

Habib University

iSciM

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ENER 104L RENEWABLE ENERGY

LABORATORY REPORT 1

Global Warming

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1 Objectives

- Understand effect of various factors in our atmosphere.
- Understand that excess CO₂ intensifies the greenhouse effect
- Why is greenhouse effect important and what does it have to do with climate change?
- Does greenhouse gases really make the temperature rise?

2 Abstract

This report explores the greenhouse effect's impact on Earth's atmosphere, taking into consideration of natural and human factors that fuel global warming. A strong emphasis is created to reduce global warming pollution, this is done with the aid of practical experiments to us understand these complex processes. Part A focuses on dissecting the causes of global warming, with emphasis on the role of greenhouse gases. A hands-on experiment, based on a climate change by modeling our earth, is conducted to measure temperature fluctuations, so that we can foster a tangible understanding of this critical environmental issue. Part B delves into photosynthesis and respiration in plants, this experiments aids to quantify carbon dioxide and oxygen exchange. This helped us understand how life itself interacts with the environment, and enabled us to grasp a better concept of Earth's ecosystems and the difficulties it faces. Overall, this report aims to provide a comprehensive understanding of the greenhouse effect and its impact on our planet.

3 Result and Analysis

3.1 Part A: The Greenhouse Effect

3.1.1 Temperature Graphs

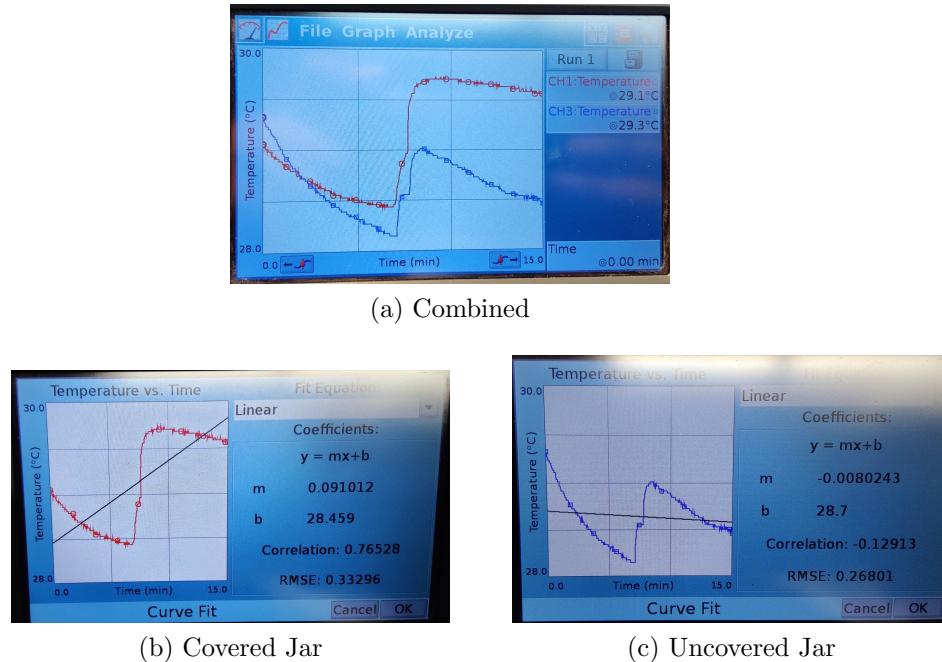


Figure 1: Temperature Graphs

We can observe from the graphs that the covered jar had a higher temperature than the uncovered jar. The irregularities in the graph are due to the temperature sensor being moved around in the jar.

3.1.2 Temperature Table

Table 1: Temperature Table

| | Covered Jar (°C) | Uncovered Jar (°C) |
|---------|------------------|--------------------|
| min | 28.4 | 28.1 |
| max | 29.7 | 29.3 |
| mean | 29.1 | 28.6 |
| st. dev | 0.51668 | 0.26998 |

We can observe from the table that the covered jar had a higher min, max, mean and standard deviation than the uncovered jar.

3.2 Part B: Photosynthesis and Respiration

3.2.1 Covered Jar

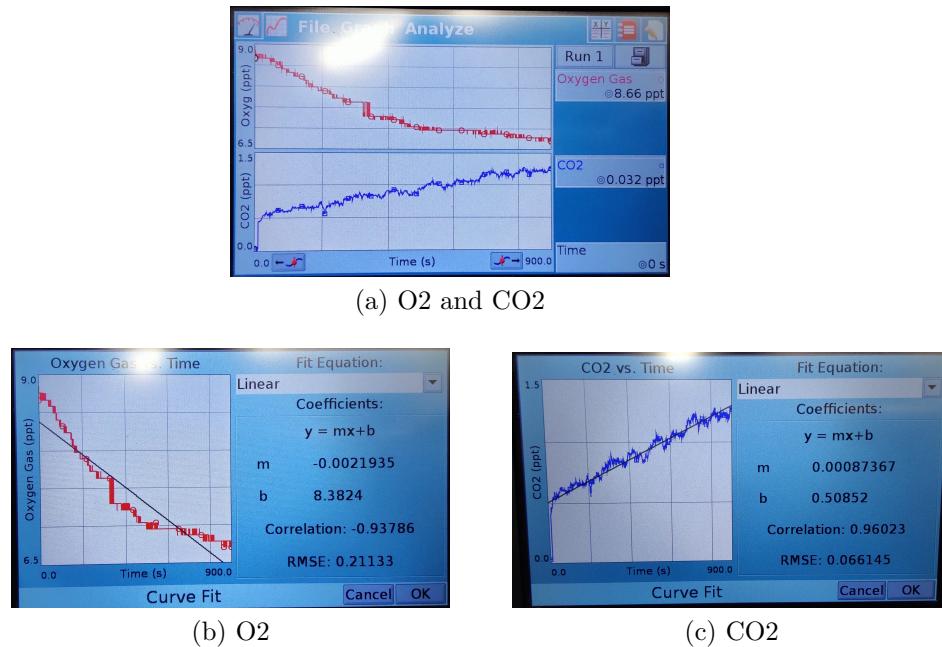


Figure 2: Covered Jar

O₂ and CO₂ Graphs We can observe from the graphs that the oxygen concentration in the covered jar decreased, and the carbon dioxide concentration increased.

Table 2: O₂ and CO₂ Table

| | O ₂ (ppt) | CO ₂ (ppt) |
|---------|----------------------|-----------------------|
| min | 6.7 | 0.032 |
| max | 8.84 | 1.277 |
| mean | 7.4 | 0.902 |
| st. dev | 0.60866 | 0.23678 |

CO₂ and O₂ Table

3.2.2 Uncovered Jar

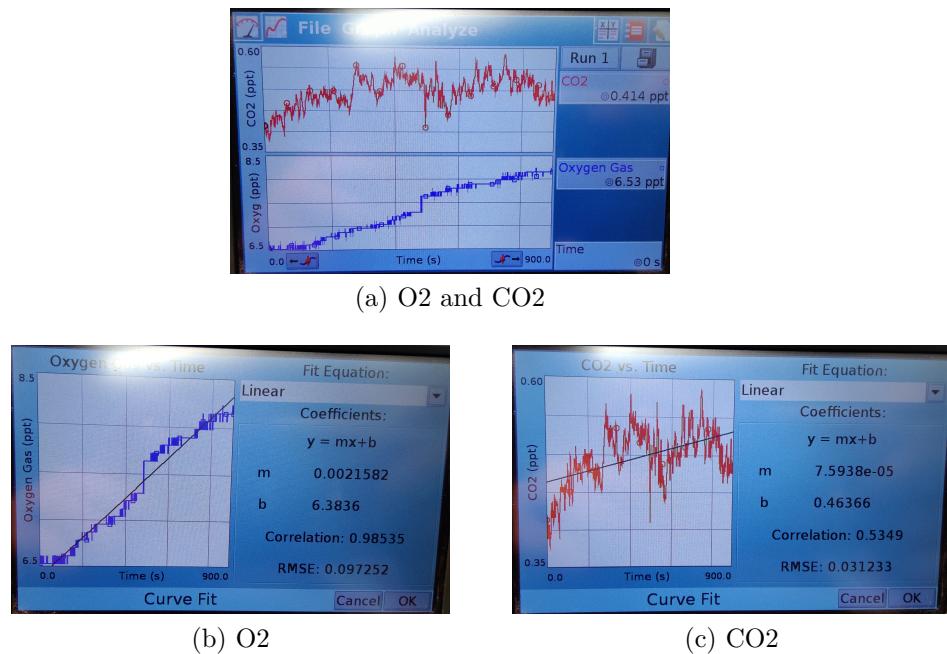


Figure 3: Uncovered Jar

O₂ and CO₂ Graphs We can observe from the graphs that the oxygen concentration in the uncovered jar increased, and the carbon dioxide concentration decreased.

Table 3: O₂ and CO₂ Table

| | O ₂ (ppt) | CO ₂ (ppt) |
|----------------|----------------------|-----------------------|
| min | 6.53 | 0.376 |
| max | 8.24 | 0.586 |
| mean | 7.35 | 0.498 |
| st. dev | 0.56999 | 0.036946 |

CO₂ and O₂ Table

4 Conclusion

For part A of the experiment, we observed that the covered jar had a higher temperature than the uncovered jar. This is because the covered jar was insulated, and the heat was trapped inside. This is similar to the greenhouse effect, where the heat is trapped inside the earth's atmosphere.

For part B of the experiment, we observed that the covered jar had a higher concentration of CO₂ and a lower concentration of O₂ than the uncovered jar. This is because the plant inside the uncovered jar was photosynthesizing, and releasing O₂ and absorbing CO₂. The plant inside the covered jar was respiring, and releasing CO₂ and absorbing O₂.

5 Questions To Ponder

5.1 Part A:

1. Explain with reasons which beaker covered or uncovered has the greatest temperature change?

The covered beaker has the greatest temperature change because it replicates the greenhouse effect, similar to the greenhouse gases present in our atmosphere, so the greenhouse effect is more prominent in the covered beaker. Due to which it a greater temperature change compared to the uncovered beaker, this is because the plastic wrap traps heat within the beaker leading to a rise in temperature significantly higher than the uncovered beaker.

2. Which beaker has the greatest rate of temperature change and why?

The uncovered beaker has the greatest rate of temperature change, as it is not covered by plastic wrap, i.e. less insulation heat transfers more easily between inside of beaker and surrounding environment. This leads to heat escaping and thus a greater rate of temperature change.

3. What is slope and the rate of reaction?

In a graph the slope is of the curve at any given point and this slope represents the rate of reaction. The steeper the slope, faster the reaction. Similarly the rate of reaction is a measure of how fast a reaction occurs. The rate of reaction is the change in concentration of products or reactants.

4. Why might the greenhouse effect be a problem for our earth?

The greenhouse might be a problem for our earth because it traps heat within our atmosphere and this is intensified by human activities such as burning fossil fuels, leading to a rise in temperature, and hence numerous problems arise. For example, global warming, leads to melting of ice caps, which further leads to rise in sea level, and due to all of this many coastal areas will be submerged, and many more to come.

5. Did the model greenhouse warm faster or slower than the control? What do you think caused the difference?

The model greenhouse warmed faster than the control, this is because the plastic wrap has insulating properties and traps heat within the beaker. This is similar to the greenhouse gases present in our atmosphere, which trap heat.

6. Describe one advantage of using a greenhouse.

There are many advantages of using a greenhouse, one of them is that it allows us to grow plants in a controlled environment, or in colder seasons where it is not possible to grow plants. This is because the greenhouse traps heat within it, which extends the growing season for plants.

5.2 Part B:

1. Were either of the rate values for CO₂ a positive number? If so, what is the biological significance of this?

Yes, the rate values for CO₂ were positive in the covered jar. This is because the plant was respiration, and releasing CO₂.

2. Were either of the rate values for O₂ a positive number? If so, what is the biological significance of this?

Yes, the rate values for O₂ were positive in the uncovered jar. This is because the plant was photosynthesizing, and releasing O₂.

3. Do you have evidence that photosynthesis occurred in leaves? Explain.

Yes, we have evidence that photosynthesis occurred in leaves. This is because the concentration of O₂ increased in the uncovered jar, and the concentration of CO₂ decreased, which hints towards photosynthesis.

4. Do you have evidence that respiration occurred in leaves? Explain.

Yes, we have evidence that respiration occurred in leaves. This is because the concentration of CO₂ increased in the covered jar, and the concentration of O₂ decreased, which hints towards respiration.