How a section of pond weed photosynthesises

Aim: to investigate how fast pondweed photosynthesises and what affects the rate of photosynthesises.

Prediction

Photosynthesis happens in green plant life and it is a chemical process. Most plants have the capability to create the provisions and energy they need for growth. Green plants do not absorb energy from the soil like other organisms but they make their own via sunlight, this is process called photosynthesis. Photosynthesis is the series of chemical reactions, which help plants make their own food. Photosynthesis occurs, on the whole, in palisade cells. These palisade cells, also known as the palisade layer, are cells below the upper surface of a leaf. The cells are regular shaped and contain many chloroplasts, which help with the photosynthesis reaction. To help produce the plants food the leaf has a large surface area to absorb the maximum of the suns rays during the day. It needs carbon dioxide to diffuse into the leaf via the stomata which is on the under side of the leaf. Because of air spaces behind the stomata the co2 can therefore diffuse into every cell in the leaf and to get into the chloroplasts to help with photosynthesis. The stomata has another function, it allows oxygen, which is the waste product of photosynthesis, to be released from the leaf. The plant obtains water through the root hairs, which are long out growths from the cells of the piliferous layer, which is the youngest layer of the epidermis or outer layer of the root. Then after being carried up the xylem vessel, which carries water through the plant, it is distributed through the cells via osmosis, which is the movement of water or any solvent through a semi permeable membrane. The energy from the sunlight, which is taken in by the chlorophyll, joins the CO2 and water to produce glucose, which is the energy for the plant to grow and respire and to give the waste product of oxygen.

I have explained photosynthesis by word but now here are the word and balanced equations for this process.

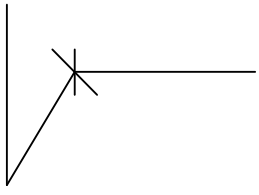
Word Equation

Carbon Dioxide + Water ⟶ Glucose + Oxygen

Balanced Equation

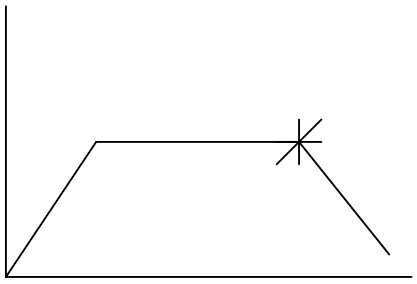
As you may be able to conclude, if any of these factors are not present photosynthesis will not occur. But there are also many limiting factors which mat affects the efficiency of photosynthesis. These are: The concentration of the carbon dioxide, the light intensity and the temperature of the environment where the plant is situated.

The concentration of the carbon dioxide is one of the limiting factors. It is very important, as it is a catalyst for the reaction. Without the presence of carbon Dioxide the reaction would not be able to take place. As the concentration of CO2 rises so does the rate of the photosynthesis reaction. At a given point the rise of CO2 will stop making a difference on the rate of the reaction. The following graph shows this:



X shows where the rise in concentration has no longer got any effect on the rate of the photosynthesis. This point is where sunlight or temperature is the limiting factor.

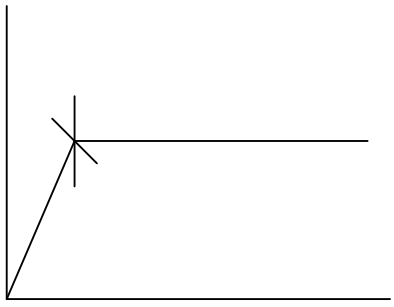
There are other limiting factors in the photosynthesis reaction, such as temperature, because photosynthesis uses enzymes to speed up the reaction. Enzymes are known as catalytic proteins because they are the vehicles, which helps the reaction to happen.ie, they speed up a reaction without themselves being changed. The enzymes have an optimum temperature of about 37oc so at a very low temperature the reaction is slow but as the temperature rises so does the efficiency of the enzymes, which, in turn, speeds up the rate of reaction. Although if the enzyme too hot, at about 45oc it will start to denature and lose its efficiency until the reaction rate falls so low that it is no longer taking place. The following graph shows the effect on temperature:



X is the point where the enzyme would begin to denature.

The final factor, which limits the rate of the reaction of photosynthesis, is the light intensification of the environment in which the plant is living. This pattern is nearly the same as the way in which carbon dioxide concentration works. If there is no light present cannot occur. Similarly, as the light intensity increases, so does the rate of photosynthesis, however when it gets to a certain point any rise in the light intensity has no effect on the rate of the reaction.

This is shown in this graph:



As before X shows when the increase in the light no longer has any effect. During this time either temperature or CO2 are the factors, which affect the plant.

I am investigating for my coursework how the intensity of the light affects the rate of photosynthesis in a piece of pondweed. Using the information, which I have gained, from the above sources I can predict that as the pondweed moves further away from the light the photosynthesis reaction will slow down. When the photosynthesis does not appear to be happening anymore I will be able to figure out the minimum amount of light needed for the photosynthesis reaction to happen.

Preliminary Work

In my preliminary work I had to conduct a test experiment to sort out any minor details, which could go wrong during the real experiment. My experiment will work by placing pondweed close to san unnatural light source and counting the amount of bubbles, which come off of it over a period of 2 minutes. I will keep moving the light source away at regular intervals until the furthest point is reached.

To start with I set up the experiment with a bulb and a power pack, the voltage on the pack will be set to 12v. At the end of the experiment I then decided if it would be suitable for what I was trying to do. After this I checked if my pondweed was bubbling and i made sure that it was easy for me to count them. I then had to decide whether I would see how long it took my pond weed to reach a target amount of bubbles or see hoe many bubbles it would make over a two minute threshold, I chose the latter. I did this because as the light source was moved further and further away the amount of bubbles quickly decreased so the second option seemed to be the wisest. Every thing seemed to run smoothly for the first test apart from the distance intervals at which I was moving the pondweed away from the light source. I found that the distances made the bubbles reduce far too quickly so I am making the distances 5cm instead of the initial 10cm.Everything also went well and I decided that it would be a sufficient method for my final test.

Method

Apparatus

. Power pack
. Section of pondweed
. Metre rule
. Stop Watch
. Boiling tube
. Bulb
. Boiling tube rack

For this experiment I firstly collected a part of pondweed and placed it upside down in a water filled boiling tube, this would allow me to see the bubbles made from the plant. I also made sure that the plant was not touching any of the sides of the tube otherwise it would stop me from seeing the bubbles clearly. I then set up the apparatus as shown in the diagram above. I then had to put the light source 10cm away from the plant until it was producing bubbles at a steady rate. I then started to countthe amount of bubbles coming from the plant and timed it for 2 minutes and recorded the results. I kept on repeating these steps until the weed was moved so far that there were no more bubbles to be counted.

Table of Results

Length away from plant	Number	Of	Bubbles every 2 minutes.
	Test 1	Test2	Average
0cm	31	33	32

5cm	16	14	15
10cm	3	5	4
15cm	0	2	1
20cm	0	0	0
25cm	1	0	0.5
30cm	0	1	0.5
35cm	0	0	0
40cm	0	0	0
45cm	0	0	0
50cm	0	0	0

Conclusion

The results in the table above show, as the weed moves away from the light the number of bubbles that were being made decreased. The meaning of these results is as follows, as the light intensification grew weaker the rate of photosynthesis also decreased. You can see this clearly from the shape of my graph, which is a smooth curve. The graph does this because the results are of a sound nature and this shows also that I have done the test well because the results correlate well thus making a smooth curve. This is because as I said clearly in my prediction, light is a factor, which limits the rate of photosynthesis. Therefore as the pondweed was moved further away from the light source the intensity was less and this affected the rate of photosynthesis, making the number of bubbles produced in 2mins decrease providing evidence that the rate of photosynthesis happening within the pondweed was also decreasing.

Evaluation

I think that the experiment, which I have done, was fairly accurate and was done as well as possible in accordance to the conditions that we were working in. Therefore I believe that my experiment as a whole was done to the highest ability that I could and my results were as sound as possible. My graph line is nearly perfect because I only have the crosses on my line of best fit slightly out of alignment. The only thing, which I could say, is that, referring back to my table of results, on 20cm there is no bubbles but on 25 and 30 there are each 0.5. This shows me that my testing was not completely accurate and I can say that this could be controlled under better conditions with more sophisticated equipment.

There are many ways in which I could make my experiment more accurate one of them is to have a gas collector this way I could monitor the amount of gas coming out of the pondweed and this would able for me to have more accurate results. This is because if I found the amount of gas for one bubble I could then draw more figures and results for my experiments. Coming back to my own experiment I could also make triplicates which would increase the amount of data which I have and allow me to have more accurate results.

The hypothesis for the work was to find out if the amount of bubbles decreased the further you move the light away. I believe that my work supports my hypothesis and that my experiment has been a success.