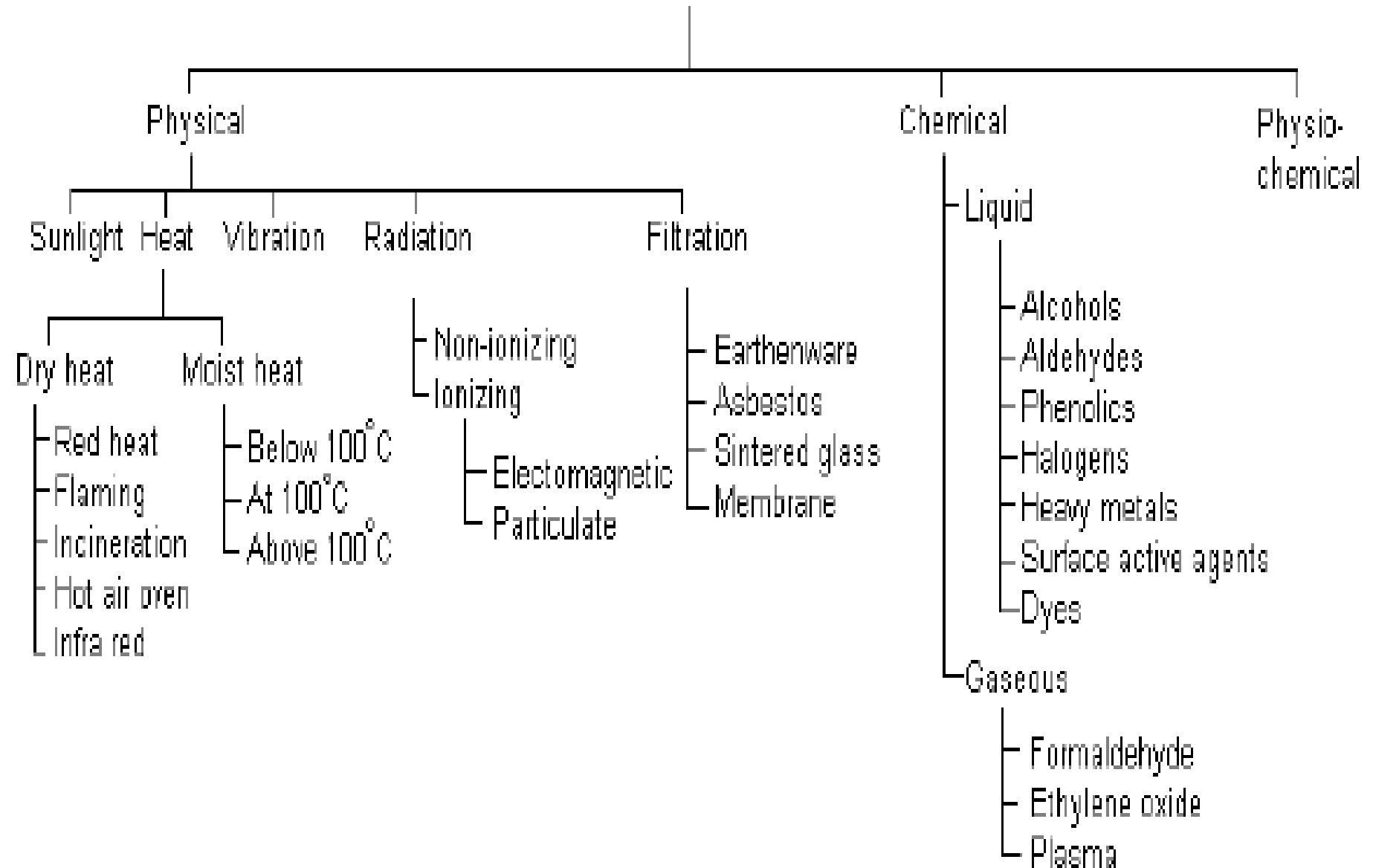
- **Sterilization** is defined as the process where all the living microorganisms, including bacterial spores are killed.
- Sterilization can be achieved by physical, chemical and physiochemical means.
- Chemicals used as sterilizing agents are called **chemisterilants**.

- **Disinfection** is the process of **elimination of most pathogenic microorganisms (excluding bacterial spores) on inanimate objects.**
- Disinfection can be achieved by **physical or chemical** methods. **Chemicals used** in disinfection are called **disinfectants.**
- Different disinfectants have different target ranges, not all disinfectants can kill all microorganisms. Some methods of disinfection such as **filtration do not kill bacteria**, they separate them out.
- Sterilization is an absolute condition while disinfection is not. The two are not synonymous.

- **Sanitization** is the **process of chemical or mechanical cleansing, applicable in public health systems.** Usually used by the **food industry.** It **reduces microbes on eating utensils** to safe, acceptable levels for public health.
- **Asepsis** is the **employment of techniques** (such as **usage of gloves, air filters, UV rays etc**) **to achieve microbe-free environment.**
- **Antisepsis** is the **use of chemicals (antiseptics) to make skin or mucus membranes devoid of pathogenic microorganisms.**

- **Bacteriostasis** is a condition where the multiplication of the bacteria is inhibited without killing them.
- **Bactericidal** is that chemical that can kill or inactivate bacteria. Such chemicals may be called variously depending on the spectrum of activity, such as bactericidal, virucidal, fungicidal, microbicidal, sporicidal, tuberculocidal or germicidal.
- **Antibiotics** are substances produced by one microbe that inhibits or kills another microbe. Often the term is used more generally to include synthetic and semi-synthetic antimicrobial agents.

# Methods of sterilization/ disinfection



## Sterilization Effectiveness Evaluation by Chemical Agents

- The Phenol Effects Phenol is used as a standard disinfectant to measure and compare the performance of other disinfectants. If a disinfectant has a phenol coefficient equal to 1, it has the same activity as phenol, but if the phenol coefficient is less than 1.0, its activity is reduced compared to phenol. In order to determine the phenol coefficient, two organisms are used, the first one being *Staphylococcus aureus*, and the second one being *Salmonella typhi*. After a certain period of time, the activity of the phenol and the disinfectant can be measured in two separate culture samples.
- For different microorganisms, phenol coefficients can be the same or different. Lysol is a good example of how it works. A dilution of Lysol at 1:150 does not produce growth after 10 minutes, while a dilution of phenol at 1:90 does not produce growth after 10 minutes. Lysol therefore has a 5 times higher phenol coefficient than phenol, meaning that it is 5 times more effective than phenol.

- **Filter Paper Method:** This method involves soaking a small disk of filter paper in the disinfectant and then putting it on an agar plate containing microorganisms for testing. An inhibition zone will appear after a while. Disinfectants with a greater zone of inhibition are said to be more active for the test sample. Disinfectant activity varies with the organism being tested.
- **Use Dilution Test:** It involves coating the stainless-steel cylinder with a broth culture of the test microorganism and allowing it to dry. Once these cylinders have been dipped in broth and the disinfectant diluted, they are then placed in test tubes. It is possible to determine the effectiveness of a disinfectant by measuring the smallest concentration at which the growth of microorganisms is inhibited.



- **Sterilization Control:** The following methods can be used to evaluate the effectiveness of sterilization by moist heat:
- **Thermocouples:** An autoclave's temperature can be measured using thermocouples. A particular autoclave temperature is deemed to be the appropriate temperature for sterilization.
- **Brown Tubes:** Along with the articles, these tubes go into the autoclave. When the temperature inside the autoclave reaches 121°, these tubes turn green, which helps determine whether the articles are properly sterilized.

- **Bacillus Stearothermophillus Spores:** These spores must be exposed to 121°C for 12 minutes in order to be killed. Within the envelope are placed paper strips containing 10<sup>6</sup> spores before being placed in the autoclave. Inoculated with culture media, these strips are autoclaved and then inoculated. It is determined if these spores are not growing in the culture media if sterilization has been properly performed.
- **Autoclave Tape:** In the autoclave, the product changes color when heated to 121°C due to lead carbonate. To check whether the sterilization process has the ability to kill bacteria (microorganisms), and then to ensure that all microorganisms have been killed.

- This can be measured by the following three factors:
- **D – value (decimal reduction time)**The D-Value indicates the time in minutes it takes to destroy 90% of viable microorganisms at a constant (defined) temperature. The less the value of D decreases (less), then the more efficient sterilization will be. This is because D value is the time required to destroy microorganisms, so less time(D value) results in killing more bacteria, so sterilization becomes very efficient

- Change in temperature is the Z-value.
- As the temperature rises, more bacteria are killed and the D - value decreases and the Z - value increases.
- A Z - value is proportional to the D - value, and a lower D - value will result in a more efficient sterilization.
- **F – value** Efficacy of a sterilization method is determined by the number of minutes it takes to kill bacterial spores through heating. It is possible to calculate the probability of survivors remaining from a load using the F value as follows: [  $F = D (\log N_0 - \log N)$  ] Where,  $N_0$  = initial population volume/original population number  $N$  = number of final residents/volume of units  $D = D$  - the organism's temperature at 121°C.