**Environmental factors effect on growth microorganisms**

The growth of microorganisms is greatly affected by the chemical and physical nature of their surroundings. An understanding of these influences aids in the control of microbial growth and the study of the ecological distribution of microorganisms. The major physical factors which affect microbial growth are solutes and water activity, pH, temperature, oxygen level, pressure and radiation. 0052202

**1- Solutes and Water activity:**Changes in osmotic concentration of the surroundings can affect microbial growth as a selectively permeable plasma membrane separates the microorganisms from their surroundings. Microorganisms need to keep the osmotic concentration of their cytoplasm. Halophiles grow optimally in the presence of NaCl or other salts at a concentration above about 0.2M. These have extensively modified the structure of their proteins and membranes rather than simply increasing the intracellular concentrations of solutes.

Water activity (aw) is the amount of water available to microorganisms and this can be reduced by interaction with solute molecules (osmotic effect). Water activity is inversely related to osmotic pressure; if a solution has high osmotic pressure, it's a w is low. Microorganisms differ greatly in their ability to adapt to habitats with low water activity. In a low a w habitat, the microorganisms must expend extra effort to grow as it should maintain a high solute concentration to retain water. Most of the microorganisms grow at a w =0.98 or higher.

**2- pH:**It refers to the acidity or alkalinity of a solution. It is a measure of the hydrogen ion activity of a solution .

The pH can affect the growth of microorganisms and each species has a definite pH growth range and pH growth optimum. Drastic changes/variations in cytoplasmic pH can harm microorganisms by disrupting the plasma membrane or inhibiting the activity of enzymes and membrane transport proteins.

**3-Temperature:**Temperature profoundly affects microorganisms as the most important factor influencing the effect is temperature sensitivity of enzyme-catalyzed reactions. Beyond a certain point of higher temperature, slow growth takes place and damages the microorganisms by denaturing enzymes, transport carriers and other proteins. The plasma membrane also is disrupted as lipid bilayer simply melts and the damage is such an extent that it cannot be repaired. At very low temperature, membranes solidify and enzymes don't work rapidly. In summary, when organisms are above their optimum temperature, both the function and cell structure is affected at low temperature, function is affected.

Microorganisms are classified into five classes based on their temperature ranges for growth.

a.  **Psychrophiles:**Microorganisms grow well at 0°C and the optimum growth temperature of 15°C or lower and maximum at around 20°C. They have adapted to their environment in several ways. Their enzymes, transport systems and protein synthetic mechanisms function well at low temperatures. The cell membranes have high levels of unsaturated fatty acids and remain semifluid when cold.

b.  **Mesophiles:**Growth optimum around 20°C to 40°C. Most of the organisms fall under or within this category including human pathogens.

c.  **Thermophiles:**The microorganisms in this group can grow at temperature of 55°C or higher. Mostly prokaryotes and a few algae and fungi belong to this group. Microorganisms have more heat-stable enzymes and proteins synthesis systems, which function at high temperature. The membrane lipids are also stable and tend to be more saturated, more branched and of higher molecular weight.

d.  **Hyperthermophiles:**Few microorganisms can grow at 96°C or above and have maximum at 100°C.