

## **How Does Light intensity affect the rate of Photosynthesis?**

### **Introduction**

All green plants need to be able to make their own food. They do this by a process called photosynthesis. For this 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. Oxygen is also made.

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.

### **Prediction**

I think that as the light source is moved closer to the pond weed, the more bubbles will be produced. This is because the light will be more intense and therefore increase the rate of photosynthesis as the intenser the light; the faster the rate of photosynthesis. This will act as a catalyst therefore increasing the speed that the plant would convert carbon dioxide and water into glucose and oxygen. The light will also be shining on a greater surface area of the pondweed and will therefore also increase photosynthesis.

### **Apparatus**

- Pond weed
- Water
- Beaker
- Test tube
- Lamp
- Meter ruler
- Perspex (To shield the heat of the lamp, making it a fair test)

### **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 I change the light distance.
- The experiment must be carried out 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.

- Keep the experiment at a constant 20degrees (this is because more oxygen is produced at this temperature).
- Take results after two minutes for each individual experiment.

### **Safety**

- Follow lab safety rules (e.g. No running and bags at back etc).
- Keep the lamp away from contact with water.
- Wear goggles to avoid damage to eyes.

### **Diagram**

### **Method**

- Collect apparatus.
- Set up apparatus as in diagram shown.
- Fill beaker with water.
- Set up lamp in correct position (e.g. 100cm).
- Turn on lamp and start stopwatch.
- Count the bubbles for the next two minutes and also make a note of the change in volume.
- Record your results.

- Repeat experiment twice more for distance 100cm and then do the same with distances 75cm, 50cm, 25cm and finally 0cm (or as close to).

### **Results**

<b>Distance (Cm)</b>	<b>1<sup>st</sup> attempt (Bubbles)</b>	<b>2<sup>nd</sup> attempt (Bubbles)</b>	<b>3<sup>rd</sup> attempt (Bubbles)</b>	<b>Average (Bubbles)</b>
100cm	6	8	4	6
75cm	14	20	15	16
50cm	24	26	23	24
25cm	45	49	47	47
0cm	56	64	62	62

### **Graph**

### **Conclusion**

Looking at my results a can see a significant increase in the rate of photosynthesis as the distance decreases. All of the results show this pattern. In the experiment when the distance was 100cm there was not much photosynthesis taking place only about 6 bubbles of oxygen were produced. However, when the lamp was 0cm away, a lot of photosynthesis was occurring. About 62 bubbles in two minutes were produced, quite a substantial difference from 100cm.

Overall it was a quite significant increase. I believe this is because when the 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. The average number of bubbles for different distances is as follows:

**100cm = 6**

**75cm = 16**

**50cm = 24**

**25cm = 47**

**0cm = 62.**

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 lamp is less. This proves that my original prediction was correct and that the closer the light source the more bubbles are produced through photosynthesis. As I mentioned before this is also because the light is intenser therefore increasing the reaction time to start photosynthesis. Also there is more light energy shining on a greater surface area when the lamp is closer so therefore the greater surface area, the more photosynthesis.

### **Evaluation**

I think that on the whole my experiment went very well. With the set of results I gathered I was able to calculate accurate averages which followed my prediction.

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

I experienced a few problems with the experiment. One problem I encountered was the change in temperature when the lamp was too close to the pondweed. I could not do anything except to put the Perspex in front of the lamp and this did not do much. In an ideal experiment I would use a sodium bulb which is the equivalent to natural sunlight and does not create any heat. This would have created even better results. Another problem we faced was counting the bubbles when the plant was photosynthesising. The bubbles were different sizes, therefore making impossible to count every bubble and getting perfect results. Although the bubbles were not counted 100% accurately I still managed to get very good results and am very pleased with the information I have found.

To take this investigation further I could investigate the amount of bubbles produced by seaweed in salt water under a lamp at different distances. This would make interesting comparison with the pondweed and I would get some good overall results.