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# The Effect Of Different Carbonated Liquids On The Rate Of Photosynthesis

## ABSTRACT

The problem that was researched and studied, was how to increase the rate of photosynthesis. This topic is important because photosynthesis is one of the most important processes regarding all life on Earth. By increasing the rate of photosynthesis, the process will be able to generate more energy at a faster pace. The procedure used to study this conflict was placing the same plant (Elodea) into different types of carbonated liquids, to test whether or not increasing the concentration of carbon dioxide would increase the rate of photosynthesis. The key findings of the experiment was that Sprite Zero demonstrated the highest release of gas bubbles from inside the plant. The water mixed with baking soda represented the least amount of gas bubbles released from the Elodea plant sample. Based on the findings one can conclude that carbonated diet soda will increase the rate of photosynthesis when compared to water and tonic water. This can be applied when gardening. For example, instead of just using H<sub>2</sub>O when watering plants, one can use Sprite Zero to water their plants, every once in a while. This would speed up the plant's rate of photosynthesis.

## INTRODUCTION

Photosynthesis is the process in which plants use light to synthesize energy from water and carbon dioxide. According to Britannica, "the rate of [photosynthesis] can be increased somewhat by increasing the carbon dioxide concentration". The experiment is designed to test whether or not, increasing the carbon dioxide concentration will truly speed up the reaction, and if so, by how much. Although "the increase in carbon dioxide directly increases plant photosynthesis, the size of the increase depends on the species and physiological condition of the plant" (Britannica). The type of plant being used in the experiment must remain the same throughout each trial to ensure accurate results when comparing the release of oxygen. The objective is to place the Elodea plant into water mixed with baking soda, tonic water, and Sprite Zero to test the release of oxygen. If the Elodea plant is placed in the three different liquid bases, which of the test tubes will release the most oxygen bubbles? If the plants are placed in carbonated liquid such as tonic water or Sprite Zero, then the release of oxygen will increase in the plants when compared to water. The plant inside of the Sprite Zero will photosynthesize the most because the liquid contains the highest carbon concentration when compared to water and tonic water.

## HYPOTHESIS

If the plants are placed in carbonated liquid such as tonic water or sprite zero, then the release of oxygen will increase in the plants when compared to water. The plant with sprite zero will photosynthesize the most because the liquid is already carbonated in comparison to water and the tonic water.

## METHODS

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First, three pieces of the Elodea sp. plant, measured at around two inches, were gathered. The stems of the plants were then lightly pressed with the edge of the ruler. The tweezers were then used to remove some of the plant's leaves near the stem. In tube A, the Elodea plant was placed into 15 mL of H<sub>2</sub>O mixed with a pinch of baking soda. In tube B, the Elodea plant was placed into 15 mL of Tonic water. In tube C, the Elodea plant was placed in 15 mL of Sprite Zero. The three tubes were then placed 10 centimeters away from the light source. The timer was used to time the three-minute trials which were repeated a total of three times. Before repeating the trial, the liquids in each tube were replaced with fresh samples. During each trial, the number of oxygen released per tube, per trial was recorded into a data table. The data table was used to create a line graph that compares the number of oxygen bubbles released per tube, over the three tables. The H<sub>2</sub>O serves as the control group. The constants are the amount of liquid, the distance from the light source, the type of light and the test tubes that were equal in size. The independent variables are the different liquids (Sprite Zero, Tonic water & H<sub>2</sub>O) since that is what is being altered in the experiment. It also caused a change in the dependent variable, which is the rate of photosynthesis, for the carbonation of a liquid directly affects the rate of photosynthesis.

## Discussion

The result of the experiment concluded that the overall hypothesis was correct. The hypothesis stated that the plant placed inside the tube filled with Sprite Zero would photosynthesize the most, for the liquid was already the most carbonated in comparison to water and the tonic water. The Sprite Zero test tube produced the most oxygen bubbles amongst the three. This was the result of an increase in the rate at which carbon is used in the light-independent reaction. Therefore, the rate of photosynthesis would gradually increase until limited by another factor. Since Sprite Zero produced the fastest rate of photosynthesis, it can be concluded that Elodea Sp. photosynthesizes the quickest while under high carbonation concentration. It was evident that altering the amount of carbonation did in fact increase the rate of photosynthesis. Amongst the limitations of the experiment were that there was no control group. The tap water used in the experiment included a pinch of baking soda. If the tap water was a constant without the addition of baking soda, the amount of oxygen bubbles would have been significantly lower, compared to the water with the baking soda. It was expected that the number of bubbles produced for the Sprite Zero would have the highest number of gas bubbles released, and continue an upward trend. Although it did have the highest production of gas bubbles, fewer bubbles were produced in the second and third trial, yet it still remained more than the amount for tap water and tonic. According to a journal article, when regulating the openness of stomata, pores through which plants exchange gasses, with the external environment, the experiment is considered to be very significant (NCBI).

Three trials were conducted to guarantee the accuracy of the experiment. Each trial was used to provide a precise representation of data. If one set of results would have come out odd or unusual, there were two other trials to rely on. During trial 3, the test tubes were left in front of the light source longer without counting the gas bubbles which might have impacted the results in that specific trial. Over the three trials, H<sub>2</sub>O with a pinch of baking soda and Sprite Zero decreased, while the tonic water decreased in trial 2, then increased in trial 3. This could have been the products of the errors found in the experiment. What could have prevented this from occurring, was if all three test tubes had been placed in front of the light source right at the start of the 3- minute timer. This is because no gas bubbles would have escaped without being

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accounted for. Another error could have taken place when counting the number of bubbles, especially since many were released together at a fast and rapid pace. To adjust the experiment, one could utilize oxygen sensors that would help measure the concentration of oxygen, instead of physically counting it through the beaker. One of the limitations of the lab was regarding time, so the trials could not be of longer intervals.

To help further research the idea that testing the impacts of different carbonated drinks have on photosynthesis, this experiment could have been tested under no light source to see if the number of oxygen bubbles would be different. An experiment of this sort would solve the question "What is the ideal oxygen level range of carbonated liquids for photosynthesis in light and dark reactions?" The hypothesis for this kind of experiment would be that conducting photosynthesis in the dark or light is not dependent on the effect of different CO<sub>2</sub> liquids, for CO<sub>2</sub> liquids only affects the rate of photosynthesis. This concept could be tested if all 3 trials were to be conducted under a light, and again under no light.. This way, it would be easy to see if the reaction happening in the light or dark had an effect on the different carbonated liquids.

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