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STERILISATION

Thermal resistance of micro organisms

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Thermal Resistance of Microorganism

- Thermal resistance of various microorganisms & spores varies according to the method of sterilization.
- Therefore , selecting any method for sterilization , it is essential to know the condition & method must be lethal (sufficient to cause death) to microorganisms & spores. So, that some following points should be consideration.
 - ☐ Thermal Death Time
 - ☐ Death Rate of Microorganisms
 - ☐ Decimal Reduction Time (D Value)



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Thermal Death Time : -

- It is defined as, the time required to kill a specific microorganisms at a given temperature under specific condition.
- Thermal death time depends on factors like, Temp., pH, presence of bactericide, No. of microorganisms & their resistance to heat.
- There is a considerable variation in thermal death time between different types of bacterial spore.

Death Rate of Microorganism : -

- This is no direct method to determine when the sterility will be achieved.
- So, in this method of final death rate of microorganism is to plot graph between survivor against time of exposure.



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Decimal Reduction Time (D Value) : -

- It is defined as time in minutes required to reduce the number of viable microorganisms by 90%.
- The order of death of microorganisms can be calculated by following eq.

$$K = 1/t (\log N_0 - \log N)$$

Where, K = Constant

t = time of exposure in minute

N_0 = Number of viable organism in the beginning

N = Number of viable organism at the end.

- After 90% reduction of microorganisms equation becomes,
- $K = 1/t$ or $t = 1/K$



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- Where, t decimal reduction time or D value
- So that , $D = 1/t$
- Thus, D value is the induction of efficiency of sterilization process & is calculated easily from graph between survivors & exposure time.

Factors affecting the thermal destruction of Microorganisms

- pH
- Protective substances
- Antibacterial agents
- Inhibitory medicaments
- The inactivation factor of the process
- Initial number of organisms



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pH :

Most of the microorganisms are resistant to heat at a pH 6 to 8, so acidic or alkaline solution is used for sterilization.

Protective Substances :

- Organic substances like protein & carbohydrates make a coat around microorganism, thus protecting them from destroying, so those substance are called as protective substances.
- Microorganisms are difficult to kill in media containing high conc. of organic substances like protein & carbohydrates (Blood products).



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Antibacterial Agents :

The addition of antibacterial agents in injection can reduce the sterilization temp. from 115°C to 100°C . It is useful for thermolabile substances. This method also called as sterilization by heating with bactericide.

Inhibitory Medicaments :

- There are certain medicaments which when converted into solution are harmful to microorganisms.
- This is due to change in pH or toxic effect of medicament.
- Such medicaments are called as self sterilizing medicaments.



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The Inactivation factor of the process :

The inactivation factor is the degree to which the viable count of organisms is reduced.

–It is given by – Inactivation factor = $10^{t/D}$

t = Exposure time in minute

D = Decimal reduction time for same temperature & condition.

Initial Number of Organisms :

- When a certain number of organisms are heated at a lethal temperature, the organisms are not killed at once, but they are killed gradually as the exposure is prolonged.
- If certain fraction of initial number is destroyed in the succeeding interval of time & will continue till all the organisms are killed & the preparation is sterilized.
- If the initial number of organisms is less, then the time required for sterilization will be less.