Dr. UMESH KUMAR

DEPARTMENT OF BOTANY

U.R. COLLEGE ROSERA
(SAMASTIPUR)

B.Sc. PART- II
(BIOLOGY SUBSIDIARY).
[GROUP- C]

(i) WATER POTENTIAL.

Water Potential

"The basic driving force in osmosis is difference in the free energy of the water on the two sides of the membrane is called water potential."

According to principles of thermodynamics every component a system possess free energy which is available for conversion to work under constant temperature condition. To understand water movement in plants we are concerned with free energy present in a specified number of molecules in one condition compared to their free energy after undergoing some change. The free energy per mole of any particular chemical species in a multicomponent system is defined as the chemical potential of that species. The larger the chemical potential of a substance, the greater will be its tendency to undergo chemical reactions, and other processes such as diffusion. The chemical potential of water is a property of considerable importance to our understanding of water and its movement in the plant and the soil. ② chemical potential of water is also called water potential and is given value of zero at the prevailing temperature and atmosphere pressure. If water potential differs in various parts of a system, water will tend to move from point of higher potential (less negative) to region of lower water potential (more negative).

The components of water potential

A typical plant cell consists of a cell wall, a vacuole with an aqueous solution and a layer of cytoplasm between the vacuole and cell wall. When such a cell is subjected to the movement of water many factors begin to operate which ultimately determine the water potential of cell sap. For solution such as contents of cells, water potential is determined by three major sets of internal factors viz, matric potential (ψm), solute potential (ψs) and pressure potential (ψp). The water potential (ψw) in a plant cell of tissue can be written as the sum of matric potential (due to binding of water to cell wall and cytoplasm), the solute potential (due to concentration of dissolve solutes, which by ③ its effects on the entropy components reduces the water potential) and the pressure potential (due to hydrostatic pressure, which by its effect on energy components increase the water potential).

$$\psi w = \psi s + \psi m + \psi p$$

Water potential and components are discussed below as follows –

(1) Matric Potential (ψm) → It is the term used for the surface (e.g: soil particles, cell wall, cell cytoplasm) to which water molecules are adsorbed. In this case of plant cells and tissues it is usually disregarded because it is not significant in osmosis. Hence the given equation is written as follows –

$$\psi w = \psi s + \psi p$$

(2) Solute Potential (ψs) → It is also known as osmotic potential. It is defined as the amount by which the water potential is reduced as a result of the presence of solute. Solute potential is always negative number.

(3) Pressure Potential (ψp) → Plant cell is elastic and it exerts a pressure on the cellular contents. As a result of inward wall pressure hydrostatic pressure is developed in vacuole termed as turgor pressure. The pressure potential is usually positive and operates in plant cell as wall pressure.

Dr. Umesh Kumar
Department of Botany
U.R. college, Rusera.