Lab. 6: Diffusion and dialysis

Diffusion across a differentiated permeable membrane

The concept of dialysis, that is partition (separation) of substances between two solutions (colloidal and true solution) by use of semi-permeable membrane, it's a simple process in which small solutes (true solution's solutes) diffuse from a high concentration to low concentration solution or from inside to outside and vice versa of dialysis bag until equilibrium is reached, and the large molecules that cannot pass through the membrane pores will remain on the same side of the membrane as they were, when dialysis initiated.

The permeability of a membrane depends on the properties of the membrane, which include the size of any holes or gaps within the membrane, as well as the charge of the membrane. A dialysis membrane can be impermeable to certain substances by having holes that are too small for a larger molecule to pass through. In addition, it can be electrically charged to exclude molecules that are charged.

Importance of the dialysis:

Dialysis is the diffusion of solute molecules across a differentially permeable membrane. The cell membrane is differentially permeable. Thus, through dialysis certain substances may enter a cell and certain metabolic products including wastes may be leave, depending on the permeability of membrane, small solute molecules may passes through, while larger molecules are held back.

eg. In human through dialysis: The artificial kidney machines remove the smaller waste particles from the human blood stream.

Factors affecting dialysis rate:

1. The two solution's composition 2-Time 3-Temperature 4- Particle size

Dialysis includes:

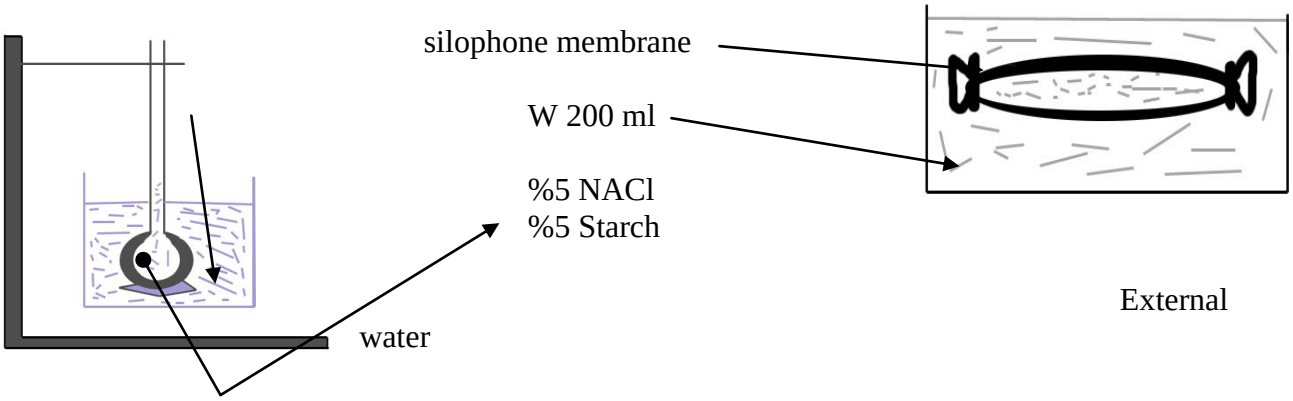
1. Diffusion of small solute particles from high to lower concentration.
2. Ultra filtration of fluids (solvent).

Practice part:

Sometimes, we use non-living models to study living system. In this experiment, dialysis tubing is used to represent a differentially permeable membrane, when you make up a dialysis bag, think of it as a simplified cell.

If we distinguish two solutions such as starch as (colloidal solution) and true solution such as (food salt) by the silophone membrane (semi permeable membrane); use this membrane after purify it with D.W for 24 hrs.

The true solution diffuse through this membrane but the colloidal solution can't diffuse through it because of larger size of its particle. We utilize this phenomenon to purify (disjoint) the colloidal solution with true solutions.



After 20 minute note the transport of Na+ and Cl-, and the inability of transportation of starch particles to the water. How?

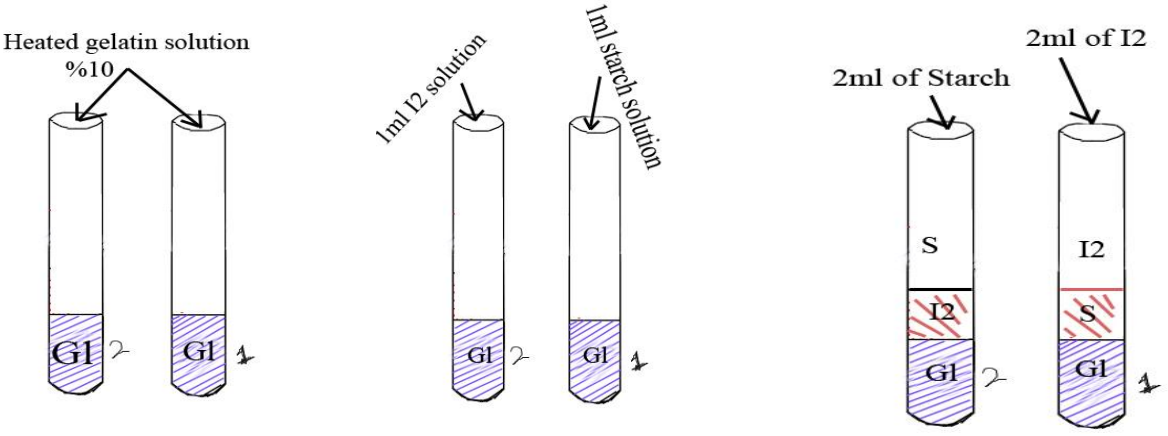
Detect starch and Cl^- as shown below:

3ml of external water + some drops of I_2 indictor ⟶ colorless proof to the non existence of starch because starch with I_2 gives the blue color

3ml of external water + some drops of $AgNO_3$ ⟶ precipitation or formation white component of AgNO3 proof to the presents of Cl^- ions.

Diffusion of starch and I_2 through solidified gelatin membrane:

Diffusion rate of them depends on the pore or gate that presents in this membrane and the size and mass of the solution particles.



Q\What happened and why?

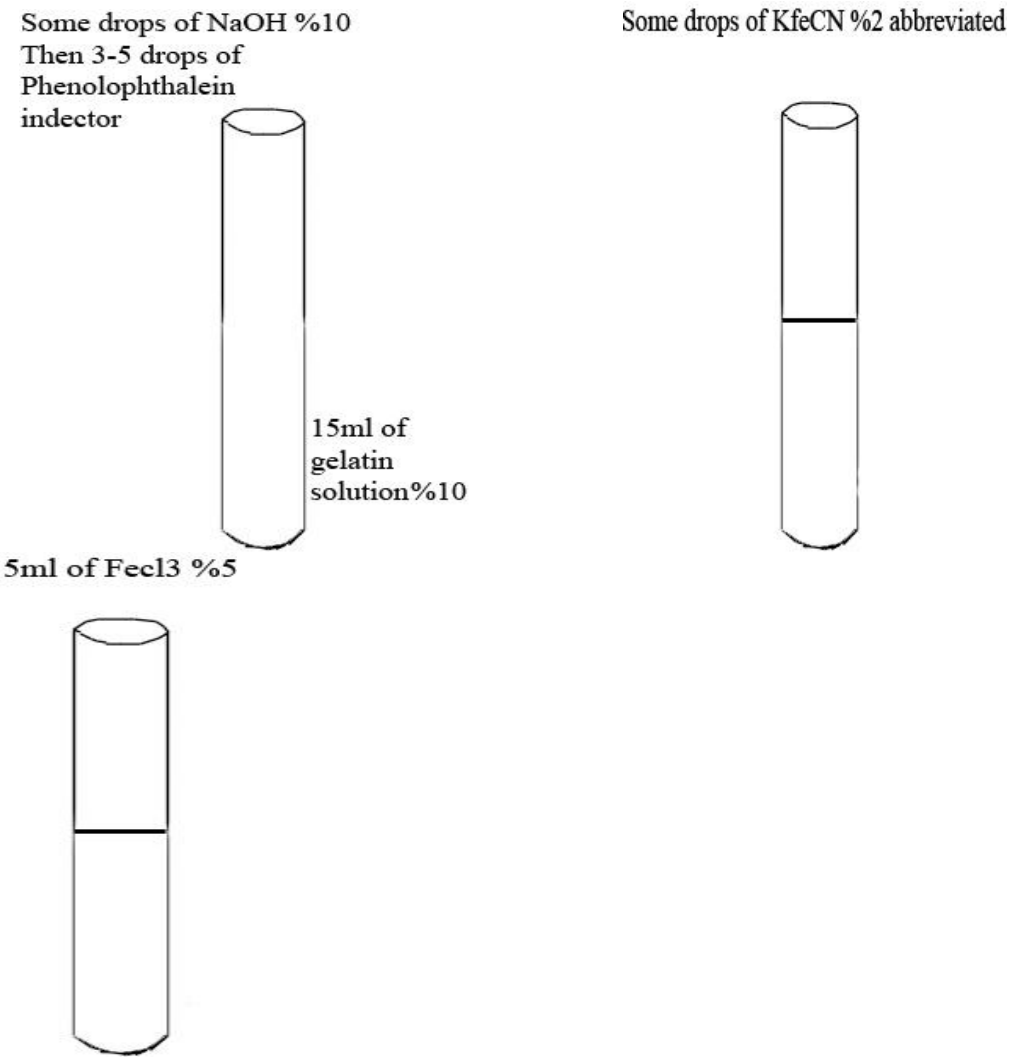
Answer\\ Appear the blue layer in test tube (1), and disappear this layer in test tube (2) because of I_2 ions have small size and mass compare to the starch particles, so

have ability to diffuse in layer (gelatin + Starch solidified) and react with starch molecules and give the blue color.

But in the test tube (2) the starch molecule cant penetrate the layer (Gelatin + I_2 solidified) because of large size and mass of its particles, so it is not reacts with I_2 and don't give the layer with blue color.

Diffusion of ions through colloidal gelatinous solidified:

The diffusion of ion is independently each to other, so diffusion rate depends on the size and mass of them and the relation is reversely.



Q\What do you observe? Why?

Q\which of the (Cl^-, Fe^{+3}) diffused faster and why?

Compose the colorless layer from food salt(NaCl) produced from diffusion of Cl^- ions in the gelatin solution, in which the Cl^- (results of dissociation of $FeCl_3$) reacts with Na+ products of dissolving NaOH, composing the NaCl, and the media become equilibrate, so causes to disappearance of pink color of indictors. In upper part compose the blue color results of diffusion of Fe+3 ions and reacts with KFeCN presents in gelatinous media composing the blue compound (FeCNFe). So the Cl^- ions diffuse faster than Fe^{+3} and scotch the longer distance than Fe^{+3}, because of the Small size and mass of Cl^- ions.