Cell Structures: Diffusion

Diffusion is the movement of a molecule from a region of higher concentration to a region of lower concentration. Two factors that influence the rate of diffusion are molecular size and temperature. In this activity you will observe the diffusion of 3 different dyes, safranin, methylene blue and potassium permanganate in an agar petri dish under two different temperature conditions (5^0 C and 25^0 C). The molecular weight of the dyes range between 158 and 350.9.

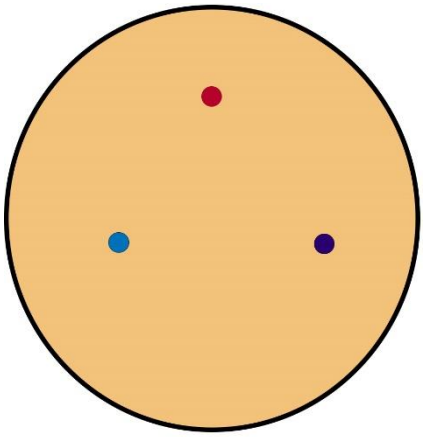
Agar is extracted from seaweed. Agar molecules are long and crosslink to form a gel-like matrix. Between the crosslinked molecules in the matrix, the water solution used to mix the agar can be found. Diffusion of molecules in an agar substrate is often referred to as liquid to liquid diffusion.

Write a hypothesis for your experiment. Which dyes to you expect to diffuse the furthest? _____

_____

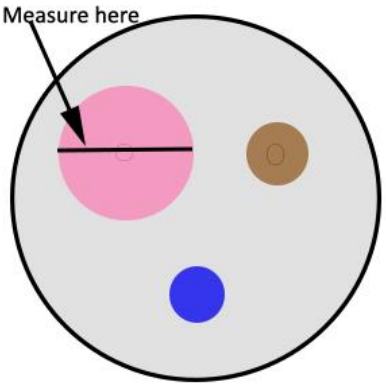
Materials

Agar petri dish – 2
Safranin – dropper bottle
Methylene blue – dropper bottle
Potassium permanganate –dropper bottle
Cork borer or pipette
Toothpick
Timer
Ruler



1. Pick up 2 petri dishes from the supply table. Label the plastic bottom of one plate, 5^0 C and include your group member's names. Label the second plate in a similar way with your group member's names and 25^0 C.
2. You need to make 3 wells in each plate, approximately 2 cm apart. The wells are holes in the agar into which the dyes will be added. To make a well, place the cork borer over the agar and push down. Pull the cork borer straight up. If the agar plug does not come out of the petri dish, use a toothpick to stab and remove the agar plug. If you are using a pipette instead of a cork borer, then trim off the end of the pipette so that the opening is ~ 3 mm wide. Squeeze the bulb of the pipette and then push the tip into the agar at the location you want your well. Release the bulb and the agar plug should get sucked up into the pipette. Repeat this procedure until you have 3 wells on each plate.
3. Turn each petri dish over and mark on the plastic bottom, label one well P, one well S and one well M.
4. Start with 5^0 C Petri dish. Carefully fill the P well with potassium permanganate using the dropper bottle. Do not overfill. Next fill the S well with safranin. Finally fill the M well with methylene blue.
5. Place the lid back on the Petri dish and incubate the plate in the refrigerator. Note the time the Petri dish was placed in the refrigerator.

6. Repeat step 4 for the 25^0 C Petri dish. Incubate this plate on your benchtop.
7. After 15 minutes measure the diameter of the circles of dye. Do this by placing the ruler underneath the Petri dish and measuring from edge to edge of the dye circle. Record your measurements below.
8. After 30 minutes measure the diameter of the circles of dye. Record your measurements below.



Diffusion of Dyes at 5^0 C		
Dye	Diameter at 15 minutes	Diameter at 30 minutes
Safranin		
Methylene blue		
Potassium permanganate		

Diffusion of Dyes at 25^0 C		
Dye	Diameter at 15 minutes	Diameter at 30 minutes
Safranin		
Methylene blue		
Potassium permanganate		

1. Which dye diffused the furthest? Which dye diffused the least?

2. Which dye has the largest molecular weight? How do you know?

3. Which dye has the smallest molecular weight? How do you know?

4. What effect did temperature have on diffusion? How do you know?

5. Was your hypothesis supported? Explain.

6. Name the independent variables for these activities.

7. Name the dependent variable.