

GROUP 4 PROJECT-CHEMISTRY PRACTICAL REPORT

NAME: ZHUANG YUAN

CLASS: 5.08 KINGS

Background information

pH influences the rate of photosynthesis. University students and scientists have conducted experiments showing how pH affects the rate of photosynthesis. The result shows that in pH 7.5 solution leaves produce oxygen the fastest and those in pH 4.5 the slowest(using pH 4.5, 5.5, 6.5 and 7.5). (Source from the internet:

www.madsci.org/posts/archives/mar2000/952732207.Bt.q.html)

pH of the solution is determined by the H^+ ion in the solution. In pond water, there are many ions present as well. Do they influence the rate as well?

Purpose

Test the relationship between the pH value of water and different ions present to the rate of photosynthesis in plants.

Hypothesis

The closer the pH value is to neutral(pH=7) and fewer ions present, the faster the rate of photosynthesis.

Variables

| dependent | independent | controlled |
|------------------------------------|--|--|
| pH of pond water using data logger | Pond water of different locations in Singapore | <ul style="list-style-type: none">• Amount of sampled Water• Light intensity• Resistivity of the wires |

Equipment and apparatus

| | | | |
|--------------|----------------------------|--|-----------------|
| 18 watt lamp | Data logger | Water sample from different parts of Singapore | Phenolphthalein |
| Hole punch | 12 ml syringe | Universal indicator | HNO_3 |
| 20 ml beaker | Measuring cylinder | Methyl orange | $AgNO_3$ |
| stopwatch | Leaves of <i>Ervatamia</i> | Screened methyl orange | NaOH |

Procedure

- Test the pH of different pond water using data logger
 1. pour 100ml of sampled water into five different beakers
 2. attach the pH sensor to the data logger
 3. dip sensor end of the data logger into the sampled water
 4. allow the sensor to stay in the water for a time of one minute
 5. record the pH level of the water
 6. repeat (5) for each water sample
 7. repeat the process two more times and calculate the average pH level for each water sample(as to increase the accuracy of the data logger)

- to prove data logger gives the correct range of pH and amount of ions present
 1. add all different types of indicator to a small portion of each sampled water
 2. record the observation
- 1. to know which contains more ions than others
 1. add NaOH and acidified AgNO_3 , phenolphthalein respectively to each sampled water
 2. observe whether precipitate forms or not and compare the amount of precipitate

Data collection and observation

Table of pH level of collected sample of pond water

| location of water sample | 1 st reading | 2 nd reading | 3 rd reading | Average pH value |
|-----------------------------|-------------------------|-------------------------|-------------------------|------------------|
| NUS Prince George Park pond | 6.29 | 6.06 | 6.08 | 6.14 |
| ACS(I) pond | 6.33 | 6.04 | 6.08 | 6.15 |
| Botanical Garden swan lake | 6.08 | 6.12 | 6.16 | 6.12 |
| Bukit Timah nature reserve | 5.86 | 5.84 | 5.49 | 5.73 |
| De-ionised water | 4.87 | 4.46 | 5.28 | 4.87 |

Observation when different chemicals are added

| Location of sampled water | Universal indicator | Methyl orange | Screened methyl orange | Phenolphthalein | $\text{HNO}_3 + \text{AgNO}_3$ | NaOH |
|---------------------------|---------------------|-----------------------------------|------------------------|------------------------------|--------------------------------|--------------------|
| NUS | Light green | Yellowish orange | Green | Small quantity of white ppt | Small quantity of white ppt | No visible changes |
| ACS | Light green | Darker shade of yellowish orange | Green | Larger quantity of white ppt | Small quantity of white ppt | No visible changes |
| Botanical Garden | Lime green | Lighter shade of yellowish orange | Green | Larger quantity of white ppt | Small quantity of white ppt | No visible changes |
| Bukit Timah | Lime green | Lighter shade of yellowish orange | Green | Larger quantity of white ppt | Larger quantity of white ppt | No visible changes |
| De-ionized water | Red | Orange | Dark Green | Larger quantity of white ppt | Small quantity of white ppt | No visible changes |

Universal indicator: very dark green
 Methyl orange: orange
 Screened methyl orange: dark green
 Phenolphthalein: colorless

Rate of photosynthesis
 (This is the biology practical hence details are excluded)

| Location of pond water | Number of discs used | 1 st reading of time needed for 50% of discs to rise/min | 2 nd reading of time needed for 50% discs to rise/min | Average time needed for 50% of the discs to rise/min |
|------------------------|----------------------|---|--|--|
| NUS pond | 10 | 76.59 | 75.44 | 76.02 |
| ACS(I) pond | 12 | 76.31 | 74.53 | 75.42 |
| Botanical Garden pond | 10 | 78.18 | 78.57 | 78.38 |
| Bukit Timah pond | 10 | 80.09 | 82.30 | 81.20 |
| De-ionized water | 12 | 103.20 | 101.22 | 102.21 |

Conclusion

- The closer the pH level of the water is to neutral, the faster the rate of photosynthesis. In this case water from ACS (I) has the fastest rate of photosynthesis since its pH level is the closest to neutral value.
- 1. While precipitate appears when phenolphthalein was added may be due to the other ions present in the water, because pond water has many more ions than normal chemicals, hence the sample water appeared to be cloudy when indicator was added.
 2. it is obvious that the more cloudy it is, the more types of ions present in the water. In this case, NUS pond water has fewest ions since only a small portion of white precipitate was observed.(the more ions present the slower the rate of osmosis from outside solution to cell sap in the root, and hence the slower the rate of photosynthesis.)
 3. According to biology concept, NUS pond water has fewest ions therefore supposedly it should be the one with highest rate of photosynthesis. However in our experiment it was not the case.

Limitations in the experimental method

- water sample were not collected at the same time on the same day.
- It rained before we collected the sample, hence the water was slightly more acidic than usual since the rainwater is acidic due to the present of HCO_3^-

- The number of leaf discs used was not constant.
- There is no control of water at pH=7 used.
- The leaf discs were left in open air for a time before being added to the beakers to be tested for the rate of photosynthesis. The leaf discs would have started photosynthesizing before being placed in the water samples, causing a shortened time and hence lead to inaccurate results.
- The pH values of the water samples received from the data logger may be flawed as the sensor of the data logger was washed with the de-ionized water after being dipped in each different sample of water. Hence the results for the pH for the water sample may be slightly more acidic than it really is, since the de-ionized water is the most acidic one according the results recorded.

Reflection

This is my first time doing a self-designed experiment. For all the past practical I have done under internal assessment are all practical in which instructions are given so that students only need to follow what is written on the paper word by word and carry out the experiment.

However this time was not the care. No instructions, no apparatus suggestions, no procedure—nothing is prepare for me. However we really found it an enjoyable and memorable experience despite all the disagreements caused when we were doing the practical.

Needless to say we have encountered many problems during the process. The most significant one was that due to the limited amount of water sample we had, no matter how much chemicals we have added, a positive change did not appear. As a result we have tried a lot of funny things, and we all burst out into laughter.

There was one thing that we all felt it was a pity. We did not carry out any titration or testing the concentration of H^+ . this should be something that has been planned before we started. When we finally realized that we should have done at least one set of titration, the time has almost gone.

Hence by reflecting upon what we did on group 4 project day, I should say that it was a success to certain extend, although we did not get all the favored results. However we could have planned the whole experiment better before that. Moreover all the uncertainties when small quantity of sample water used, should be taken into consideration before the experiment is carried out.