

An Investigation on how light Intensity affects the rate of photosynthesis.

Aim

To investigate how different levels of light intensity affects the rate of photosynthesis in pondweed.

Theory

Photosynthesis is the process by which plants, some bacteria use the energy from sunlight to produce sugar, which cells in the leaf convert into "fuel" used by all living things. The conversion of unusable sunlight energy into usable chemical energy occurs in the chloroplast of green plant cells. Contained in chloroplast is a green chemical known as chlorophyll. Most of the time, the photosynthetic process uses water and releases oxygen.

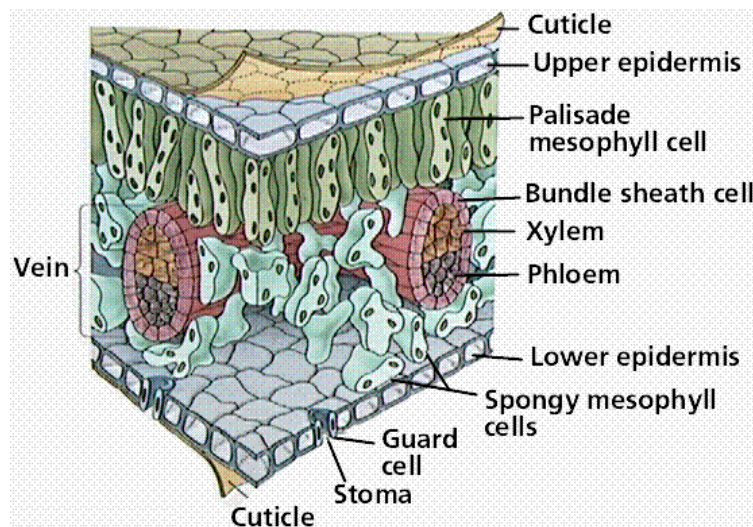


Diagram illustrating cross section of leaf

There are many factors that affect the rate of photosynthesis. Three of the most important ones are carbon dioxide, temperature and light. The maximum rate of photosynthesis will be constrained by one of these issues; these are known as limiting factors. Limiting factors prevent the rate of photosynthesis of the plant from reaching its full potential, even though all other conditions are correct.

Carbon dioxide

Plants need water (H_2O) and carbon dioxide (CO_2) to make food through the process of photosynthesis. The water is gathered by the plant's roots. Carbon dioxide is gathered from the air through the stomata.

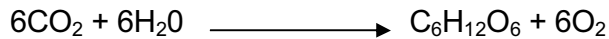
The leaf uses chlorophyll and sunlight to change the water and carbon dioxide into oxygen and glucose (sugar). This sugar is mixed with water and sent to other parts of the plant to be used by the plant as food. The oxygen, which is a by-product of photosynthesis, is released into the air through the stomata. Too little carbon dioxide in the atmosphere surrounding the plant will result in a lower rate of photosynthesis.

Temperature

Enzymes act as a catalysts in plants to speed up the rate of photosynthesis. Most enzymes for plants work at an optimum temperature of around 20c. Subsequently, if the temperature reaches above that the plants enzymes don't work as well and start to become denatured.

Light

Photosynthesis occurs in the presence of light, it occurs in the chloroplasts of the green plant cells. Photosynthesis is the production of simple sugars from carbon dioxide and water causing the release of glucose and oxygen. It is expressed in a chemical equation as:



Light intensity affects the rate of photosynthesis because light falls on the chloroplast in a leaf and chlorophyll traps it, which would then provide energy available for chemical reactions to take place. The amount of light exposed to a plant would therefore affect the rate of photosynthesis upon the plant. The more light exposed to the plant, the more energy available for chemical reactions to occur.

Variables

The three key variables

Independent Factor (output variable)

The factor that will be manipulated and changed

Dependent Factor (input variable)

The dependent factor relies on the independent factor, as it changes according to the independent factor

Controlled factor (controlled variable)

Hypothesis

I predict that the closer the lamp is from the plant, the faster photosynthesis will occur until a fixed point when the other two limiting factors come into affect and discontinue the rate of photosynthesis to increase.

Apparatus

100ml Beaker

Test tube

Funnel

Pond Weed

Stop Watch

40 Watt Lamp

Ruler

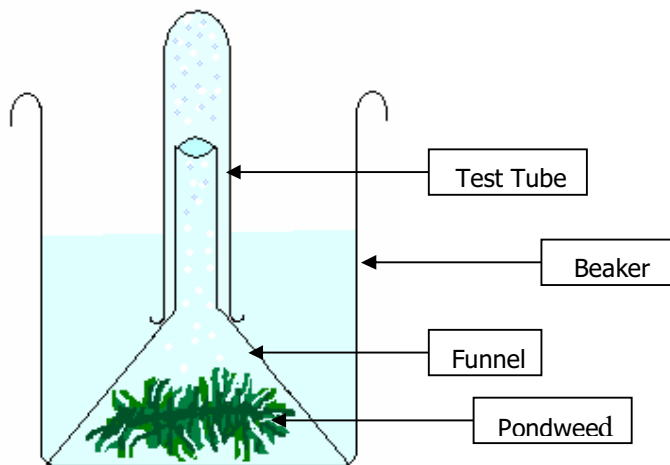
Stirring Rod

Method

1. Fill beaker with 20ml of tap water
2. Pour a teaspoon of sodium carbonate into the beaker
3. Stir contents of the beaker using a stirring rod
4. Place the pondweed in the beaker

5. Place a funnel over the pondweed
6. Fill a test tube with water
7. Place thumb over test tube and quickly tip test tube on top of the funnel spout being careful not to spill any water
8. Place a 40 Watt lamp 80 cm away from the beaker containing the pondweed
9. Count the oxygen bubbles rising from the pond weed
10. Repeat steps 8 and 9 decreasing the distance of the lamp from the pondweed.

Diagram



Results

Distance of lamp from Pondweed (cm)	Amount of oxygen Produced (per 10 sec)
25	198
30	132
35	114
40	91
45	87
50	84
55	66
60	57
65	45
70	39
75	33
80	31

Analysis of Results

From the results, I can see that as the lamp gets closer to the beaker, the rate of photosynthesis increases.

Conclusion

The results show that when the intensity of light was high, then the rate of reaction of photosynthesis in pondweed will be quicker. This is because the results proved my prediction to be correct. Chlorophyll wasn't able to absorb enough light energy to be used for photosynthesis, when the lamp was far away. This is because the intensity of light wasn't as high as it was when the lamp was closer. So, when the lamp was 20cm away, the number of bubbles produced was 400, but when the lamp was 60cm away, the number of bubbles produced was 30. This shows a stark contrast; it also shows the difference the intensity of light makes to a plant when it needs to photosynthesise. As the lamp moved further away, the intensity of light decreased and therefore, the rate at which the pondweed was photosynthesising also decreased.

Evaluation

My results are fair enough to draw a conclusion but there are many anomalies, which could have been prevented if I had conducted this experience thinking of more factors, which can affect the rate of photosynthesis. I could have taken another set of results and compared and averaged out. The setting and surroundings may have affected my results as I performed my experiment in the science laboratory.