Ellen John

Investigation into the effect of light intensity on the rate of photosynthesis

Aim

To find out how the amount of light present effects the rate of photosynthesis.

Plan

Without light plants are unable to photosynthesis this is because they need the light energy from the sun to convert carbon dioxide and water into oxygen and glucose.

Carbon dioxide + water + light energy → oxygen + glucose

I am going to investigate how one of the variables, in this case light, effects the rate of photosynthesis .To carry out the experiment the equipment I will need is a beaker, test tube, lamp and long ruler. Firstly fill the beaker with water and the test tube then place the pondweed (elodea) into the test tube and add some sodium hydrogen carbonate, this helps the level of carbon dioxide to stay constant so carbon dioxide does not become a limiting factor. Then place the test tube upside down in the beaker. Then place the lamp at the given distance from the plant. The distances that the light will be placed from the beaker are 5cm, 10cm, 15cm, 20cm, 25,cm and 30cm. Then count the number of bubbles produced in one minute as the bubbles show that the plant is photosynthesising. Record the results in a table.
Precise and reliable results will be obtained by making repeat readings. I will take six different readings and repeat them three times.

Diagram

Prediction

I predict that the rate of photosynthesis will decrease as the light intensity decreases. This is because as the light is moved further away, it is acting as the limiting factor. It's rays are being spread over a larger areas so the light is therefore less concentrated on the beaker containing the test tube and pondweed.

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Fair test

Other things such as the temperature and carbon dioxide levels of the water can act as limiting factors so to make the test fair these will need to be controlled. This will be done by measuring the temperature of the water in the beaker to make sure it is not increasing it is important that the temperature is kept constant as it affects the rate at which the plant will photosynthesis therefore if it changes then the experiment would not be fair, if at anytime it does then more cold water will be added. $NaHCO_3$ will be added to keep the level of carbon dioxide fairly constant.

Results

Distance of light from plant	**O bubbles counted/min**			**Average Bubbles/min**	**1000 / distance^2** (light intensity)
	1	**2**	**3**		
5	44	40	39	41	40
10	17	19	20	18.7	10
15	2	2	2	2	4.4
20	1	2	1	1.3	2.5
25	0	0	0	0	1.6
30	0	0	0	0	1.1

Conclusion

The results show that the amount of bubbles decrease as the light intensity decreases showing that there is less photosynthesis taking place. Therefore when the light is placed 5cm from the beaker there is a high level of photosynthesis occurring. It drops steeply at 10 and 15cm, However after 15cm the decrease in the rate of photosynthesis begins to slow and flatten out. This proves that light is a limiting factor as without enough of it the rate of photosynthesis drops dramatically. The results also prove that my prediction was right as the further away the light was moved the less bubbles where produced. The second graph shows how the amount of bubbles increase as the light intensity increases, this is due to a higher amount of light being concentrated on the plant so it is given more energy. The graph starts to level off and is not in a straight line as the light intensity has decreased so it has become a limiting factor causing the rate of photosynthesis to decrease.

Evaluation

The results seem fairly accurate, this can be seen from the shape of the graph, there is a curve that includes all of the points which shows that there are no anomalous result. Though the results taken for when the distance of the light is 5cm from the beaker there is quite a varied amount of bubbles counted in the three readings. This is most likely to be due to human error, someone miss counting the bubbles. A more reliable way to measure the rate of the photosynthesis would of be to measure the amount of oxygen being produced by attaching a syringe to the test tube, this would suck the air into a capillary tube, you can then measure more accurately the amount of oxygen being produced by measuring the air bubble in the capillary tube rather than counting the bubbles produced each minute. To improve the second graph I would take another reading after the light intensity passed 40 to see if the amount of bubbles being produced would carry on increasing at the same rate or would slow down. I think the results obtained are sufficiently accurate to support my conclusion as the results prove what I have said.