B

Bio SBA for DSE2023 cohort

P. 1

Experimental question

How does the concentration of ethanol affect the membrane permeability of beetroot?

Design

The cells of beetroot have red pigment in the vacuoles. When the membranes of the vacuole and the cell membrane are damaged by ethanol, a kind of alcohol, pigment will leak out. With this information, design an experiment to answer the experimental question.

1. In this experiment, we are investigating how a factor (independent variable, IV) affects another factor (dependent variable, DV). What are the DV and IV of this experiment?

DV : Concentration of ethanol

IV : Membrane 's permeability of beetroot

2. Explain how the membrane permeability of the beetroot cells can be measured based on the above information. Suggest an accurate and reliable method for the measurement.

Observate the experiment after half hour and 1 hour , For example put 3 beetroot in different test tube , inside the test tube have different ethanol with different concentration , but one is filled with water which is control set-up If more fast the pigment release, then the membrane is more permeable.

3. What do you predict the results when beetroot tissues are put into different concentrations of ethanol?

The highest concentration of ethanol will damage the membrane more faster or break down , that means the pigment ~~of~~ can do diffusion before ~~the~~ others beetroot tissue , So the ~~it~~ membrane is more permeable .

4. Will you (1) put the same beetroot into different concentrations of ethanol one after one, or, (2) put different beetroot into different concentrations of ethanol? Discuss the strengths and drawbacks of each design.

(1) , because if you put different beetroot into different concentration , then the test ~~before~~ becom unfair , ~~beet~~ the beetroot inside, is different , means test tube there are two independent variable .

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5. Your teacher stresses that the beetroot has to be cut into same size and shape in each concentration of ethanol. Explain why it is needed.

Because the ratio of volume and surface area in different size (and shape) is different.

3:54 3:18

6. One student proposes putting a 3 cm cylinder of beetroot into each concentration of ethanol. Another student thinks the cylinder should be cut into three 1-cm discs to be put into each concentration of ethanol. Which one do you think is better? Explain why.

Another student's idea is better, because 3 cm^3 's ratio of volume and surface area is 1:18, but the ~~1 cm³~~ three 1 cm^3 's ratio is 1:6, Then the size is decrease and it is easier for beetroot to do diffusion faster.

7. Apart from ethanol and the shape and size of beetroot, are there other factors that may affect the leakage of pigment from beetroot cells? Explain your answers. How can these factors be controlled?

The temperature of the environment, because higher Temperature will make particles move faster, means can finish diffusion in shorter time. But we need to do fair Test, so we can put these test tube in same place, such as freezer. Although it takes lot of time, but it must be fair.

8. What is the major assumption underlying the whole experimental design? (An assumption is something we think it is true, though we cannot be sure. A major assumption is the one that the experiment cannot make any conclusion without assuming it to be true).

The water potential of the cells of beetroot is the same

(Materials and Methods to be handed out to students after completing the design.)

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Design

The cells of beetroot have red pigment in the vacuoles. When the membranes of the vacuole and the cell membrane are damaged by ethanol, a kind of alcohol, pigment will leak out. With this information, design an experiment to answer the experimental question.

1. In this experiment, we are investigating how a factor (independent variable, IV) affects another factor (dependent variable, DV). What are the DV and IV of this experiment?

Independent variable is the size of the cells of beetroot.
The dependent variable is the concentration gradient of alcohol.

2. Explain how the membrane permeability of the beetroot cells can be measured based on the above information. Suggest an accurate and reliable method for the measurement.

We can try to look at the diffusion of the beetroot cells. If the red colour of red pigment is diffuse out by diffusion, that means the cell membrane is permeable. If not, the cell membrance of the beetroot cell is impermeable.

3. What do you predict the results when beetroot tissues are put into different concentrations of ethanol?

If the ethanol has low concentration gradient, the red colour of the red pigment will diffuse out by diffusion. If it has high concentration gradient, the ethanol will enter to the cell. The reason is the net movement of it is from high concentration gradient to low concentration gradient.

4. Will you (1) put the same beetroot into different concentrations of ethanol one after one, or, (2) put different beetroot into different concentrations of ethanol? Discuss the strengths and drawbacks of each design.

I will use (1). First, (1) is a fair test but (2) is not. It is the strength of (1)
Second, for the drawbacks, because in (1), it use the same beetroot after one, so the result may be not very easy to see.

F

p. 2

5. Your teacher stresses that the beetroot has to be cut into same size and shape in each concentration of ethanol. Explain why it is needed.

If it is same same size and same shape, it will be a fair test. Also, we can see which beetroot can be diffuse faster in different concentration gradient of ethanol.

6. One student proposes putting a 3 cm cylinder of beetroot into each concentration of ethanol. Another student thinks the cylinder should be cut into three 1-cm discs to be put into each concentration of ethanol. Which one do you think is better? Explain why.

I think the second student's idea is better, because the size can affect the rate of diffusion, if it is smaller, it can diffuse quickly and show the result more faster.

7. Apart from ethanol and the shape and size of beetroot, are there other factors that may affect the leakage of pigment from beetroot cells? Explain your answers. How can these factors be controlled?

First, is the volume of ethanol, the volume of each ethanol should be the same.

Also, the room temperature of the place that doing experiment, because the room temperature will affect the temperature of ethanol, if the temperature of the ethanol is different, it will affect the result.

8. What is the major assumption underlying the whole experimental design? (An assumption is something we think it is true, though we cannot be sure. A major assumption is the one that the experiment cannot make any conclusion without assuming it to be true).

The major assumption is the red pigment will dissolve out from high concentration gradient to low concentration gradient. Maybe the red pigment will leak out.

(Materials and Methods to be handed out to students after completing the design.)

K

P. 1

Experimental question

How does the concentration of ethanol affect the membrane permeability of beetroot?

Design

The cells of beetroot have red pigment in the vacuoles. When the membranes of the vacuole and the cell membrane are damaged by ethanol, a kind of alcohol, pigment will leak out. With this information, design an experiment to answer the experimental question.

1. In this experiment, we are investigating how a factor (**independent variable, IV**) affects another factor (**dependent variable, DV**). What are the DV and IV of this experiment?

DV: Shade of red of solution after experiment
IV: Amount of solution added, mass of beetroot pieces added, temperature of solution

2. Explain how the membrane permeability of the beetroot cells can be measured based on the above information. Suggest an accurate and reliable method for the measurement.

Compare and contrast the shade of red of each boiling tubes, the more red the solution is the greater effect the ethnol had. By measuring how deep the red color is in each tube

3. What do you predict the results when beetroot tissues are put into different concentrations of ethanol?

Different tubes would result in a different intensity of the shade of red in the solution. ie. the higher the concentration of ethanol, the more red that solution would be.

4. Will you (1) put the **same** beetroot into different concentrations of ethanol **one after one**, or, (2) put **different** beetroots into different concentrations of ethanol? Discuss the strengths and drawbacks of each design.

Put different beetroot because less pigments is obtained if the same beetroot is used, and it is better for a fair experiment since the same amount of starting pigment is obtained.

K.

P.2

5. Your teacher stresses that the beetroot has to be cut into same size and shape in each concentration of ethanol. Explain why it is needed.

Different size and shape will change the total surface area of beetroot exposed to the solution, creating another dependent variable we don't want. To maintain a fair test same size and shape of beetroot has to be used. i.e. control the experiment to only have one dependent variable which is the shade of red of resulting solutions.

6. One student proposes putting a **3 cm cylinder** of beetroot into each concentration of ethanol. Another student thinks the cylinder should be cut into **three 1-cm discs** to be put into each concentration of ethanol. Which one do you think is better? Explain why.

Three 1-cm discs because it has more total surface area, which can sped up the experiment, therefore the results will be more different. i.e. the difference in different concentration of ethanol will be more obvious to observed so experimenters can tell the difference better.

7. Apart from ethanol, the shape and size of beetroot, are there other factors that may affect the leakage of pigment from beetroot cells? Explain your answers. How can these factors be controlled?

The temperature of the solutions since a high temperature can also damage the cell membrane and cause pigment leakage. This can be controlled by using solutions at room temperature and executing the experiment in a room temperature environment. The freshness of the beetroot can also affect the leakage of pigment from beetroot cells, to control this, we should extract beetroot pieces from the same beetroot sample and avoid using different beetroot samples

K.

P.3

8. Do you think the **volume** of ethanol (not the concentration) bathing the beetroot needs to be kept the same for each treatment? Explain your answer.

Yes. If the volume of ethanol cannot cover the beetroot pieces fully in an ethanol bath, the test will become unfair since some parts of the beetroot cells are not leaking pigments, changing the result of the experiment. ; e. to control the independent of ethanol volume added can maintain the fairness of the whole experiment.

9. What is the **major assumption(s)** underlying the whole experimental design? (An assumption is something we think it is true, though we don't have any proof. However, if we don't accept the assumptions to be true, valid conclusions from experiment can never be drawn).

The assumption is the more red the resulting solution is the more pigments were leaked during the experiment, which therefore shows the impact the concentration of ethanol has on the membrane permeability of beetroot.

10. Your teacher suggests you to replicate the experiment if time is allowed. Explain the underlying reason(s).

This can eliminate error as the more experiment results are obtained, we can compare different results and find a reasonable average as conclusion, which is better than using just a single result.

G

P. 1

Experimental question

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Design

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1. In this experiment, we are investigating how a factor (**independent variable, IV**) affects another factor (**dependent variable, DV**). What are the DV and IV of this experiment?

The dependent variable is the effectiveness of concentration of ethanol to the membrane permeability of beetroot. The independent variable is the different concentration of ethanol

2. Explain how the membrane permeability of the beetroot cells can be measured based on the above information. Suggest an accurate and reliable method for the measurement.

Observing the darkness of the red colour in the tube by mixing beetroots and ethanol, because the more damages of the membrane are, the colour will be darker because the red pigment can be taken out from the damage of membrane

3. What do you predict the results when beetroot tissues are put into different concentrations of ethanol?

The highest concentration of ethanol, the more damage of membrane are, therefore the colour with red pigment in the tube of the highest concentration shouble be darker

4. Will you (1) put the **same** beetroot into different concentrations of ethanol **one after one**, or, (2) put **different** beetroots into different concentrations of ethanol? Discuss the strengths and drawbacks of each design.

In the same beetroot we can sure the size and shape of the beetroot should be the same during the experiment, but that beetroot may be sticked by other ethanol and affect the result; In the different beetroots, we can sure the ethanol won't mix together (mix together) to , but the size and shape of the beetroots may not be same to be and the result isn't accurate.

G.

5. Your teacher stresses that the beetroot has to be cut into same size and shape in each concentration of ethanol. Explain why it is needed.

It is because if the beetroot has same size and shape, this test can be a fair test and the results will be more accurate and reliable.

6. One student proposes putting a **3 cm cylinder** of beetroot into each concentration of ethanol. Another student thinks the cylinder should be cut into **three 1-cm discs** to be put into each concentration of ethanol. Which one do you think is better? Explain why.

When the size of
Three 1- cm discs is better, because 1-cm discs of beetroot is smaller, the time taken of the experiment should be shorter due to the damage of membrane is being faster, but 3 cm is much larger and it takes more time to observe the results.

7. Apart from ethanol, the shape and size of beetroot, are there other factors that may affect the leakage of pigment from beetroot cells? Explain your answers. How can these factors be controlled?

Also, if the beetroots aren't taken out from the same beetroot, the results will be affected, because different beetroots, their cell containing is different, then, the test isn't a fair and it will affect the result to be not accurate and reliable. Therefore, we need to use a big enough size of beetroot to take out the beetroot for the experiment

~~and the amount of red pigment will not be~~ the same

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8. Do you think the **volume** of ethanol (not the concentration) bathing the beetroot needs to be kept the same for each treatment? Explain your answer.

Yes, it is because the same volume can sure it is a fair test, otherwise because the volume is different, for example the low concentration of ethanol has more volume than the highest, the colour of the lowest is may darker than the highest, then, the result may be affected because of the different volume of ethanol

9. What is the **major assumption(s)** underlying the whole experimental design? (An assumption is something we think it is true, though we don't have any proof. However, if we don't accept the assumptions to be true, valid conclusions from experiment can never be drawn).

The major assumption is the higher concentration of ethanol, a larger damage of the membrane in beetroots cell and more red pigment can be capture.

10. Your teacher suggests you to replicate the experiment if time is allowed. Explain the underlying reason(s).

More times of experiment, the number of result can be more too, then, there are more data to be concerned and the result of the experiment can be more accurate and reliable

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P. 1

Experimental question

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Design

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1. In this experiment, we are investigating how a factor (**independent variable, IV**) affects another factor (**dependent variable, DV**). What are the DV and IV of this experiment?

   DV is the ~~dk darkness of the~~ colour. from the pigment leak out.
   IV is the concentration of ethanol.

2. Explain how the membrane permeability of the beetroot cells can be measured based on the above information. Suggest an accurate and reliable method for the measurement.

   By using a time stopper each beetroots are put into different concentration of e.

3. What do you predict the results when beetroot tissues are put into different concentrations of ethanol?

   The more concentrated ethanol added, the ~~more~~ darker colour show in the test tube which add beetroot tissues

4. Will you (1) put the **same** beetroot into different concentrations of ethanol **one after one**, or, (2) put **different** beetroots into different concentrations of ethanol? Discuss the strengths and drawbacks of each design.

   Put different beetroots into different concentration of ethanol. Strengths is that ~~it can~~ the experiment can be finished in shorter time.

5. Your teacher stresses that the beetroot has to be cut into same size and shape in each concentration of ethanol. Explain why it is needed.

~~For some~~ To keep the beetroot to have the same surface area to lower the error of the experiment to carry out fair test.

6. One student proposes putting a **3 cm cylinder** of beetroot into each concentration of ethanol. Another student thinks the cylinder should be cut into **three 1-cm discs** to be put into each concentration of ethanol. Which one do you think is better? Explain why.

I think putting a 3 cm cylinder is better. The bigger size of the cylinder, the more & higher rate is the reaction. Therefore, the a ~~more~~ shaper difference of colour between each test tube can be shown.

7. Apart from ethanol, the shape and size of beetroot, are there other factors that may affect the leakage of pigment from beetroot cells? Explain your answers. How can these factors be controlled?

~~Volume of the ethanol in each test tube. Higher volume of ethanol diluted the pigment leak out from beetroot cells, the colour will be paler. Therefore, the experiment aren't a fair. To control the volume of ethanol. Measuring cylinder haven been used to measure exact the volume of different concentration ethanol in each test tube should be the same.~~

~~Been~~ temperature. The higher ~~volume~~ temperature, the higher rate of ~~evaper~~ evaporation of the ethanol. The volume of ~~@~~ each test tube become different, affect the measurement of colour, the test become unfair and unaccurated. To control it, the experiment set can be put in a water bath to keep ~~&~~ the experiment in a same temperature.

8. Do you think the **volume** of ethanol (not the concentration) bathing the beetroot needs to be kept the same for each treatment? Explain your answer.

Yes. The higher volume of ethanol diluted the pigment leak out from beetroot cell, the colour will become more paler, the experiment become unaccurate.

9. What is the **major assumption(s)** underlying the whole experimental design? (An assumption is something we think it is true, though we don't have any proof. However, if we don't accept the assumptions to be true, valid conclusions from experiment can never be drawn).

The pigment leak out is related to the concentration of the ethanol.

10. Your teacher suggests you to replicate the experiment if time is allowed. Explain the underlying reason(s).

Replicate the experiment to collect one more set of data, ensure the result should be the same with the experiment finished last time.