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Psychology 125

August 28, 2023

Laboratory 2: Molecular Activity and Membrane Transport

Purpose:

The purpose of this experiment is to understand the difference between passive and active transport. Also, to be able to define diffusion, osmosis, active transport, dialysis, and filtration. It is also to show the different results of dropping red blood cells into hypertonic, isotonic, and hypotonic solutions. Lastly, to understand the importance of the ideas from these experiments in terms of molecular activity and passive transport processes.

Procedures:

In each experiment they have specific procedures that need to be followed. In this laboratory, there were five (5) experiments conducted and procedures were followed accordingly.

2-B: Measurement of diffusion through a liquid

Petri dishes have been filled with agar with two holes. In one hole, two drops of methylene blue were put into the hole and two drops of potassium permanganate into the other hole. Time was recorded and the diameter of the spot after dropping the liquids. The diameter of each spot was recorded in millimeters every minute for 15 minutes.

2-D: Demonstration of the filtration

Three papers were folded into cones and were inserted into three separate glass funnels. 100- milliliter solutions of charcoal and water were prepared, and each solution had its own consistency (thick, medium thickness, and thin). The amount of charcoal used in the solutions was calculated. 50 ml were poured in the first try of the experiment while another 50 ml on the second part. The number of drops were counted when the funnel was half filled and when the funnel was nearly empty.

2-F: Measurement of osmosis

Dialysis bags were filled with sucrose solutions to the bottom of thin glass tubes. The other bag was filled with 25% sucrose while the other one was filled with 50% sucrose solution. It was made sure that the ends of the tubes were immersed in the solutions. Next, both bags were inserted into separate beakers of distilled water making sure that dialysis bags were fully submersed but not touching the bottom of the beakers. Dialysis bags were suspended by applying a ring stand clamp to the glass tubes. After that, the system waited for 5 minutes to equilibrate and then marked the fluid levels of each glass tube with a felt pen and recorded the time. The fluid level of the glass tube was recorded in millimeters every 10 minutes for 50 minutes.

2-G Measurement of differential permeability of sugar and starch

First, the dialysis bag was filled with a 1% starch to 10% glucose solution. Next, the bag was tied to a glass rod and suspended it in a beaker of distilled water. The water was tested from the bottom of the beaker to make sure that it was free of starch or sugar. After 15 minutes had passed, the water was checked again for starch and sugar. For the starch, 10 drops of Lugol's solution were added to the 5 ml water obtained from the beaker. For sugar, 3 ml of Benedict's

solution was added to the 5 ml of water obtained from the beaker. The solution was boiled for 5 minutes. The water in the beaker was tested again at 30, 40, and 60 minutes.

2-H: The effect of tonicity on red blood cells – Demonstration

One milliliter of distilled water (hypotonic), physiological saline – 0.85% NaCl (isotonic, and salt water – 2.0% NaCl (hypertonic) were put into three separate test tubes. A small drop of blood was added to each tube and the contents were mixed thoroughly and put on a mount slide. Each slide was examined under the high-dry lens of a compound microscope.

Results

2-B: Measurement of diffusion through a liquid

Trial 1

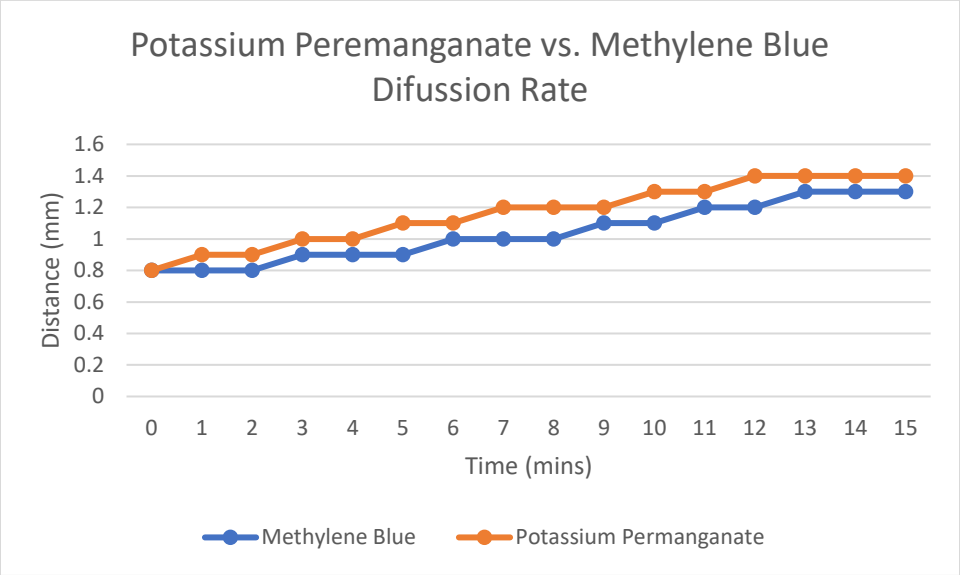
Time (mins)	Temperature (℃)	Diameter (mm)
5 mins	25℃	39 mm
5 mins	5℃	30 mm
Largest diameter after 5 mins	5℃	30 mm
5 mins	45℃	42 mm

Trial 2

Time (mins)	Temperature (℃)	Diameter (mm)
5 mins	25℃	39 mm
5 mins	5℃	30 mm

Largest diameter after 5 mins	5°C	30 mm
5 mins	45°C	43 mm

2-C: Measurement of diffusion through agar



	Molecular Formula
Potassium Permanganate	$KMnO_4$
Methylene Blue	$C_{16}H_{18}ClN_3S$

2-D: Demonstration of filtration

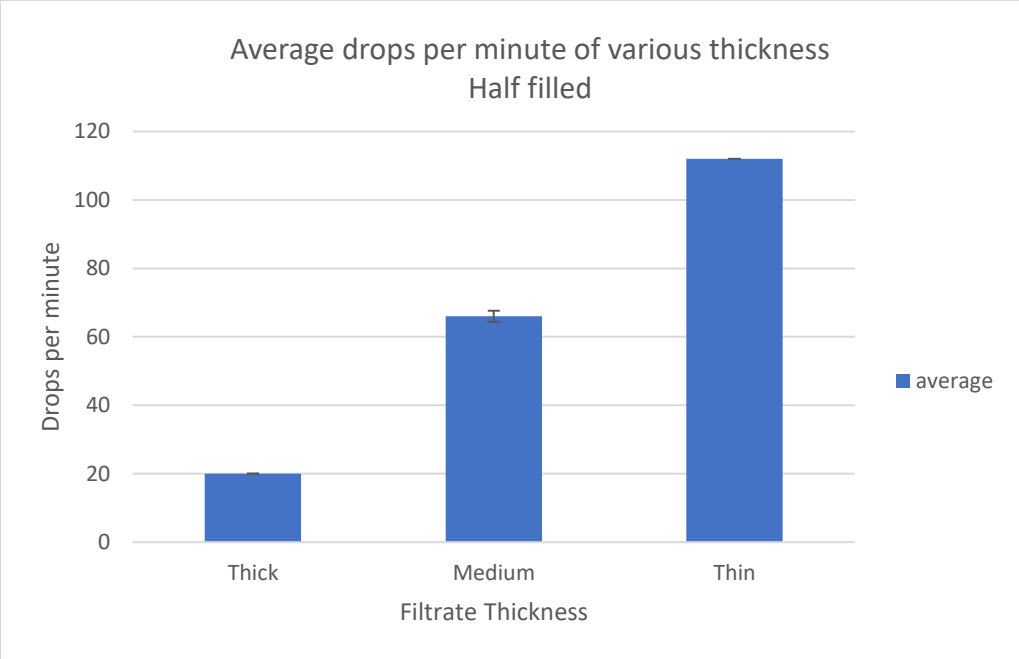
Trial 1

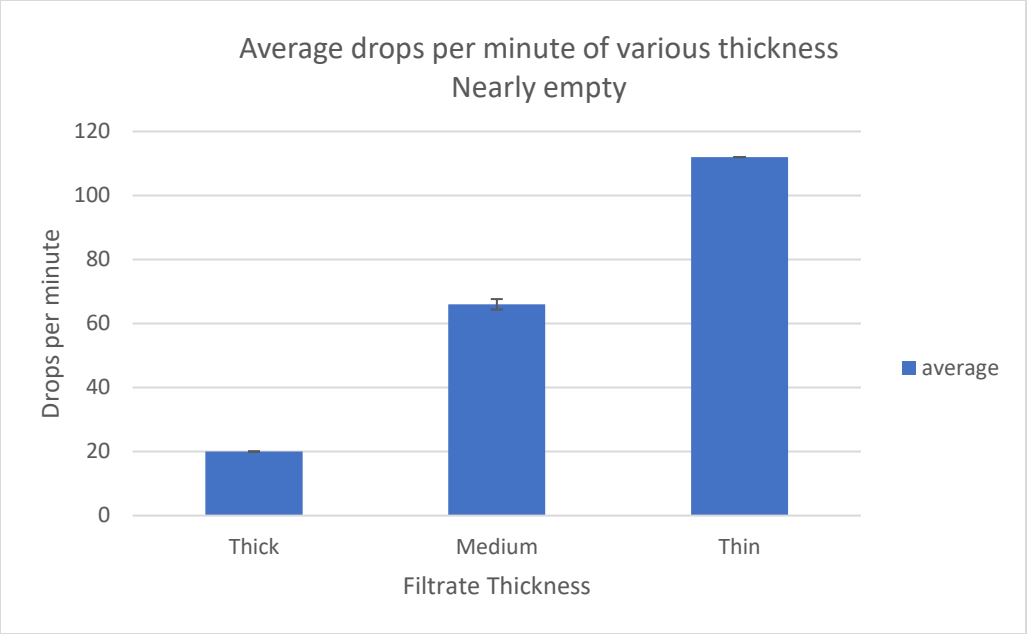
Thickness	**Half-filled/ Nearly empty**	**Drops / Minute**
Thick	Half-filled	56 drops / minute
	Nearly empty	20 drops / minute

Medium thick	Half-filled	80 drops / minute
	Nearly empty	68 drops / minute
Thin	Half-filled	120 drops / minute
	Nearly empty	112 drops / minute

Trial 2

Thickness	**Half-filled/ Nearly empty**	**Drops / Minutes**
Thick	Half-filled	52 drops / minute
	Nearly empty	20 drops / minute
Medium thick	Half-filled	80 drops / minute
	Nearly empty	64 drops / minute
Thin	Half-filled	116 drops / minute
	Nearly empty	112 drops / minute





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

Time	Sugar	Starch
15 minutes	N/A	N/A
30 minutes	N/A	N/A
45 minutes	Green/Blue	N/A
60 minutes	Green/Blue	N/A

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

A. Distilled water (hypotonic)

- transparent red to pink colors

B. Physiological saline – 0.85% NaCl (isotonic)

- Red blood cells scattered

C. Salt water – 2.0% NaCl (hypertonic)

- Red Blood Cells looks so dense, can see the circular shapes

Discussion

In experiment **2-B**, the different measurements of the diffusion through a liquid were measured. Based on the results, the temperature affects the diffusion of a certain element in a liquid. At 25℃, the diameter was 30 mm. The largest diameter after 5 mins was 30 while doing the experiment. On the other hand, at 45℃ the diameter of the diffusion was 42 mm in 5 minutes. The experiment was done the second time and got the same results except for the temperature at 45℃ which gave a result of 43 mm. The change was only 1 mm.

In experiment **2-C**, the different measurements of diffusion through agar were measured. Based on the graph, The potassium permanganate has a faster diffusion rate than the methylene blue in agar. While doing the experiment, after dropping the potassium permanganate in the plate with agar it immediately started to scatter a bit than methylene blue. In that case, the diameter of the potassium permanganate after it diffused was larger than the methylene blue. The methylene blue diffused barely in the span of 15 minutes compared to potassium permanganate.

In experiment **2-D**, there were two trials which gave us almost identical results. The procedure asked to get results from when the cone was half filled and when it was nearly empty. For the first trial, when the cone was half filled, the results were 56 drops/minute for thick, 80 drops/minute for medium thick, and 120 drops/minute for thin. When the cone was almost empty the gathered results were 20 drops/minute for thin, 68 drops/minute for medium thick, and 112 drops/minute for thin. For trial 2, the results gathered for the cone when it was half filled were 52 drops/minute for thick, 80 drops/minute for medium thick, and 116 drops/minute for thin. For the

cone when it was nearly empty the gathered results were 20 drops/minute for thick, 64 drops/minute for medium thick, and lastly 112 drops/minute for thin. The thickness of the of the liquid affects the drops of the liquid.

In experiment **2-G**, the differential permeability of sugar and starch were observed. Based on the observation, the only color change happened was at the 45 minutes mark and 60 minutes mark. There were no color changes in water after adding 3 ml of Benidict's solution to the water. On the other hand, after adding 10 drops of Lugol's solution to the water a color change happened. It happened at the 45 minutes and 60 minutes mark of the experiment. The colors were blue green that indicates that there was a little amount of sugar in the water.

In experiment **2-H**, the effects of tonicity on red blood cells were observed. On part A, distilled water was infused with red blood cells. Since distilled water is hypotonic to red blood cells, the red blood cells will swell causing leakage that gives a transparent red to pink color. On part B, physiological saline was infused with physiological saline – 0.85% NaCl. Since physiological saline – 0.85% NaCl is isotonic to the red blood cell there were no net gain or loss of water from the cell. This means that the solution is in equilibrium. Lastly, on part C, red blood cells were placed in salt water – 2.0% NaCl. Since salt water – 2.0% NaCl is hypertonic to red blood cells, the water will move out of the red blood cells causing the cells to shrink. That explains why the shape of the cells can be seen easily.

Conclusion

In conclusion, the temperature affects the diffusion rate. The higher the temperature the faster the diffusion rate and the larger the diameter just like what happened to experiment **2-B**. At the temperature of 45℃, it got the largest diameter which is 43 mm compared to the 5℃. Next,

the thickness of the solution affects the diffusion as well. The thinnest solution has more drops than the thick and medium thick solution. The diffusion of potassium permanganate and methylene blue in agar were very different from each other. The potassium permanganate diffused faster than the methylene blue. For the fourth experiment, adding 10 drops of Lugol's solution to the water made the color changed to a blue green color which means it has a little bit of sugar in. There were no signs of starch in the water. Lastly, distilled water is water is hypotonic to red blood cells that caused the RBCs to swell causing leakage that gives it a transparent red to almost pink color. The physiological is isotonic to the red blood cells therefore there is no net gain or loss of water from the cell meaning it is in equilibrium. For the last part, salt water is hypertonic to red blood cells so the water will move out of the red blood cells causing the cells to shrink.