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An experiment to investigate the
Effect of light intensity on
The rate of photosynthesis

Introduction

Photosynthesis takes place in the chloroplasts of green plant cells; it can produce simple sugars using carbon dioxide and water causing the release of sugar and oxygen.

The chemical equation of photosynthesis is:



It has been proven many times that plants need light to be able to photosynthesize, so you can say that without light the plant would neither photosynthesize or survive. The reason light intensity is being used compared to whether or not a plant needs light is because the experiment wants to show that the rates of photosynthesis will vary according to how much light from a light bulb will be trapped in the chloroplasts, in the leaf. The more energy trapped the more efficient a chemical reaction can take place and the speed of photosynthesis will increase. There are many things which can affect the photosynthesis of a plant such as light intensity, temperature and carbon dioxide levels. There will be a maximum level of photosynthesis during the experiment it is called a limiting factor. This factor will prevent the rate of photosynthesis from rising above a certain level, even if the conditions are improved to meet the best requirements for photosynthesis.

Variables

Input - Light intensity is to be varied by increasing and decreasing the distance from the light source to the plant

Output - The rate of photosynthesis is to be measured by counting the bubbles of oxygen produced by the plant every two minutes, and therefore finding the rate of photosynthesis

Control – The amount of water available to the Elodea will stay the same level in the 400 cm³ beaker. The colour of the lamp will stay the same (yellow) as to plants Chlorophyll easily absorbs blue light, however it does not easily absorb green or yellow light, rather it reflects it, this decreases the rate of photosynthesis. This can easily be controlled, simply by using the same lamp throughout the experiment. Finally the temperature will stay the same which was at room temperature 21 °C. I will check the temperature frequently, in case the heat given off from the lamp should slightly raise the temperature.

Method

Apparatus used

Desk lamp

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Elodea pond weed

Beaker

Test tube

Ruler

Thermometer

Knife

Cold water from tap

Stop watch

Funnel

The apparatus was set up as below:

Elodea that was kept well illuminated in a lab was taken for this experiment. The stem of the Elodea was cut with a scalpel at an angle, and then a 400 cm³ beaker was filled with tap water. A funnel was placed at the bottom of the beaker with the pond weed inside the funnel with the cut end placed up the tube of the funnel. A test tube filled with water was then placed over the top of the funnel, a thermometer was also placed in the water while the experiment was taking place so that the temperature could be checked to see how hot the water was. Then the lab blinds were pulled down so that no light could come from the windows and the lights were turned off. A desk lamp was set up facing the Elodea, a meter ruler laid along side the lamp so that the distance could be measured. A stop clock was set and the numbers of bubbles were recorded down. Each distance was done twice so you had some results that you could compare against each other. Then every two minutes the lamp was moved back 5 cm each time and then left for two minutes and once again the results were recorded down.

Prediction

I predict that the higher the light intensity increases, so will photosynthesis. The lower the light intensity the slower the rate of photosynthesis and eventually it will decrease in l

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level. Though eventually how ever high the height intensity is the rate of photosynthesis will level off.

Results

Distance (cm)	Number of bubbles counted (every two minutes)	Averages
0	230	
0	229	
5	227	
5	227	
10	220	
10	219	
15	190	
15	191	
20	153	
20	148	

Analysis

My graph shows that the closer the distances of the light source the higher the rate of photosynthesis. This is because photosynthesis is a reaction and reactions need energy and it this gets from light. The more light there is the more energy the reaction gets and this speed's up the whole process of photosynthesis. This can be seen on the graph as the highest point this is where the Elodea is photosynthesizing at a high rate and it starts to slowly drop as the distance is increasing. The graph goes from a slow decent to all of a sudden it drops and keeps on falling until the results end at a distance of 20 cm and a number of 153 bubbles in those two minutes. The second results follow the same pattern with a slight difference by of one or two bubbles every two minutes. The only considerably difference is the last point on the graph of the second results and the number of bubbles was 148 there is quite a difference between the 148 and 153. My graph has no anomalies, and it closely followed to what I had predicted that the closer the distance of the light the higher the rate of photosynthesis would be and thus produce more bubbles in the time recorded. The only thing which did not fit my prediction was that the graph did not level off, however I believe this did not happen as I did not have enough time to record any more results. If I did have more time and had extra distances then I believe that the graph would have leveled off and come out of such a steep fall. I can say that the increase in distance thus making the light intensity stronger increased the rate of photosynthesis and when further away made the rate of photosynthesis almost come to its limiting factor the straitening of the graph.

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Evaluation

I am happy how my experiment turned out, I do think though there were many points at which the accuracy was not perfect in the experiment. For instance working out the distance between the lamp and the beaker holding the Elodea, as the lamp had a cover around the bulb which meant it was hard to measure the exact distance as the cover restricted your measurement. If I repeated the experiment I would use a lamp with out a cover around it. Also I would make the time you counted the bubbles in longer possibly by another minute and a half, as two minutes are not a long enough time to fully see photosynthesis at its best. I would also give myself a longer time to do the experiment in so I could get an even more reliable graph with a limiting factor which could back up my evidence of photosynthesis. I would be more prepared next time so that I could get ready the apparatus more quickly and get on with the experiment, I would finally have left a gap of time between when the lamp was moved to a new distance and the recording of the bubbles began so that the Elodea could adapt to the new changes before running straight on with the next set of the results. I am happy with the experiment as I proved that light intensity has an effect on the rate of photosynthesis. I have a reliable set of results and graph with no anomalies my experiment had a low error percentage.