

## Abstract

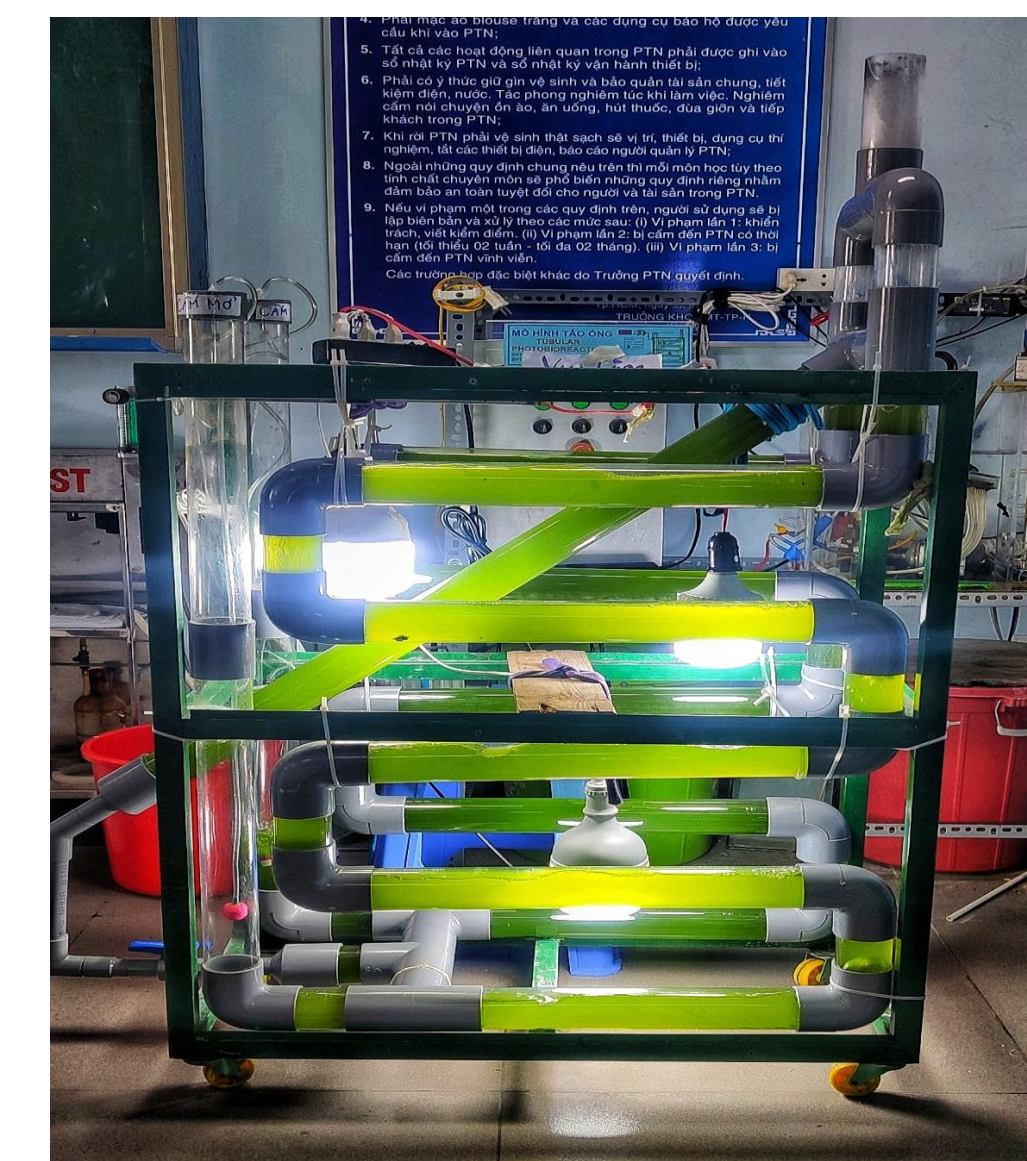
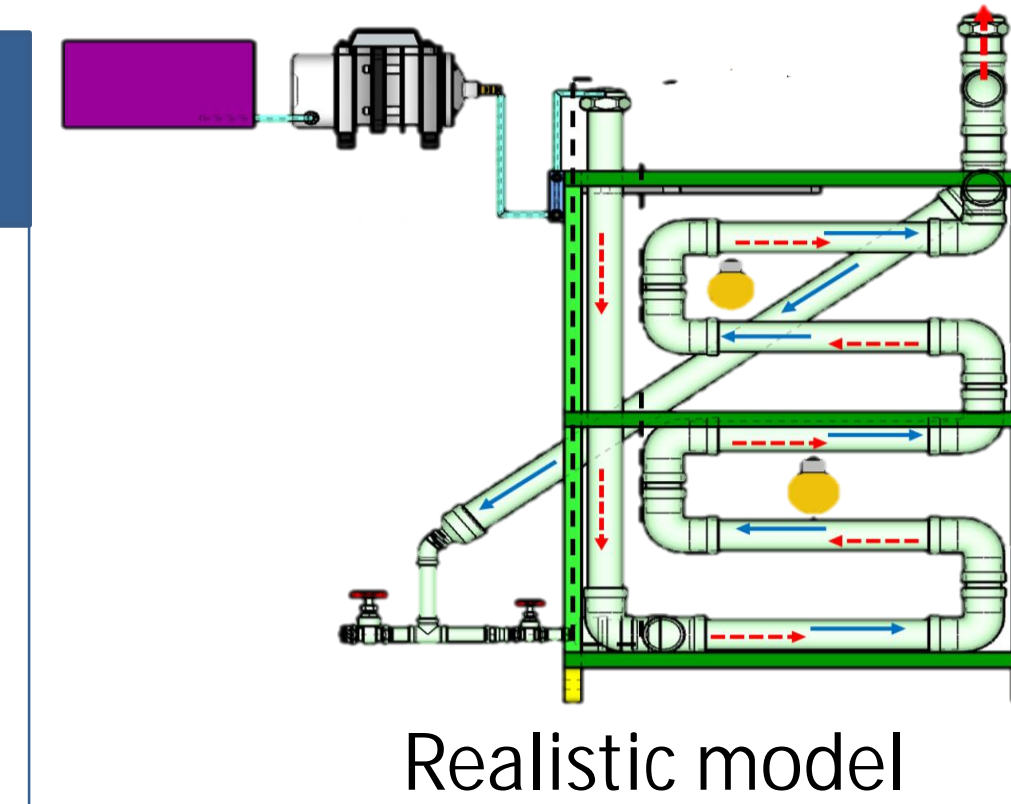
The problem of air pollution is growing and the impact is more obvious than ever, in which carbon dioxide - CO<sub>2</sub> represents a series of problems that we are facing every day but have not yet been able to solve the problem. effective solutions. Currently, microalgae are known to be organisms capable of photosynthesis and use free CO<sub>2</sub>, bicarbonate ions, as a source of nutrients to grow. When microalgae grow in good environmental conditions, it will not only bring about efficiency, CO<sub>2</sub> treatment results but also to obtain algal biomass for many other applications. This study designed experiments using a tubular algae culture system using Tubular photobioreactor technology to evaluate the ability of microalgae *Chlorella vulgaris* to grow and absorb emissions. Microalgae were evaluated for their ability to grow under the conditions of natural gas supply (G1 stage), and under the condition of exhaust gas supplied from mini motorcycle engines (G2 and G3 stages) with each stage of about 30 days. Indicators such as pH, DO, N-NO<sub>3</sub><sup>-</sup>, N-NO<sub>2</sub><sup>-</sup>, N-NH<sub>4</sub><sup>+</sup>, Total Nitrogen, TSS biomass, P-PO<sub>4</sub><sup>3-</sup>, Alkalinity were assessed with a frequency of 3-5 times/week. Preliminary results show that the Tubular photobioreactor model system has provided a stable growth environment for microalgae in both the natural gas and exhaust gas phases. When through the system, microalgae have reduced pollution by 30-40% of input emissions and algae have also taken advantage of CO<sub>2</sub> to grow good biomass.

## Introduction



### Value brings from microalgae:

- ✓ Significantly reduce the amount of CO<sub>2</sub> in the atmosphere
- ✓ Bringing fresh air
- ✓ Generate precious bioenergy
- ✓ Biomass applications in cosmetics, animal feed, pharmaceuticals

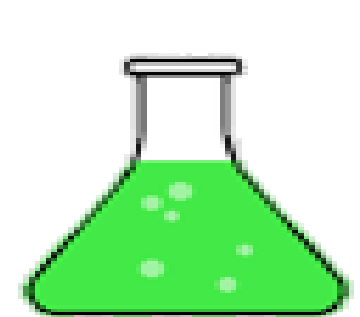
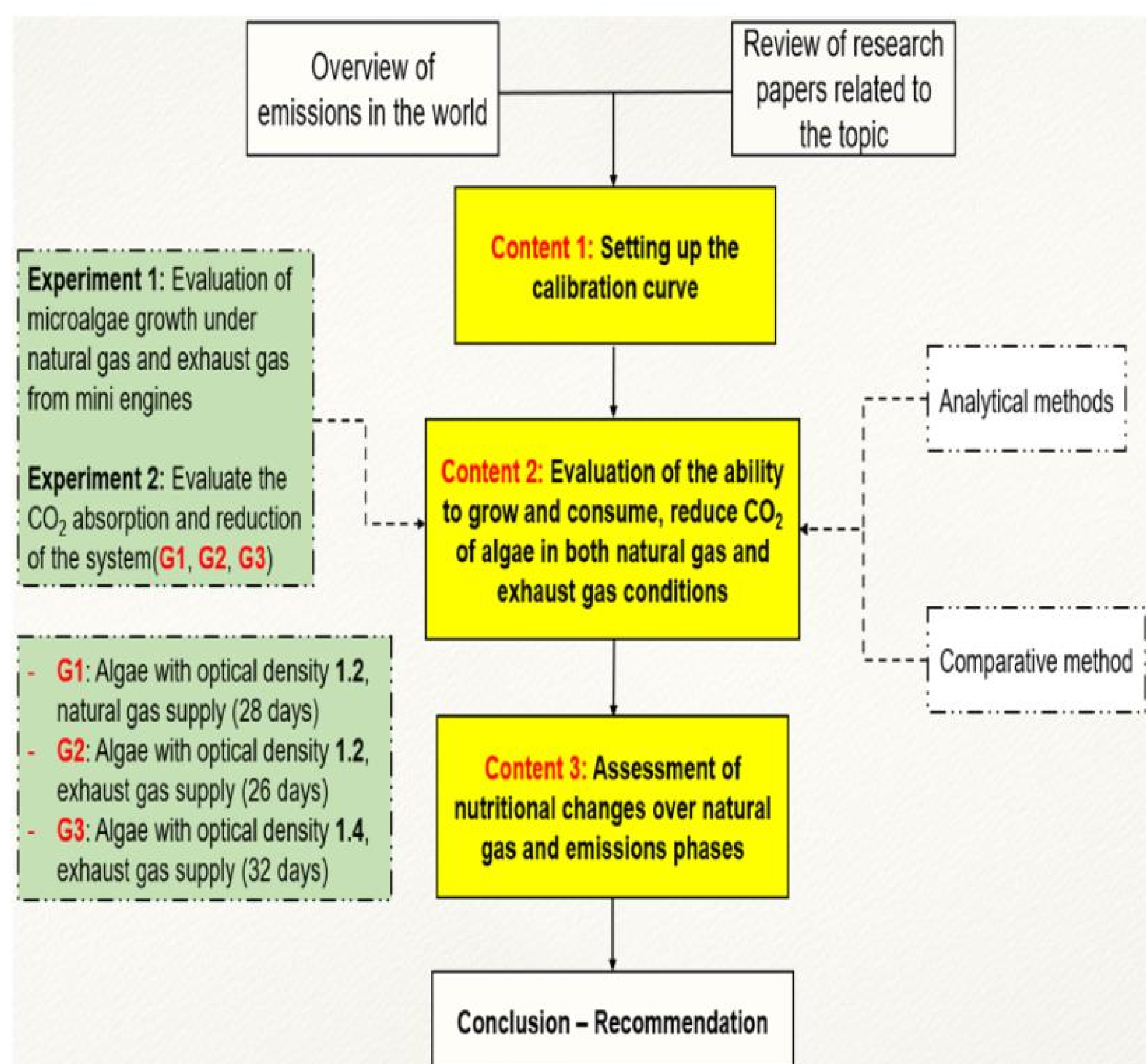


### CO<sub>2</sub> Sensor

DATA COLLECTOR FOR CO <sub>2</sub> SENSOR			
PORT	DATA	Sampling Time	Average
COM1	139	12:04:27	1798
COM2	140	12:04:37	1802
COM3	141	12:04:47	1804
COM4	142	12:04:57	1804
COM5	143	12:05:07	1841
COM6	144	12:05:17	1850
COM7	145	12:05:27	1781
COM8	146	12:05:37	1770

Data is transferred to the evaluation Excel file

## Methods and Materials



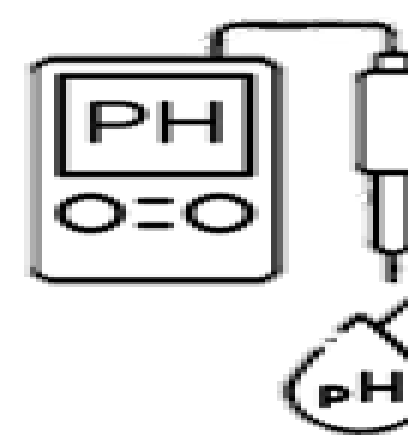
Withdrawal of biomass



Using microscope, red blood cell counting chamber



Optical Density Measurement



Measure, analyze parameters, targets

## Results

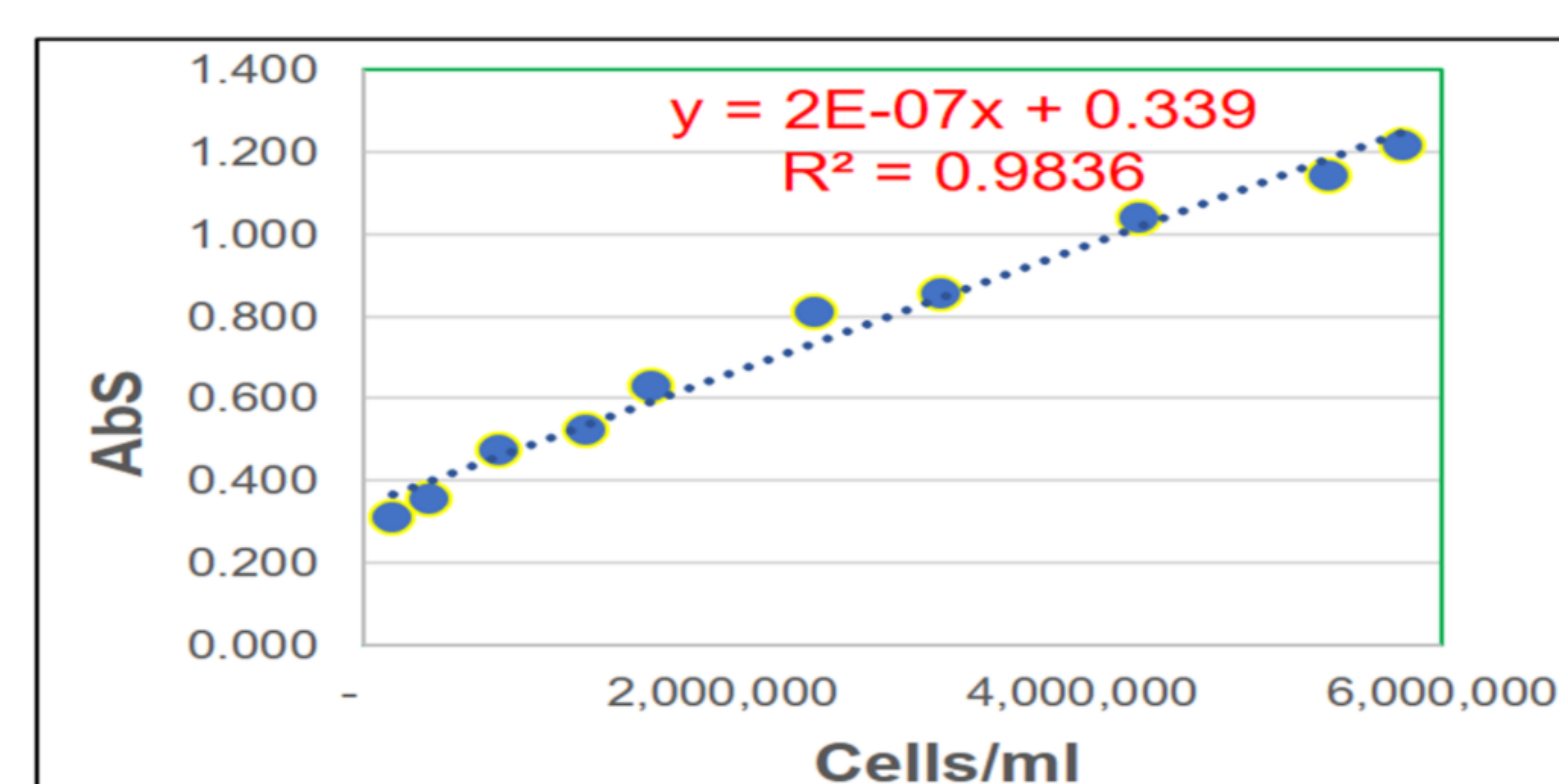


Figure 1: Standard curve plot of correlation between cells and ABS absorption

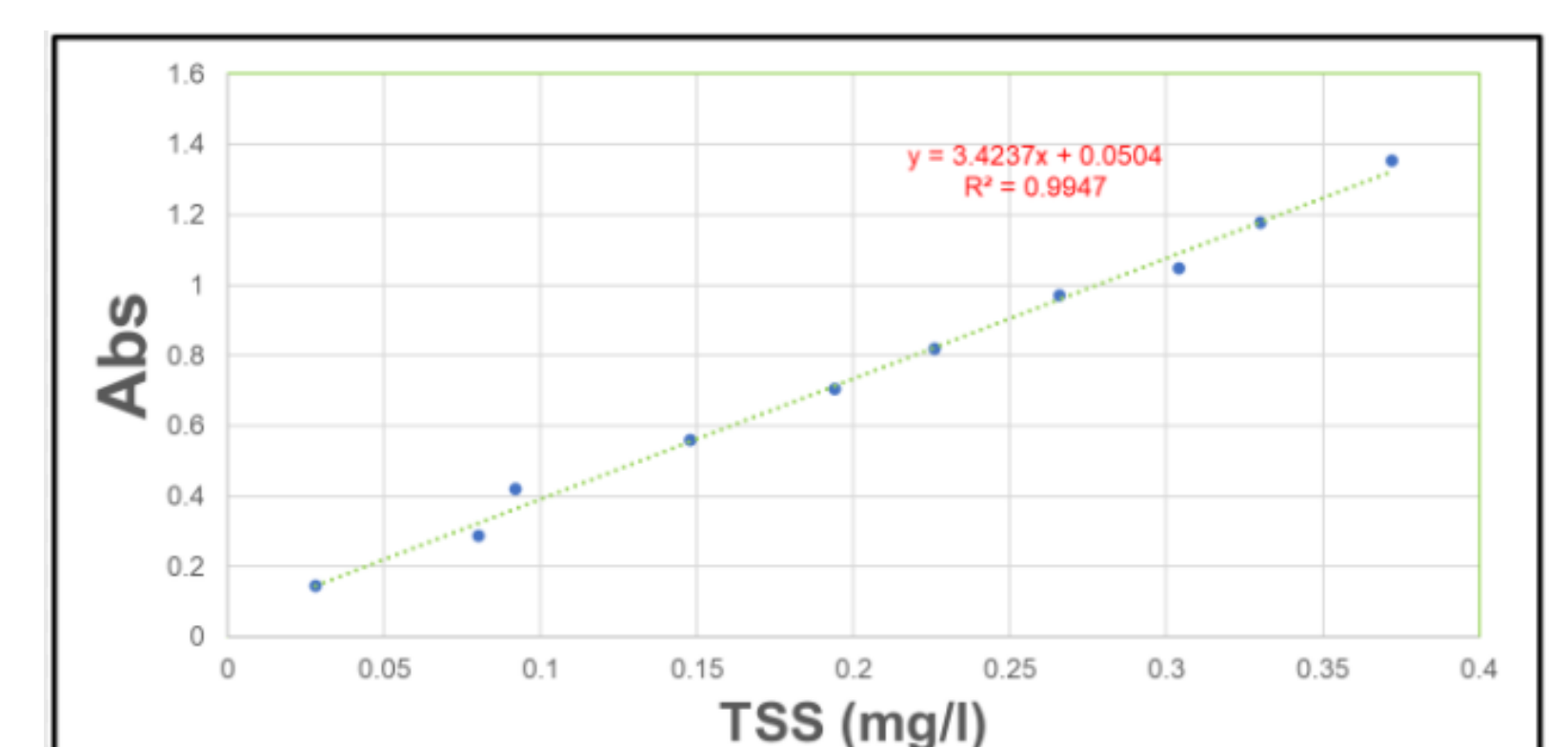


Figure 2: Standard curve for determination of algal biomass by analyzing TSS

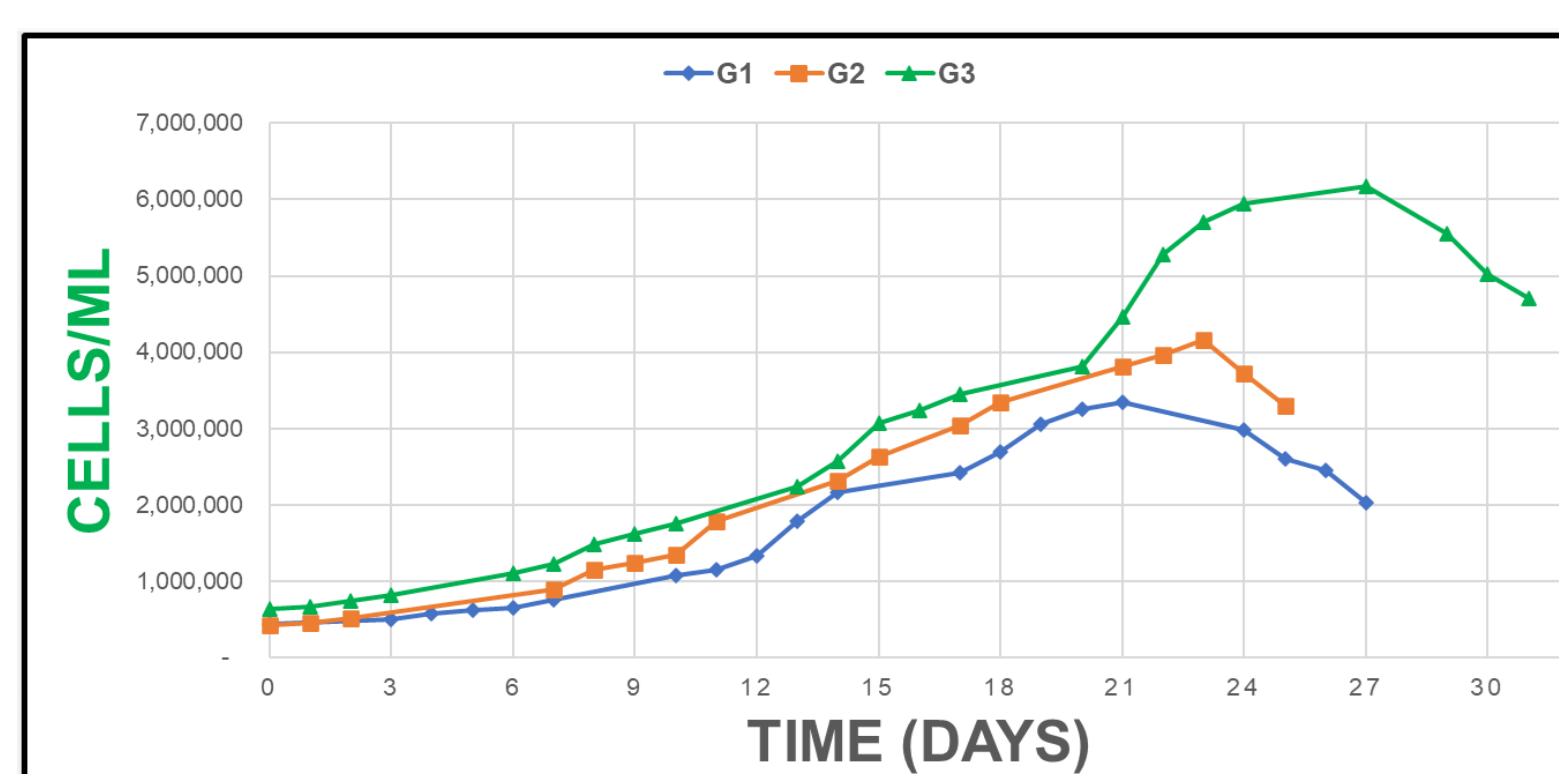


Figure 3: Graph showing the growth of algae through the experimental stages

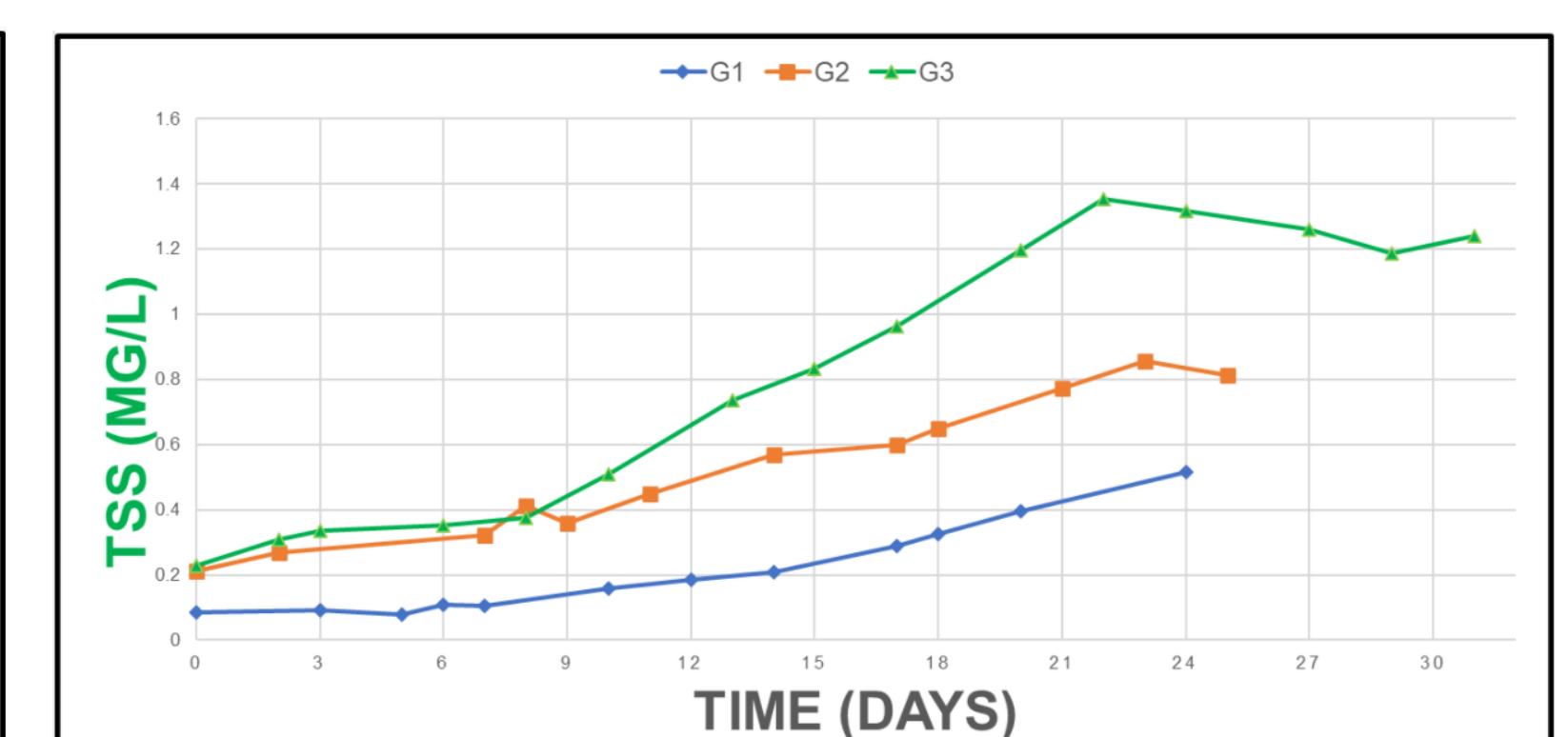


Figure 4: Graph showing the change of algal biomass over the experimental periods

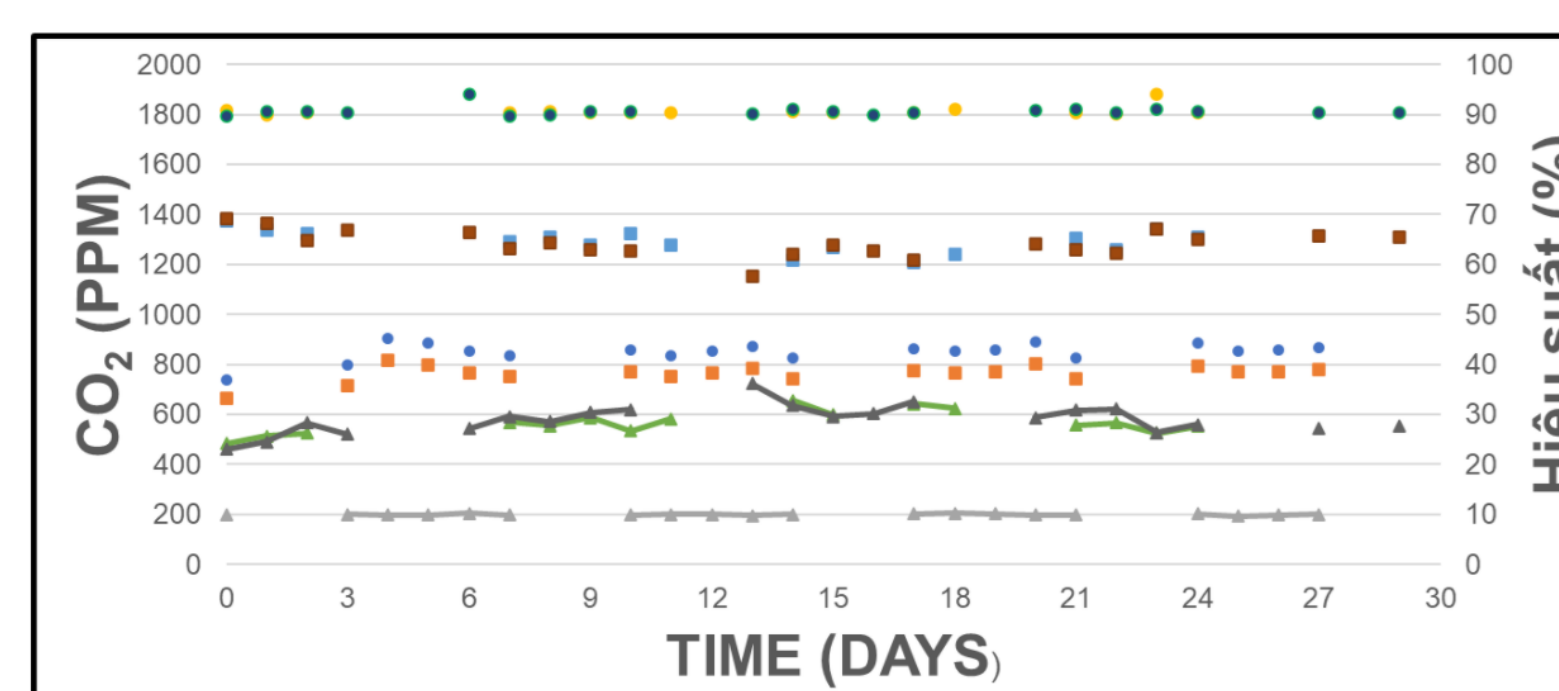


Figure 5: Graph showing the system's CO<sub>2</sub> absorption and reduction efficiency

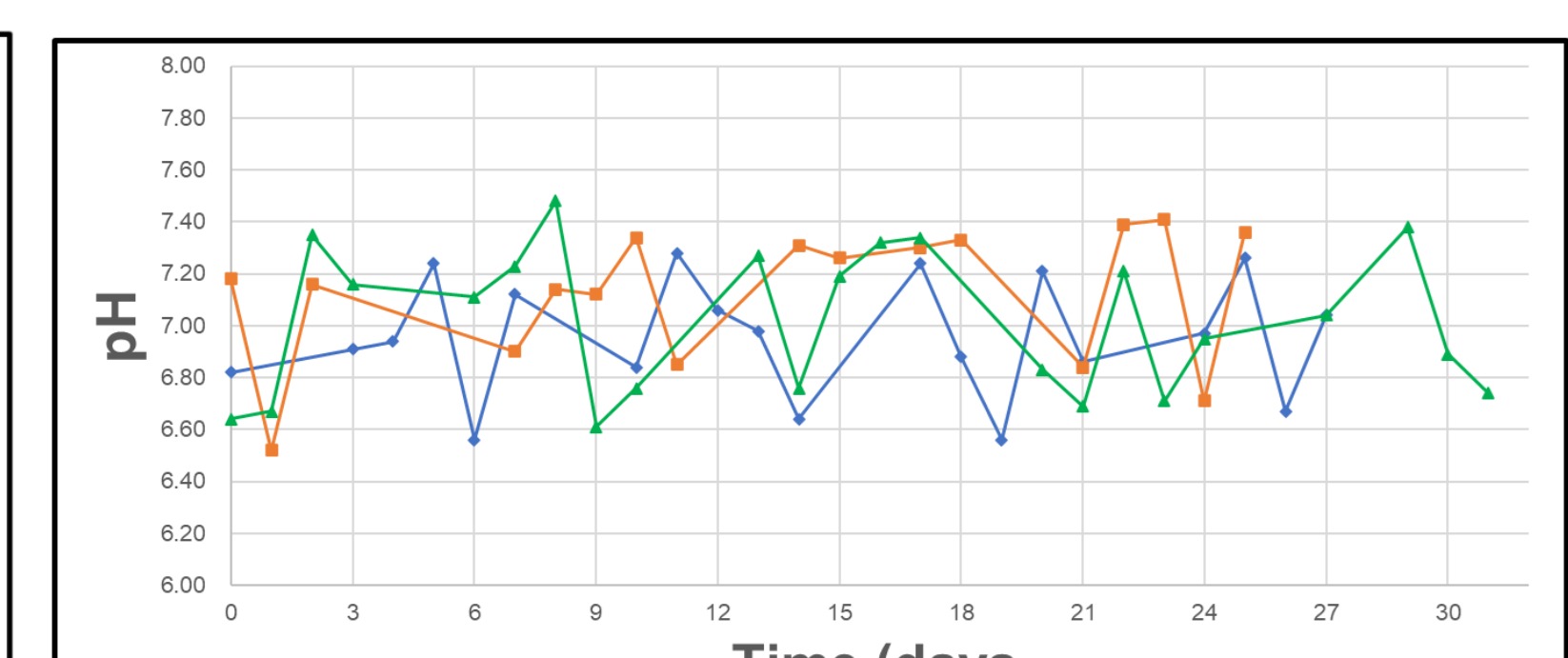


Figure 6: Graph showing the pH change over the test periods

## Conclusions

After a long time of experimentation, the results showed that the algae adapt and grow well in the conditions of natural gas and exhaust gas supplied from mini engines. The results showed that under natural gas conditions, the algae in batch G1 developed best with a biomass concentration of 3.3x10<sup>6</sup> cells/ml. In the condition of exhaust gas from the algae engine in batch G2, G3 continued to adapt and grow well, reaching 4.1x10<sup>6</sup> cells and 6.2x10<sup>6</sup> cells/ml, respectively, after 26 and 33 days of experiment. About the average CO<sub>2</sub> absorption efficiency in natural gas in batch G1 achieved 10% and the CO<sub>2</sub> reduction efficiency in batch G2 averaged 28.38%, the highest was 32.19% and the average batch G3 reached 29.04%, the highest was achieved. 36.14%. The pH or DO parameters are also reached at a suitable level for algae growth in the system. The content of N and P after analysis also shows the change in the algae's ability to consume over the stages in the system.

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