Mariah Hall

Bio 125- Tuesday Lab

August 27, 2023

Laboratory 2- Molecular Activity and Membrane Transport

Purpose:

The purpose of this lab is to learn about how materials move in and out of cells by mechanisms of passive and active transport. It also is to learn about the several factors that influence their ability to pass through membranes.

Procedure:

2B- Measurment of diffusion through a liquid

-Obtain 3 separate petri dishes, fill each dish with 40mls of 25-degree Celius water.

-Using the specula, obtain a crystal of potassium permanganate and drop one into each dish.

-After 5 minutes have passed from the initial drop of potassium permanganate into the dishes, measure the largest diameter of the colored spot in millimeters.

- Repeat the prior steps for water at 5-degree Celsius and 45-degree Celsius

-Compare and graph results

2C- Measurment of Diffusion through agar

-Use the prefilled petri dishes of agar. Two holes have already been made into the agar.

-In the first hole, place two drops of methylene blue.

-In the second hole, place two drops of potassium permanganate.

-Notate the initial time and diameter of each spot for the time zero measurement.

-Obtain the diameter measurement in millimeters once every minute for 15 minutes.

-Compare and graph average diffusion diameter versus time for both chemicals.

- Use the Merck index to interpret results

2D- Demonstration of filtration

-Fold 3 separate filter papers into cones.

-Place each filter paper into a glass funnel, using water to help adhere to the funnel.

-Make 3 different 100ml solution concentrations using 100mls of water and charcoal.

-Using a scapula measure out different amounts of charcoal into each solution, creating a thin, medium thick and thick solution.

-Record the mass of charcoal used in each solution.

-Pour 50mls of each solution, one at a time, into the funnel.

-Immediately start to count the number of drops per minute for each solution and make note.

-Count the number of drops per minute for each solution when the funnel is half-filled and make note.

- Count the number of drops per minute for each solution when the funnel is nearly empty and make note.

-Repeat with the remaining 50mls of the solutions.

2F- Measurment of osmosis

- Obtain two separate dialysis bags

- Fill one bag with the 25% sucrose solution and one bag with the 50% sucrose solution. Secure each bag by tying each end of the bags with string

-Insert each bag into separate beakers of distilled water, ensuring each bag is fully submerged but not touching on the bottom of the beakers by using a ring stand clamp to the glass tubes.

-Check for leakage

-Allow 5 minuets to pass for the systems to equilibrate, then mark the fluid levels of each glass tube, notating the time

-Determine the rate of osmosis for each system.

2G- Measurement of differential permeability of sugar and starch

-Obtain a dialysis bag

-Fill dialysis bag with half 1% starch solution and half 10% glucose solution.

-Secure the bag at the top and bottom by tying a piece of string tightly.

-Tie the bag to a glass rod and suspend it into a beaker of distilled water, test the water from the bottom of the beaker to ensure no starch or sugar are present.

-After 15 minutes have passed check the water again for starch and sugar in the following ways:

Test for starch by adding 10 drops of Lugol's solution to 5mls of water from the beaker.

Redish color indicates no starch and navy-blue color indicates starch present

Test for sugar by adding 3mls of Benedict's solution to 5mls of water obtained from the beaker. Simmer the solution at a low boil for 5 minutes.

Blue color indicates no sugar present, and any color changes indicate some sugar is present. (green=little sugar, yellow= moderate sugar, orange= more sugar and red= lots of sugar)

-Test the water in the beaker again at 30, 45 and 60 minuets

-Record results and explain the significance of the findings in relation to the permeability of the dialysis bag.

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

-Observe a wet mount slide under the high-dry lens of a compound microscope of a small drop of blood mixed with distilled water, notate appearance, and illustrate

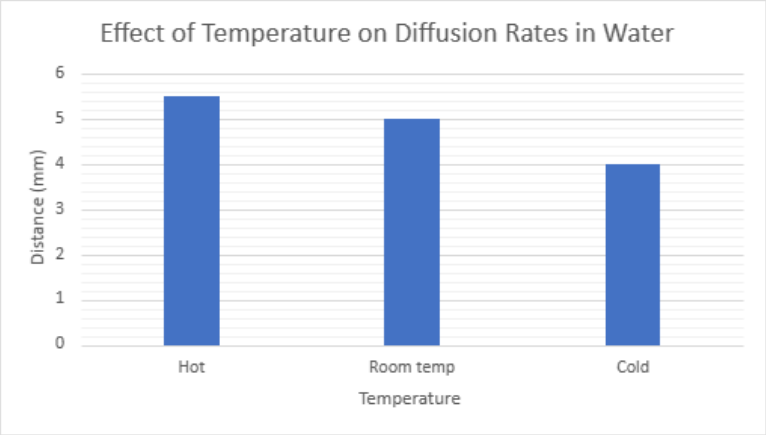
-Using the same type of microscope, observe a wet mount slide of a small drop of blood mixed with physiological saline or 0.85% NaCl, notate appearance and illustrate.

-Observe a wet mount slide of a small drop of blood mixed with salt water or 2.0% NaCl, notate appearance and illustrate.

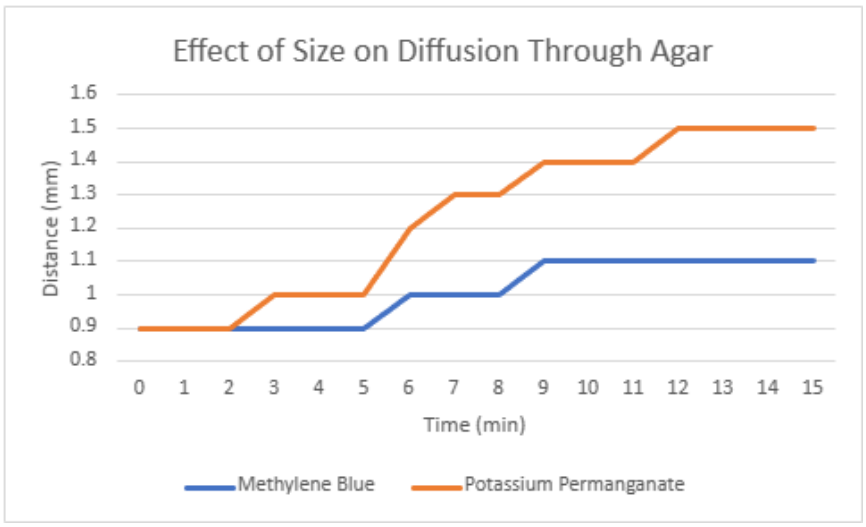
-Explain each observation and provide an explanation of each.

Results:

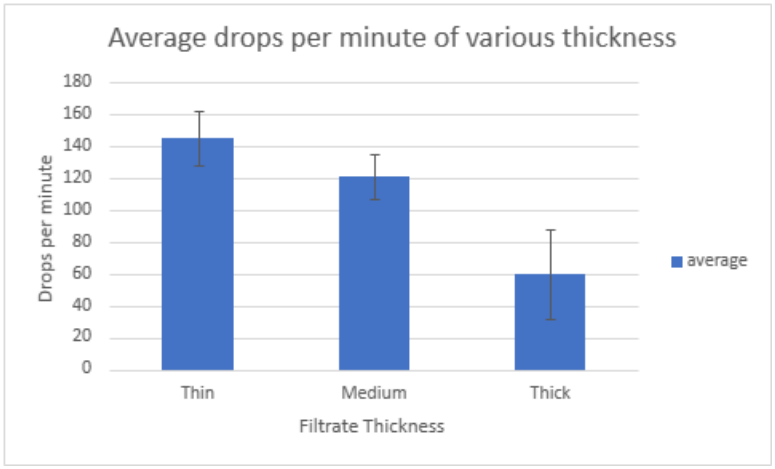
2B:



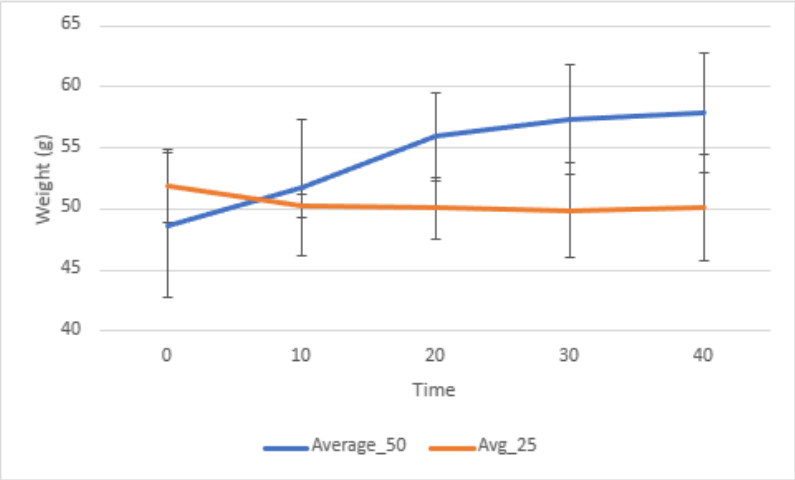
2C:


Effect of Size on Diffusion Through Agar
Distance (mm)
1.6
1.5
1.4
1.3
1.2
1.1
1
0.9
0.8
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
Time (min)
Methylene Blue
Potassium Permanganate

2D:


Average drops per minute of various thickness
Drops per minute
180
160
140
120
100
80
60
40
20
0
Thin
Medium
Thick
Filtrate Thickness
average

2F:



2G

Differential Permeability of sugar and starch

Time (mins)	Starch Presence	Sugar Presence
15	No Starch	Little Sugar
30	No Starch	Moderate Sugar
45	No Starch	More Sugar
60	No Starch	Lots of Sugar

Discussion-

2B- Measurment of diffusion through a liquid

-Based on the results from this experiment we were able to see that diffusion does occur faster at a higher temperature vs a lower temperature.

2C- Measurment of Diffusion through agar

-We were able to determine that potassium permanganate diffuses at a quicker rate than methylene blue.

-Per the Merck Index

Methylene Blue

Molecular formula

$C_{16}H_{18}ClN_3S$
Molecular weight

319.85
Percent composition

C 60.08%, H 5.67%, Cl 11.08%, N 13.14%, S 10.02%

Potassium Permanganate
Molecular formula

$KMnO_4$
Molecular weight

158.03
Percent composition

K 24.74%, Mn 34.76%, O 40.50%
-Based off the information provided by the Merck Index, potassium permanganate is less dense than methylene blue and this is the reason potassium permanganate diffuses faster.

2D- Demonstration of filtration

-During this experiment, we found that the charcoal did not pass into the filtrate. The thinnest solution had the fastest rate of filtration. The driving force behind filtration is the amount of pressure placed upon the filter, meaning the thin did not apply a lot of pressure on the filter funnel in comparison to the amount of pressure required by the thickest solution. The factors that we were able to observe affecting the filtration included; how fast the water was dumped into the funnel if we stirred the solution again prior to pouring it into the funnel and the size of our funnel opening. I do not think those factors specifically are illustrated in our results because straight across the thin solution filters faster followed by the mid thick solution and lastly the thickest.

2F- Measurment of osmosis
-This experiment was so long, and it was annoying to have to take these bags out, dry off excess water and weigh it. However, based on our results osmosis moved at a faster rate for the 50% sucrose solution because the distilled water moved into the higher concentrated solution, whereas the 25% solution was less so it moved slower.

2G- Measurement of differential permeability of sugar and starch

-I thought the previous experiment was annoying, but this was the worst and longest one of them all. After going over our data it was determined that the dialysis bags were more permeable to the sugar rather than the starch. This is because sugar molecules are smaller than starch molecules, allowing them to pass through.

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

-Red blood cells swell in hypotonic solutions like distilled water. They can sustain themselves in an isotonic solution like 0.85% NaCl being able to slightly shrink and swell in a dynamic equilibrium. Lastly, a red blood cell shrinks in a hypertonic solution like 2.0%. This was the

simplest yet most interesting experiment for me out of them all. It is so amazing to be able to see how each type of solution affects our red blood cells.

Conclusion:

-Diffusion is real and temperature and size of molecules does influence it.

-Solutions do filter out quicker the thinner they are.

-Osmosis is real and is quicker with higher concentrations.

-Sugar molecules are smaller than starch therefore more permeable.

- Hypertonic solutions do have a higher solute concentration than the cells in this solution. Hypotonic solutions have a lower solute concentration than cells in this solution. Isotonic solutions have the same solute concentration as the cells in the solution.