

Biology:

Photosynthesis Investigation

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AIM: to find effects of distance of a light source from pond weed has on the amount of oxygen produced

water + carbon dioxide → glucose + oxygen

H₂O + CO₂ → C₆H₁₂O₆ + O₂

Photosynthesis

All green plants need to be able to make their own food. They do this by a process called photosynthesis. For photosynthesis to occur they need sunlight energy. This energy is absorbed by a green pigment called chlorophyll, which is mainly found in the leaves. This energy then combines with water molecules (from the soil) and carbon dioxide (from the air). Then as a result of this, a type of sugar is produced. This is called glucose. Also oxygen is made.

Variables

- pH of the water
- Surface area of the plant
- Temperature of the water
- Light

Variable to be tested

For my experiment I have chosen to use light distance as my variable. This means that to carry out a fair test everything else must be kept the same during the experiment.

Hypothesis

I think that as the light source (desk lamp) is moved closer to the pondweed, the rate that oxygen is produced will increase therefore more oxygen will be produced and also more glucose. I believe this will happen because when the light source is nearer to the plant more of the plants surface area is coming in to contact with the light from the desk lamp therefore more photosynthesis will occur which will mean more oxygen and glucose will be produced.

Apparatus

- Funnel.
- Measuring cylinder.
- Stop watch.
- Beaker.
- Desk lamp.
- Ruler.
- Pondweed.
- Water.

Fair Test

To ensure that a fair test is carried out the following things must be done:

- the same pondweed must be used every time we change the light distance.
- Do the experiment three times for each distance to get an accurate average.
- There must only be one variable and that is the distance of the light source from the plant.
- Take results after one minute for each individual experiment.

Safety

- Follow lab safety rules (e.g. no running, bags under desk etc).
- keep the desk lamp away from contact with water.
- be careful not to spill any water onto electrical plugs

Diagram

Plan

I am going to set up the equipment as explained in the diagram and then proceed to count the number of bubbles produced every minute with varying distances of a light source. I will move the light source further away from the pondweed by 10cm each time and record the results in a table and graph.

I will record the number of bubbles produced in one minute for the distances of 10cm, 20cm, 30cm and 40 cm and then calculate the average. I will also record the number of bubbles generated from natural light.

Method

- Collect apparatus.
- Set up apparatus as in diagram with 2 – 3cm of pondweed
- Cut the end of the pondweed to release O₂ and attach a paper clip on one end so the cut end is facing up.
- Fill measuring cylinder and beaker with 400ml warm water (optimum conditions)
- Set up desk lamp in correct position (e.g. 10cm).
- Allow 3 – 5 minutes for the pondweed to adapt to the conditions.
- Turn on desk lamp and start stopwatch.
- Count the bubbles for the next minute.
- Record your results.
- Repeat experiment twice more for distance 10cm and then do the same with distance 20, 30, and 40cm.

Modified Plan/Method

I did not have to change any of my plan or method.

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DISTANCE FROM LIGHT (CM)	NUMBER OF BUBBLES PRODUCED IN ONE MINUTE			
	Test 1	Test 2	Test 3	Average
0	52	45	49	48.6
10	32	35	36	34.3
20	20	16	21	19
30	17	15	16	16
40	11	10	10	10.3
Natural Light	12	11	12	11.6

Results Table

Analysis

Looking at my results I can see a significant increase in the rate of photosynthesis as the distance decreases. All of the results I have given show this pattern. In the experiment when the distance was 40cm not much photosynthesis took place. Only about 10 bubbles of oxygen were produced, but when the desk lamp was 0cm away a lot of photosynthesis was occurring. On average 48 bubbles in one minute. This is quite a substantial difference from 40cm. Overall it was a quite significant increase. I believe this is because when the desk lamp is close to the pondweed more of the pondweeds surface area has light energy shining upon it which means more photosynthesis will occur in a shorter time.

Looking at my results it is quite evident that the number of bubbles produced is much greater when the distance of the pondweed from the desk lamp is less. This proves that my original hypothesis was correct that "as the distance decreases of the desk lamp from the pondweed therefore more oxygen bubbles are produced." As I mentioned before this is because there is more light energy shining on a greater surface area when the desk lamp is closer so therefore greater surface area equals more photosynthesis.

My graph has one anomalous result, and that is for the distance of 20cm. Looking back to my results table I can see that for test 2 only 16 bubbles were counted compared to the 21 counted for tests 1 and 3. There is the possibility that I or my group had miss counted the second test but I would have to repeat the experiment to eliminate the result.

Evaluation

I think that on the whole my experiment was ok. The results I gathered were good and with this set of results I was able to calculate accurate averages which followed my prediction.

I believe my measurements were about as accurate as we could get using the apparatus that we did.

A problem I encountered was the change in temperature when the desk lamp was close to the pondweed. Because I could not do anything to amend this I had to accept any slight change in my results.

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To improve and take my investigation further I could investigate how the colour of light affects photosynthesis. I would use a colour filter and change the filter from red to blue etc.

I could also continue to count the bubbles produced at the different distances for a further 3 minutes or so to investigate if the amount of bubbles would increase or decrease.