Practical Plant Physiology Lab. 3

Substances can be classified as strong **electrolytes**, **weak electrolytes** or **non-electrolytes**.

All matter is made of tiny particles. The particles are atoms, ions or molecules.

Electrolytes dissolve in water or some other solvent and form ions. Sodium chloride (NaCl) is an electrolyte. **Strong electrolytes** completely ionize when dissolved, when solid NaCl is placed in water, it completely dissociates to form Na^+ and Cl^- ions.

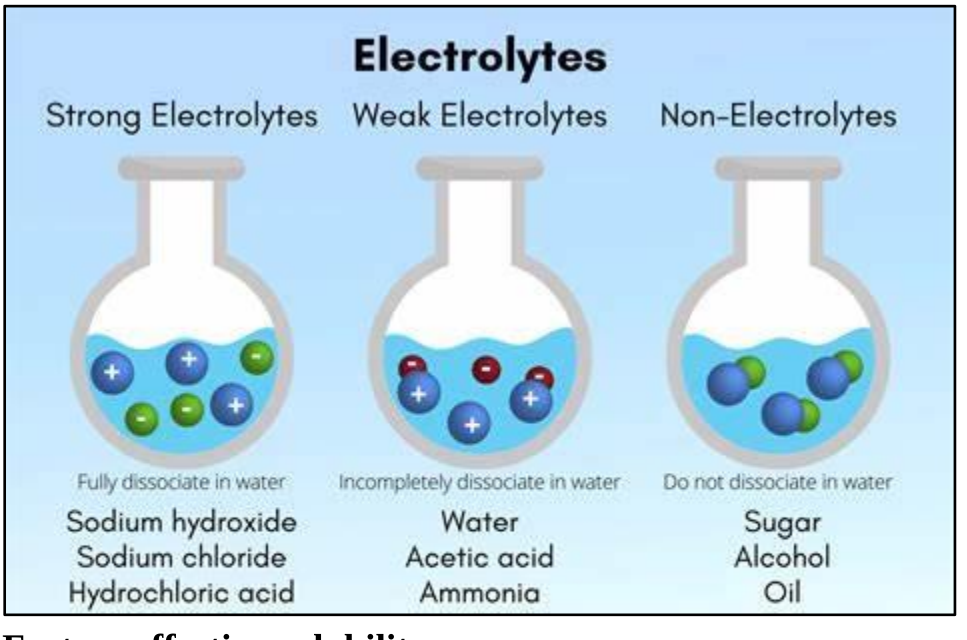
$$NaCl\ (s) \xrightarrow{H_2O} Na^+\ (aq) + Cl^-(aq)$$

If most of the solute does not dissociate, the electrolyte is weak. Water is also considered to be a **weak electrolyte**. That is, only a small fraction of the H_2O molecules in water dissociate to form H^+ and OH^- ions.

A non-electrolyte does not dissociate at all in solution and therefore does not produce any ions. Non-electrolytes are typically polar covalent substances that do dissolve in water as molecules instead of ions. Sugar ($C_{12}H_{22}O_{11}$) is a good example of a non-electrolyte.

$$C_{12}H_{22}O_{11}\ (s) \xrightarrow{H_2O} C_{12}H_{22}O_{11}\ (aq)$$

The solubility of a substance is the maximum amount of a material (called the solute) that can be dissolved in given quantity of solvent at a given temperature.



Factors affecting solubility:

1. **Temperature** solubility increases with temperature. The situation is though different for gases. With increase of the temperature, they became less soluble in each other and in water.

2. Polarity In most cases solutes dissolve in solvents that have a similar polarity, **"Like dissolves like".** Non-polar solutes do not dissolve in polar solvents.

(**Electrical polarity (positive and negative) is present in every electrical circuit. Electrons flow from the negative pole to the positive pole)**

3. **Pressure** for majority of solid and liquid solutes, pressure does not affect solubility. Usually has no effect, if you do not dissolving a gas in a liquid

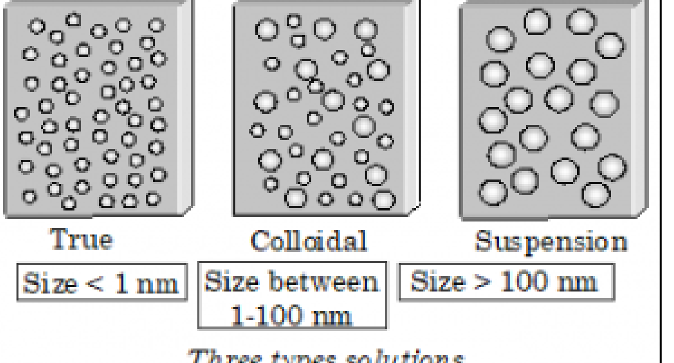
There is **equilibrium** when the concentrations of **reactants** and **products** are in an unchanging ratio. Another way of saying this is that a system is in equilibrium when the forward and reverse reactions occur at equal rates.
A solution that is in **equilibrium** with undissolved solute is said to be **saturated.** Additional solute will not dissolve if added to such a solution. The amount of solute needed to form a saturated solution in a given quantity of solvent is known as the solubility of that solute. For example, the solubility of NaCl in water at 0°C is 35.7 g per 100 mL of water. This is the maximum amount of NaCl that can be dissolved in water to give a stable, **equilibrium** solution at that temperature.

Based on distinct properties, solutions can be classified into:

1. **True Solution** is a homogeneous mixture in which the solute particles have diameters between 0.1 nm to 1 nm i.e., the solute particles are of molecular dimensions. Such dispersed particles dissolve in solution to form a homogenous system. These do not settle down when the solution is left standing. The particles are invisible even under powerful microscopes and cannot be separated through filter paper, parchment paper or animal membranes. **For example**, sodium chloride in water is a true solution. Most ionic compounds form true solutions in water. Organic compounds like sugar and urea also form true solutions in water.

2. Suspension Solution Suspension is a heterogeneous mixture. Suspensions consist of particles of a solid suspended in a liquid medium. Suspensions are systems with two distinct phases. The particles in suspensions are **bigger than 100 nm to 200 nm across.** The particles of a suspension may not be visible to the naked eye but are visible under a microscope. **Examples of suspensions are sodium chloride in benzene, or sand in water.**

3. Colloid Solution is a heterogeneous mixture in which particle size of substance is intermediate of true solution and suspension i.e. between 10-**7** – 10-**9** µm.
Colloid Solutions represent an intermediate kind of a mixture between true solution and suspension.
Note µm = micrometre
1 meter m=1,000,000 micrometers µm
Meter [m] Nanometre [nm] 1 m = 1000,000,000 nm



Three types solutions