Molecular Activity and Membrane Transport

Bio 125

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Sep 04, 2023

The purpose of this laboratory exercise was to understand the concept of filtration and diffusion, where materials moved in and out of the cells. These experiments showed transportation of different materials through different membranes, including the properties of diffusion, osmosis, and differential permeability.

2-B: Measurement of diffusion through a liquid Procedure

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

2-C: Measurement of diffusion through agar Procedure

1.Petri dishes have been filled with agar. Two holes have been made in the agar. Into one hole, place two drops of methylene blue. Into the other hole, place two drops of potassium permanganate. Record the time and immediate diameter of each spot. This will be your time zero measurement.

2.Measure the diameter of each spot in millimeters once every minute for fifteen minutes. Calculate the averages from the data collected by all groups doing this exercise. Summarize this data.

3.Construct a graph of average diffusion diameter versus time for both chemicals.

4.Determine the diffusion rate of each chemical. Which has the fastest diffusion rate, methylene blue or potassium permanganate? Record these results.

5.Look up the molecular formula and structure of methylene blue and potassium permanganate in a MerckIndex. Make note of this information.

2-D: Demonstration of filtration Procedure

1. Fold three filter papers into cones and insert them into three separate glass funnels. Wetthe paper to make them stick to the glass.

2. Prepare three 100-milliliter solutions of charcoal and water. Make one thick, one medium thickness, and one thin. Record the mass of the charcoal used in each preparation. NOTE: if your "thin" solution continually runs through the filter, making it impossible to count drops, it is too thin; you will need to make all your solutions proportionally thicker.

3. Pour 50 ml of each solution, one at a time, into a funnel.

4. Immediately count the number of drops produced per minute. NOTE:it may be easier to count the drops for 15 seconds then multiply by four to obtain drops per minute.

5. Count the number of drops per minute when the funnel is half-filled.

6. Count the number of drops per minute when the funnel is nearly empty.

7. Did the charcoal pass into the filtrate? Which solution had the fastest rate of filtration? What is the driving force behind filtration? What other factors influence the rate of filtration? Do your results illustrate these influencing factors?

8. Repeat these procedures with the remaining 50 ml. of solution

2-F: Measurement of osmosisProcedure

1. Attach dialysis bags filled as much as possible with sucrose solutions securely to the bottom of two open, thin glass tubes. One bag should be filled with a25% sucrose solution and the other should be filled with a 50% sucrose solution. Make sure ends of the tubes are immersed in the solutions. NOTE: reliable results depend on your ability to tightly seal the dialysis bags.

2. 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 and suspend each by gently applying a ring stand clamp to the glass tubes. Check for solution leaking out of the bags.

3. Allow five minutes for the systems to equilibrate. Then, mark the fluid levels of each glass tube with a felt pen. Record the time.

4. Record the fluid level of the glass tubes in millimeters every 10 minutes for 50 minutes.

5.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 mm/min.

6.Determine the rate of osmosis for each system. Which system had the fastest osmotic rate, the 25% or 50% sucrose solution?

2-G: Measurement of differential permeability of sugar and starch

Procedure

1. Fill a dialysis bag with a 1% starch–10% glucose solution. Reliable results depend onyour ability to tightly seal the dialysis bag.

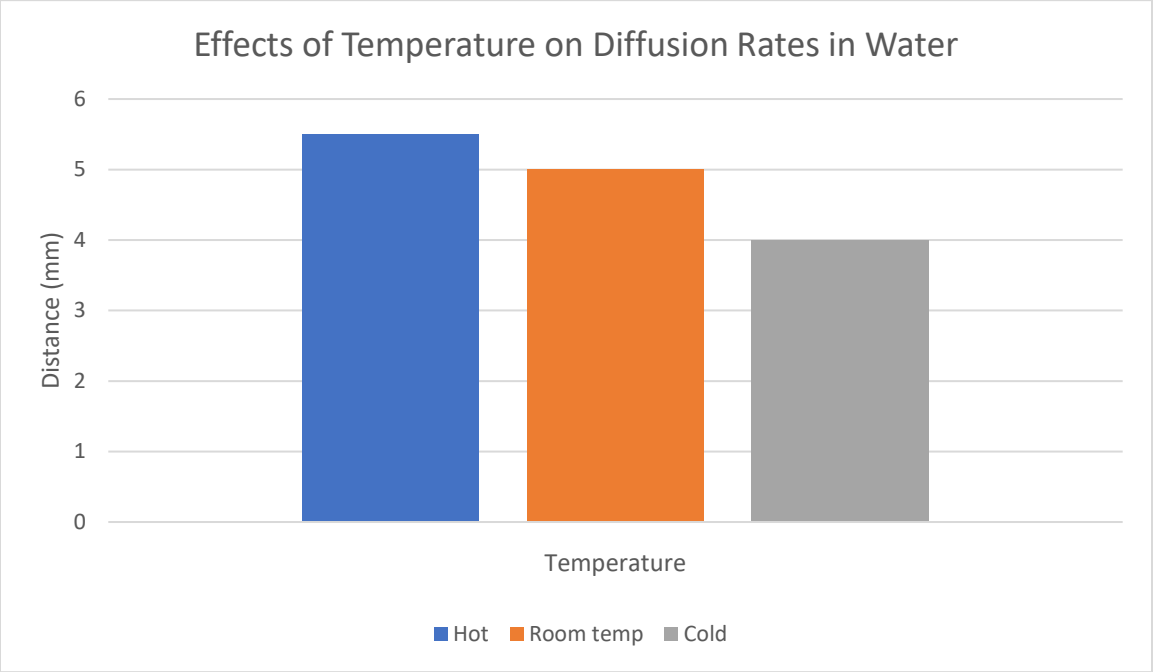
2. Tie the bag to a glass rod and suspend it in a beaker of distilled water. NOTE: Test the water from the bottom of the beaker to ensure that it is free of starch and/or sugar.

3. After 15 minutes have passed check the water again for starch and sugar in the following way: Test for starch: a. Add 10 drops of Lugol's solution to 5 ml of water obtained from the beaker. Reddish color = No starchNavy blue color = Starch present 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)

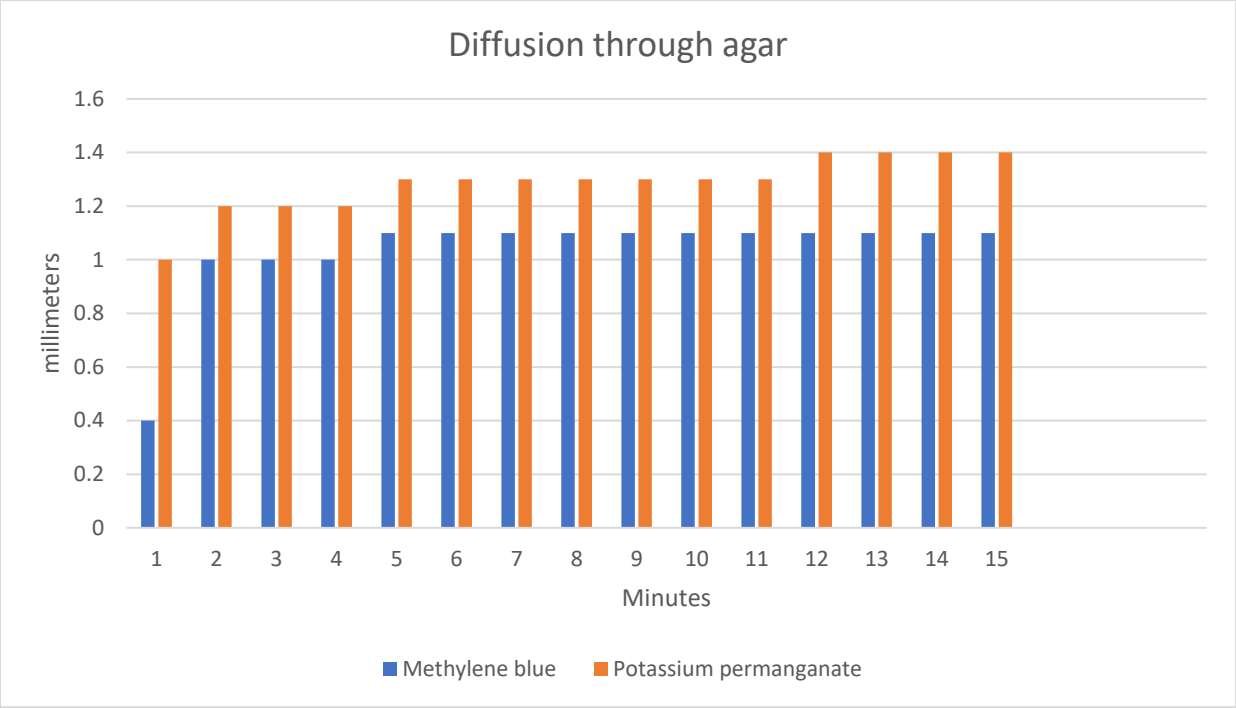
4. Test the water in the beaker again at 30, 45 and 60 minutes.

5. Record these results. Explain the significance of these findings in relation to the permeability of the dialysis bag.

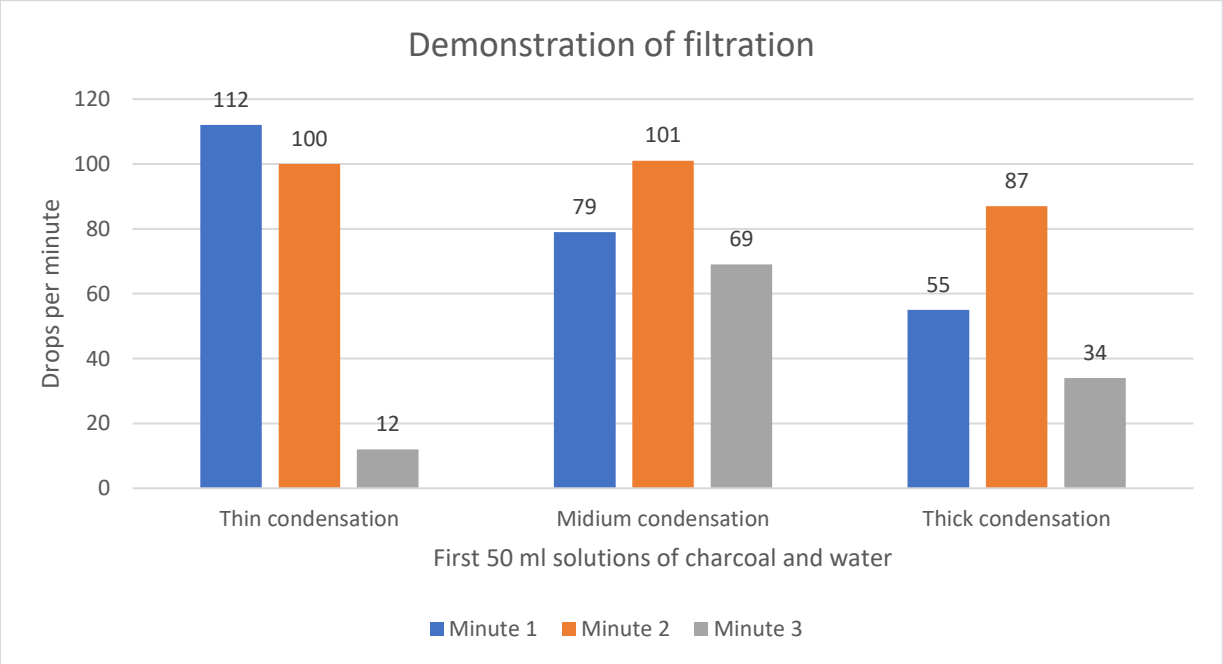
2-B: Measurement of diffusion through liquid

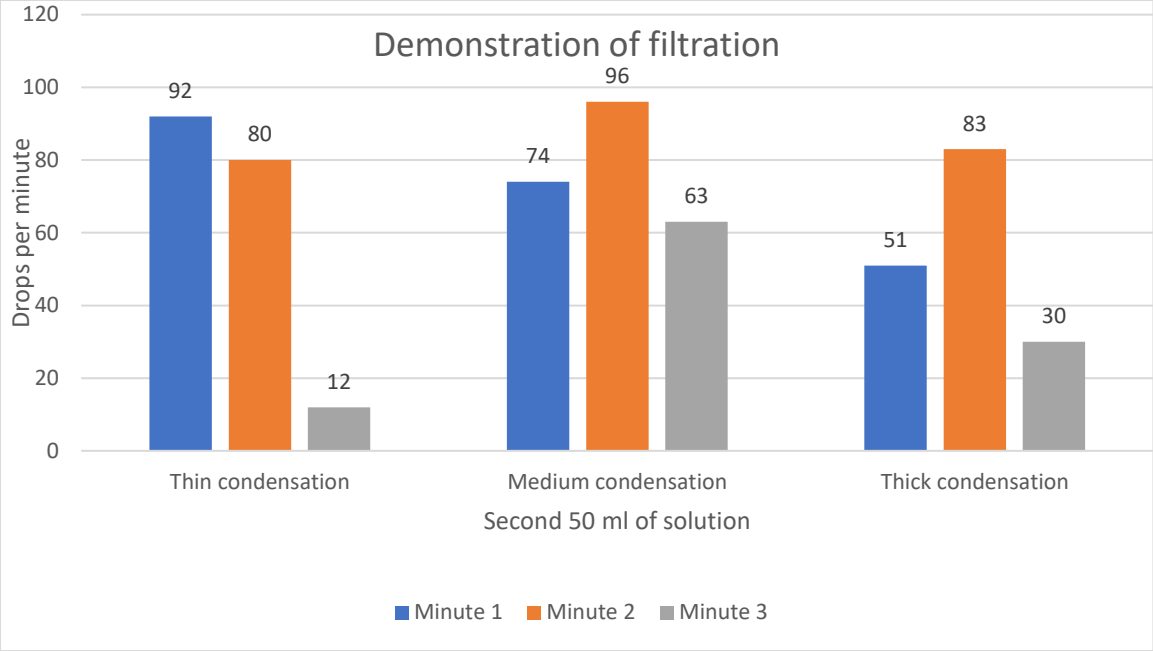


2-C: Measurement diffusion through agar

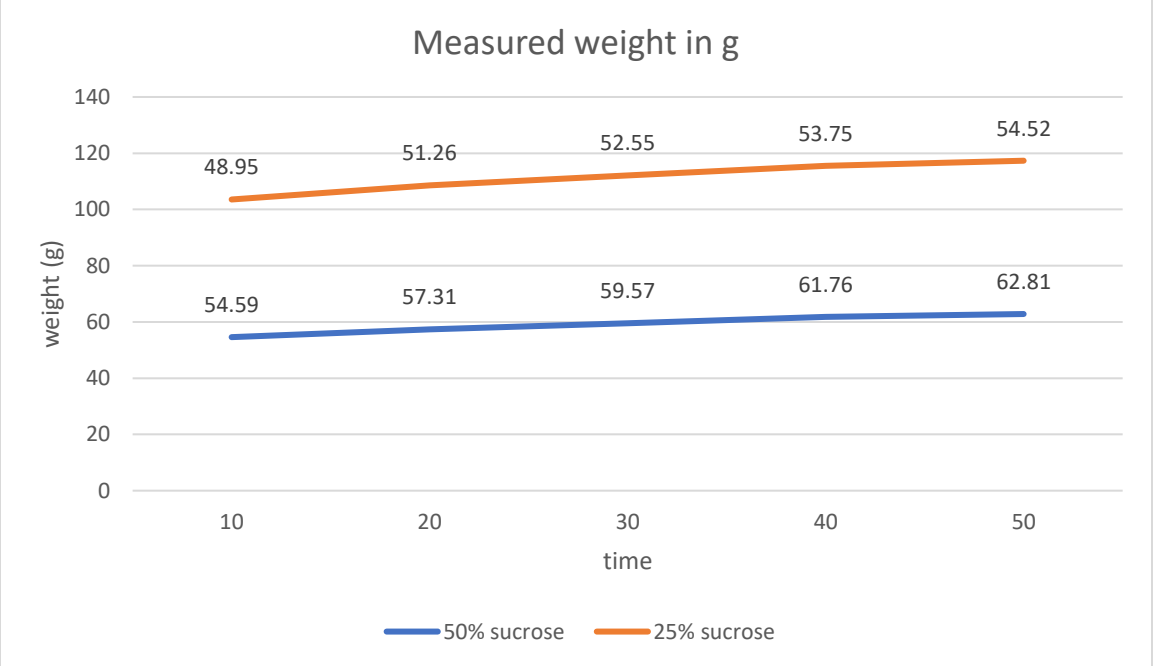


2-D: Demonstration of filtration

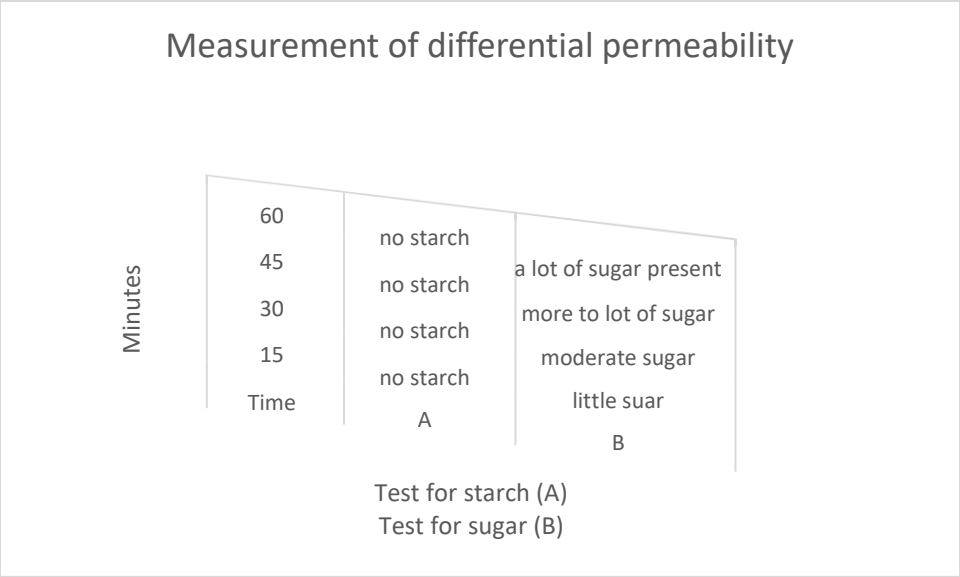




2-F: Measurement of osmosis



2-G: Measurement of differential permeability of sugar and starch



Discussion

At the end of the experiment, demonstration of filtration, the result was not accurate. That was because with the medium thickness substance, the filtration rate was faster than the thin substance. Clearly it was because of an error. Maybe I made the cone the wrong way, leaving an open end, and for that reason the filtration and result were altered. So, I need to make sure that I am performing the experiments with accuracy, so the results won't be altered.

Conclusion

Diffusion is temperature and size dependent, filtration is dependent upon solution density, and osmosis is concentration dependent.