

Measuring responses of spinach leaves in various light waves



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Photosynthesis: Measuring the responses of Spinach Leaves in various Light Waves

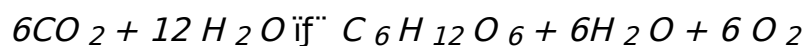
Abstract

The object of this study was to measure the amount of Spinach Floating Disks in each of the petri dishes per each experiment set. The experiment was measured by using 100 mL of a 0.2% solution of Sodium Bicarbonate NaHCO_3 that was poured into each of the three petri dishes for the two experiments. The 1st experiment tested Carbon Dioxide (CO_2) levels created from Sodium Bicarbonate (NaHCO_3) in this experiment as to test the hypothesis in comparison to that of Oxygen (O_2) to determine as one level increases so will the other. In the 2nd experiment used the working hypothesis which stated that the red dye that simulates the red light spectrum will produce more photosynthesis than that of the blue, whereas green will produce very little if any. Outcomes of the 1st experiment showed that light-dependent photosynthesis reacted to the heat lamp producing more oxygen. Respectively, the red dye had a 100% effective rate of photosynthesis and oxygenation.

Introduction

According to the Laboratory Investigations for Biology, 2nd Ed. The process of photosynthesis can be summarized in the equation below (John, 2016).

Chloroplasts



By definition photosynthesis is the process in which some organisms and plants use sunlight to create food from carbon dioxide or CO_2 and water or H_2O . The products for photosynthesis can be described as the use of carbon dioxide with water to make glucose. A sugar that plants use as a source of food or convert to starch and is stored. A byproduct of this process is oxygen (John, 2016) and (Freeman, et al., 2017).

There are two phases in photosynthesis. The 1st phase is known as the light dependent reaction phase. This phase requires a chemical process to occur where the pigment chlorophyll absorbs light energy. It then, in turn use high-energy bonds of ATP and NADPH molecules to complete the process. The 2nd phase of photosynthesis is called carbon-fixation process. This phase does not require light because the energy has already been captured (John, 2016). This phase is similar to the 1st phase in which ATP and NADPH are being used except this process uses carbon dioxide to make glucose.

According to (Freeman, et al., 2017) glucose is a simple sugar that is a six-carbon monosaccharide and is the major source for plant food. As stated previously plants can turn glucose a carbohydrate into starch for later use or to reinforce cell walls of the plant. The photosynthesis process as a whole takes place within the chloroplast. Chlorophyll, the green color of plants is a pigment that uses enzymes and other molecules which are required for photosynthesis (John, 2016)

Carbon Dioxide (CO_2) levels created from Sodium Bicarbonate (NaHCO_3) in this experiment is the hypothesis being tested in comparison to that of Oxygen (O_2) to determine as one level increases so will the other. If the <https://assignbuster.com/measuring-responses-of-spinach-leaves-in-various-light-waves/>

least amount of diluted NaHCO_3 was used up, then the Spinach Leaf will not produce large amounts of Oxygen. This experiment is measuring various strengths of NaHCO_3 as the independent variable. Other variables not recorded would include room temperature, the size of the sample, and the health of the plant. In this case the number of the disks floating in the solution is the dependent variable.

For this experiment ten punched Spinach Leaf Disks were used for testing purposes. The more oxygen released from each of the disks increases the ability of the disk to float to the surface of the petri dish. This process works because the liquid is being replaced with gaseous compound and regains its buoyancy. For this experiment light was used as the control.

According to (Yao, et al., 2017) the increase in photosynthesis rate correlates with the intensity of the light being used. It is also mentioned that a light that is too intense can reduce the photosynthesis rate. Which facilitates an important goal of finding the optimal conditions for cultivation.

As explained earlier, the level of development of the chloroplasts is directly affected by photosynthesis. (Yao, et al., 2017) explains that this directly affects the rate of growth of a plant and have different identifying markers under varying light intensities. Leaf morphology which shows plasticity is a reflection of this, where under weak light conditions an experiment on eggplants has shown a specific decrease in of the Datura according to (Mao et al. 2012) taken from (Yao, et al., 2017) in an expanded report on Effects of light intensity on leaf microstructure and growth of rape seedlings cultivated under a combination of red and blue LEDs. (Farquhar and Sharkey 1982) of

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the same report by (Yao, et al., 2017) caution high-light intensity can cause serious oxidative damages and destroy the photosynthetic system to leaf tissues.

Using the determined information from (Yao, et al., 2017), in this lab the experimenters created a unique experiment not too dissimilar from the Effects of light intensity on leaf microstructure and growth of rape seedlings cultivated under a combination of red and blue LEDs. To simulate the light wave spectrum of the Red, Blue, and Green (RGB) the experimenters used food coloring to dye the solute. Where the working hypothesis states that the red dye that is used to simulate the red light spectrum will produce more photosynthesis than that of the blue, whereas green will produce very little if any.

The dependent variable will again be the number of floating Spinach Leaf Disks. The independent variable in the unique experiment are the various colors being introduced with the heat lamp for light as a form of light spectrum. The control will be the heat lamp. Replication of this experiment will be conducted by the team of experimenters next the unique experiment station in this report. In this experiment if the red manipulated spectrum of light produces the most oxygen then the other independent variables blue and green will produce little to no oxygen.

Methods

According to the lab manual by (John, 2016); The experimenters were to conduct three separate light tests to determine oxygen production if any which will cause the Spinach Leaf Disks to float. 100 mL of a 0.2% solution

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of Sodium Bicarbonate NaHCO_3 was poured into three petri dishes. The first test measures the amount of floating disks in a light devoid room. In this case the petri dish with ten disks was placed in a drawer as to keep any light from disturbing the experiment.

This part of the process is known as the 2nd phase or carbon fixation as mentioned in the introduction of this paper. The second test uses natural room light, or fluorescent tube lights to measure the amount of floating disks. Using a second set of 10 disks in a petri dish the experimenters allowed ample amounts of room light to expose the disks in order to measure the 1st phase in photosynthesis, light-dependency. The last and final test of the three experiments measures the amount of floating disks under a heat lamp. The experimenters waited 30 minutes for each of the experiments before gauging results.

Following the lab manual by (John, 2016) for the unique experiment, the testers duplicated the three test process for step three only. Still measuring the amount of floating disks, the experimenters added the RGB dye to each one of petri dishes. Again the 100 mL of a 0.2% solution of Sodium Bicarbonate NaHCO_3 was poured into three petri dishes. Each of the three petri dishes were left exposed to heat lamps for 30 minutes.

Results

The experimenters evaluated each of the initial three tests under three different conditions. Complete darkness, natural light, and under a heat lamp. Phase 1 of photosynthesis consisted of light dependent plants. Plants grown under natural light served as the control. As identified in (Table 1), the <https://assignbuster.com/measuring-responses-of-spinach-leaves-in-various-light-waves/>

control or natural light did not produce any floating disks. While under increased light, the heat lamp the Spinach Leaf Disks thrived and photosynthesized to the extent of 100% of expected results.

Phase 2, or the Carbon Fixation process which does not require light had no effect. Carbon Fixation of the plant did not store enough energy to start photosynthesis. In the unique experiment phase 2 was not conducted.

The results of the unique experiment that was tested in three different color spectrums; RBG is listed in (Table 2). Predominately the synthesized red spectrum of light produced the most results of the three colors tested.

Table 1 Results of Subjecting Spinach Leaf Disks to Different Light Conditions

	# of Disks Floatin g	% of Disks Floatin g
Dark	0	0%
Roo m Light	0	0%
Unde r Lam	10	100%

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Table 2. Results of Subjecting Spinach Leaf Disks to Different Color Spectrums

Color	# of Disks Floatin g	% Disks Floatin g
Red	9	90%
Green	3	30%
Blue	5	50%

Discussion

In experiment one carbon dioxide (CO_2) levels created from sodium bicarbonate (NaHCO_3) in this experiment was used as the hypothesis that was being tested in comparison to that of oxygen (O_2) to determine as one level increases so will the other. The hypothesis was accepted in this experiment. As was predicted, the more light that was exposed the more oxygen would be produced which would cause the disks to float. Sources for error in this experiment would include improper set up of the vacuum flasks conducted by the previous lab experimenters. Other errors would include bad sampling techniques of the Spinach Leaf Disk.

More time in this experiment would improve or give more accurate results for photosynthesis. It would allow a greater measure of values from the experiment. Also conducting multiple sets of the same experiment in order to gain an average ratio to gauge success or failure. In this experiment the learned outcome was that photosynthesis works in two ways. The 1st is light-dependent photosynthesis and the 2nd was carbon fixation. Secondary outcomes learned in this experiment are that different light spectrums produce different results. Where red would produce more oxygenation than blue or green which produces little to no oxygen.

In the Unique Experiment the working hypothesis stated that the red dye that simulates the red light spectrum will produce more photosynthesis than that of the blue, whereas green will produce very little if any. Limitations and error of this experiment will include the same listed above in the 1st experiment as well as how little or how much dye is used in the testing of the light spectrum. With greater time and multiple test of the same experiment averaged values could be derived from the test to give a more accurate result.

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