Lab Report 2 : Molecular Activity and Membrane Transport

Purpose: To learn how to observe and identify diffusion, osmosis, passive transport and active transport (ATP) and filtration.

Procedures:

2. 2-B Measurement of diffusion through liquid
    a. Working in groups, fill three Petri dishes with 40 ml. of 25°C water.
    b. Drop one crystal of potassium permanganate into each dish.
    c. Be sure to use the same amount of potassium permanganate for each dish. Record the time.
    d. Measure, in millimeters, and record the largest diameter of the colored spot after 5 minutes.
    e. Repeat steps 1-3 for water at 5°C and at 45°C.
    f. Construct a graph of ranges and means for each temperature.

3. 2-C measurement of diffusion through agar
    a. Petri dishes have been filled with agar. Two holes have been made in the agar. Into one hole, place two drops of methylene blue.
    b. Into the other hole, place two drops of potassium permanganate.
    c. Record the time and immediate diameter of each spot. This will be your time zero measurement.
    d. Measure the diameter of each spot in millimeters once every minute for fifteen minutes.
4. 2-D demonstration of filtration
    a. Fold three filter papers into cones and insert them into three separate glass funnels. Wet the papers to make them stick to the glass.
    b. Prepare three 100-milliliter solutions of charcoal and water. Make one thick, one medium thickness, and one thin.
    c. Record the mass of the charcoal used in each preparation.
    d. Pour 50 ml of each solution, one at a time, into a funnel.

e. Immediately count the number of drops produced per minute. Count the number of drops per minute when the funnel is half-filled.
f. Count the number of drops per minute when the funnel is nearly empty.
g. Repeat these procedures with the remaining 50 ml. of solution.

5. 2-F Measurement of osmosis
   a. Attach dialysis bags filled as much as possible with sucrose solutions securely to the bottom of two open, thin glass tubes.
   b. One bag should be filled with a 25% sucrose solution and the other should be filled with a 50% sucrose solution.
   c. Insert both bags into separate beakers of distilled water making sure the dialysis bags are fully submersed but not touching the bottom of the beakers
   d. suspend each by gently applying a ring stand clamp to the glass tubes. Check for solution leaking out of the bags.
   e. Allow five minutes for the systems to equilibrate.
   f. mark the fluid levels of each glass tube with a felt pen.
   g. Record the time.
   h. Record the fluid level of the glass tubes in millimeters every 10 minutes for 50 minutes.
   i. If the fluid level rises to the top of the glass tube sooner than 50 minutes, record the time it took to get there, measure the length in millimeters from the equilibration line to the top of glass tube. Divide that length by the number of minutes to get your rate in mmmin.

6. 2-G Measurement of differential permeability of sugar and starch

   a. Fill a dialysis bag with a 1% starch - 10% glucose solution. Reliable results depend on your ability to tightly seal the dialysis bag.
   b. Tie the bag to a glass rod and suspend it in a beaker of distilled water
   c. After 15 minutes has passed check the water again for starch and sugar in the following way:

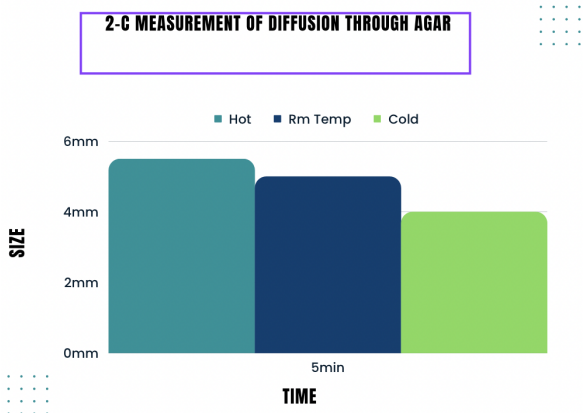
d. Test for starch:. Add 10 drops of Lugol's solution to 5 ml of water obtained from the beaker. Reddish color = No starch Navy blue color = Starch present
e. Test for sugar: a. Add 3 ml of Benedict's solution to 5 ml of water obtained from the beaker. Simmer the solution at a low boil for 5 minutes. Blue color = No sugar Color change = Sugar present (green = little sugar; yellow = moderate sugar; orange = more sugar; red = lots of sugar)
f. Test the water in the beaker again at 30, 45 and 60 minutes.

6. 2-H: The effects of tonicity on red blood cells - Demonstration

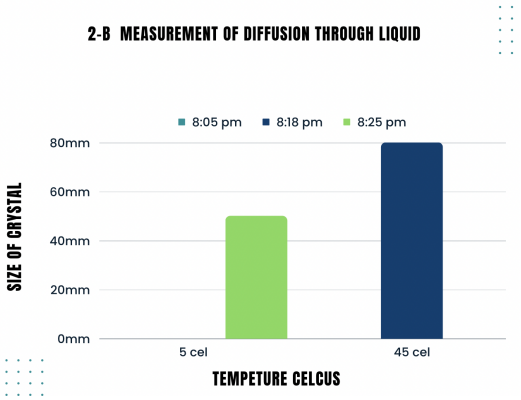
a. One milliliter of each of the following solutions will be in three separate test tubes.
b. . Distilled water (hypotonic)
c. Physiological saline – 0.85% NaCl (isotonic) c. Salt water – 2.0% NaCl (hypertonic)
d. A small drop of blood will be added to each tube and the contents thoroughly mixed.
e. A wet mount slide will be made of each solution.
f. Examine each slide under the high-dry lens of a compound microscope.
g. Observe the following:
h. Hemolysis of cells in the hypotonic solution. (Note the transparent solution.
i. Maintenance of cell size in the isotonic solution.
j. Crenation of cells in the hypertonic solution.

Results:

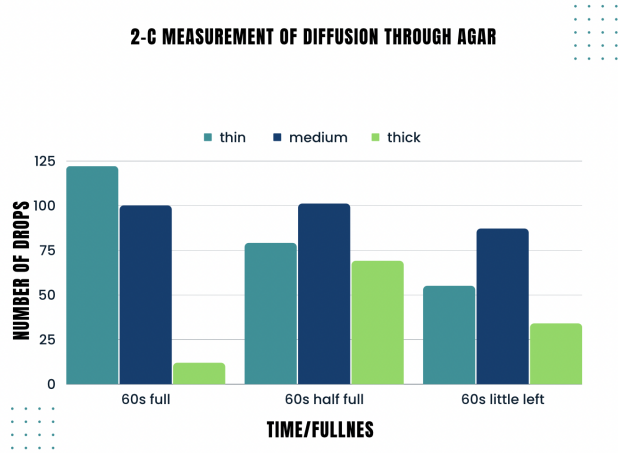
2-B Measurement of diffusion through liquid



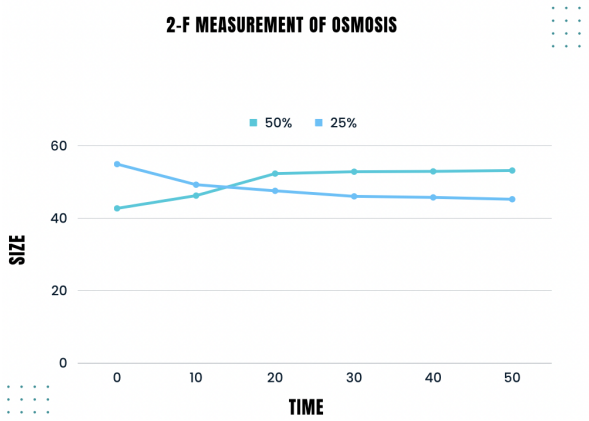
2-C Measurement of Diffusion



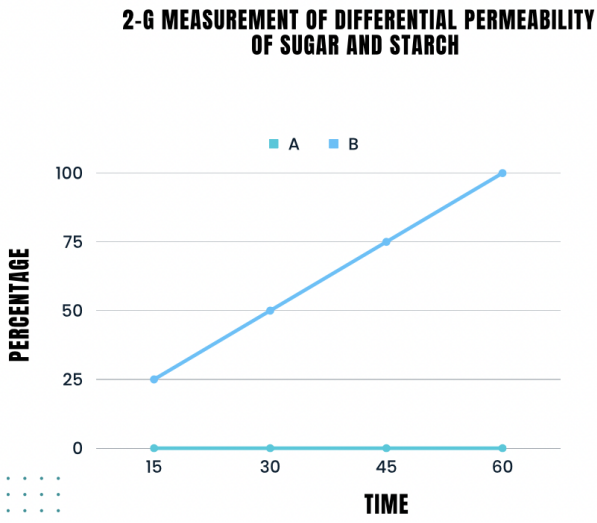
2-D demonstration of filtration



2-F Measurement of osmosis



2-G Measurement of differential permeability of sugar and starch



Discussion: In conclusion, the series of experiments delved into fundamental biological processes, yielding valuable insights. The investigation of diffusion through liquids unveiled the temperature's impact on diffusion rates, with a constructed graph illustrating the relationship. Diffusion through agar highlighted the role of molecular properties in varying diffusion rates. The filtration experiment underscored how solution thickness affects filtration dynamics. Osmosis experiments provided a comprehensive view of water movement across membranes, emphasizing osmotic equilibrium. Differential permeability insights elucidated membrane selectivity. Lastly, the tonicity experiment demonstrated cellular responses to

different solutions. Collectively, these experiments contribute significantly to understanding diffusion, osmosis, filtration, and cellular behaviors under varying conditions, spanning implications across scientific, medical, and engineering domains.

Conclusion: In conclusion, the experiments delved into diffusion, osmosis, filtration, and tonicity. These investigations shed light on temperature's effect on diffusion, filtration dynamics, water movement in osmosis, and the impact of tonicity on red blood cells. Collectively, they provide valuable insights into fundamental biological processes and their underlying principles.