Environmental effects on Microbial Growth

The activities of microorganisms are greatly affected by the chemical and physical conditions of their environments. Different microorganisms react to their environment in different ways. An environment that is harmful to one microorganism may be beneficial to another. Sometimes an organism can tolerate an adverse condition in which it is unable to grow.

Main Environmental Factors Affecting Microbial growth

Many environmental factors significantly affect microbial growth. The major ones are:

1. Temperature
2. Oxygen
3. pH
4. Osmotic effects

Effect of Temperature on Microbial Growth

Temperature is the most important factor that determines the rates of growth, multiplication, survival, and death of all living organisms. Growth and reproduction of living organisms are dependent on a co-ordinated series of enzyme-catalysed chemical reactions. The rates of enzyme reaction increase with the increase in temperature. Since microbial activity and growth is manifestations of enzymatic reactions, their rates of growth are temperature-dependent. The temperature relationships of a microorganism are usually described by the three cardinal temperatures, the minimum, optimum, and the maximum temperatures of growth.

Each microorganism has:

1. A minimum temperature below which no growth occurs.

2. An optimum temperature at which growth is most rapid.

3. A maximum temperature, above which growth is not possible.

Microorganisms can be grouped into broad categories, according to their temperature ranges for growth.

Psychrophiles:-

Psychrophiles are found in environments that are constantly cold and they may be killed rapidly by brief exposure to room temperature. They can grow at 0^{o}C, and some even as low as -10^{o}C; their upper limit is often about 20^{o}C. e.g.: *Pseudomonas* sp. and *Mucor* sp.

Psychrophiles produce enzymes that operate optimally at cold temperatures but are often inactivated at even moderate temperatures.

Cytoplasmic membranes of psychrophiles have been shown to contain a higher content of unsaturated fatty acids, which help to maintain a semi fluid state of the membrane at lower temperatures.

Mesophiles:-

Grow in the moderate temperature range, from about 25^{o}C (or lower) to 45^{o}C. Mesophiles are found in warm-blooded animals and in terrestrial and aquatic environments. e.g.: *E.coli* and *Tricoderma* sp.

Thermophiles:-

Grow in the high temperature range (heat-loving), from about 45^{o}C to 70^{o}C or more. e.g.: *Bacillus* sp. and *Aspergillus fumigatus.*

The enzymes and other proteins of thermophiles are much more heat stable than those of mesophiles. Thermophiles have lipids rich in saturated fatty acids allowing the membrane to remain stable and function at high temperature.

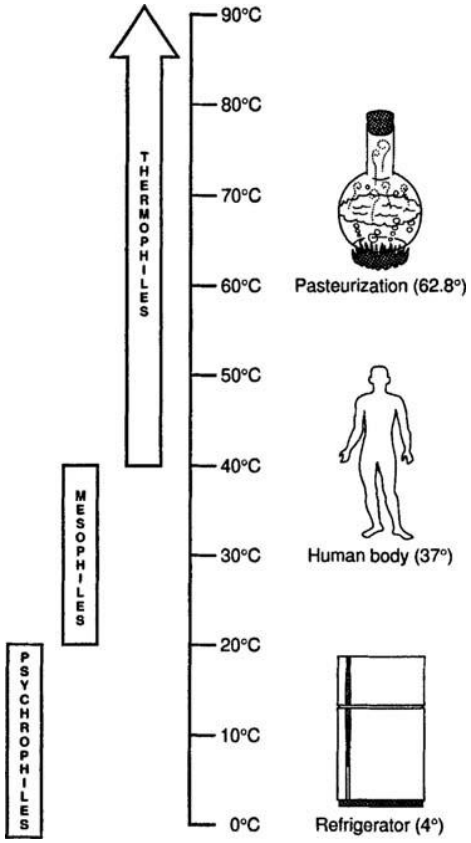
Lethal effect of temperature

Thermal death point (TDP)

That high temperature at which death of micro-organism occurs under a specified length of time, usually 10 minutes

Thermal death time (TDT)

Is a concept used to determine how long it takes to kill a specific m.o. at a specific temperature.



Three types of m.o. and the temperature environments in which they thrive

Procedure:

1. Pour sterilized Czapeks Dox Agar medium into 6 sterilized petridishes; allow the plate to become solidified.

2. Uses sterilized cork borers to cut disks of agar and mycelium from the 7 days fungi culture.

3. Transfer an inoculum into poured solidified czapeks Dox medium upside situation that the mycelium becomes contact with the medium

4. Incubate the inoculated medium at different temperature (0, 4, 15, 25, 37, 45ºC).

5. After 7 days of incubation for each temperature measure the diameter of the mycelium for each, and compare the growth at each temperature and determine the optimum temperature, maximum and minimum.