

Abstract

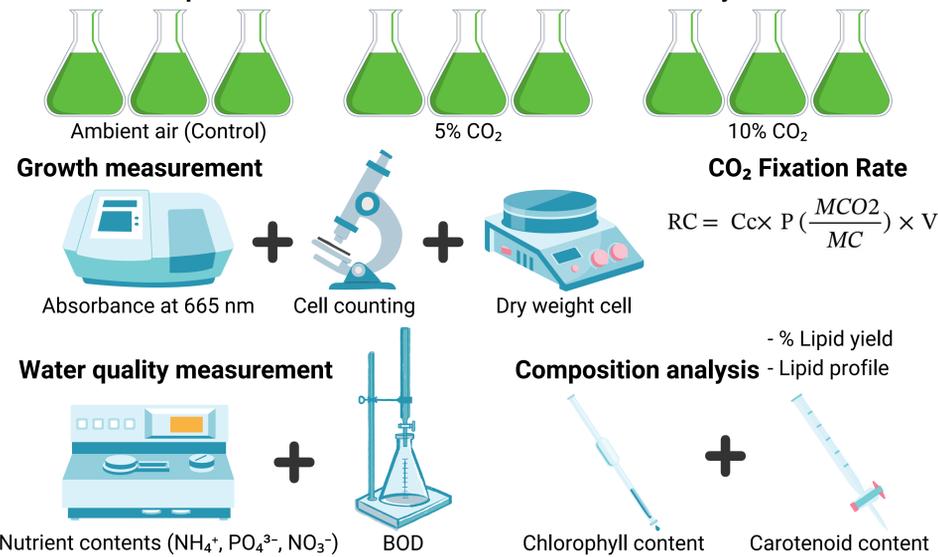
Untreated wastewater from industrial sources, along with exhaust gases like carbon dioxide (CO₂), presents a significant environmental issue. CO₂, as a major greenhouse gas, contributes to global warming, leading to long-term detrimental effects on the planet. Microalgae, which thrive in wastewater due to the nutrients it contains, can also absorb CO₂ for photosynthesis. This study examines the cultivation of *Acutodesmus* sp. AARL G090 in wastewater from a coffee factory and a mulberry paper factory, under conditions of ambient air, 5% CO₂, and 10% CO₂. The cultivation took place in the laboratory, where growth rate, dry weight, chlorophyll a, carotenoids, nutrients (ammonia, phosphate, nitrate), and fatty acid content were measured. Results showed that the coffee factory wastewater enhanced better algal growth, as it contained more nutrients and organic matter than the wastewater from the mulberry paper factory. After cultivation in ambient air, 5%, and 10% CO₂ concentrations, the algal biomass in the coffee factory wastewater was 0.69 ± 0.39, 0.95 ± 0.04, and 1.00 ± 0.05 g/L, respectively. The fatty acid content of the algal biomass is currently being analyzed.

Introduction

Currently, there is research on the use of microorganisms to help reducing global warming, whether directly or indirectly. Microalgae have been researched for their various properties. They can grow in wastewater and can also absorb carbon dioxide to use for their growth. In addition, cultivating algae with wastewater also reduces the cost of increasing the yield or biomass of algae to be used as a new generation of fuel, supplement and further more in the future.

Methodology

Acutodesmus sp. AARL G090 cultivation in coffee and mulberry wastewater



Results

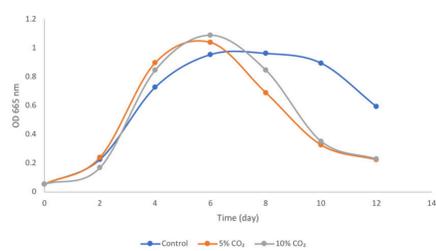


Fig. 1 Absorbance at 665 nm in coffee wastewater cultivation. Shows that cultivation in with increased concentrations of CO₂ conditions had faster growth rates of *Acutodesmus* sp. AARL G090 than in control condition.

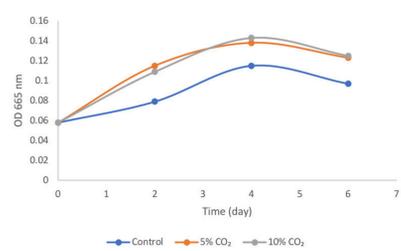


Fig. 2 Absorbance at 665 nm in mulberry paper wastewater cultivation. Shows that cultivation in with increased concentrations of CO₂ conditions had faster growth rates of *Acutodesmus* sp. AARL G090 than in control condition.

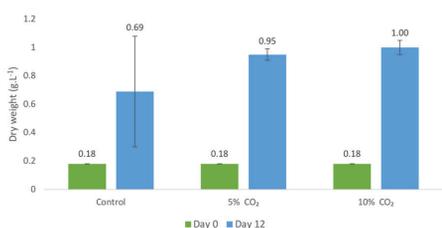


Fig. 3 Dry weight in coffee wastewater cultivation. Shows that after cultivation in all three different concentrations of CO₂ conditions had no different in dry weight of *Acutodesmus* sp. AARL G090.

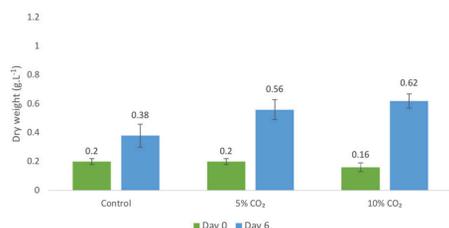


Fig. 4 Dry weight in mulberry paper wastewater cultivation. Shows that after cultivation in with increased concentrations of CO₂ conditions had higher dry weight of *Acutodesmus* sp. AARL G090 than in control condition.

References

Brandie Jefferson, (2022), *Growing algae outside of wastewater*. Retrieved from <https://phys.org/news/2022-01-algae-wastewater.html>
Sahana Ghosh, (2024), *Boosting algae's carbon absorption*. Retrieved from <https://www.nature.com/articles/d44151-024-00165-w>

Objectives

- To cultivate microalgae using industrial wastewater and carbon dioxide.
- To investigate the potential of microalgae for carbon dioxide sequestration.

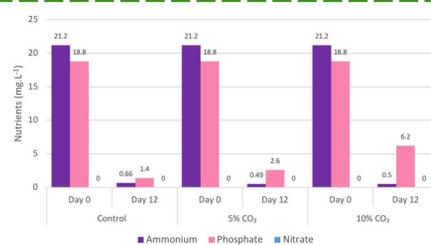


Fig. 5 Nutrients in coffee wastewater cultivation. Shows that after cultivation in all three different concentrations of CO₂ conditions of *Acutodesmus* sp. AARL G090 there was a decrease in the amount of nutrients (NH₄⁺ and PO₄³⁻) because microalgae has been used and no NO₃⁻ were found in coffee wastewater.

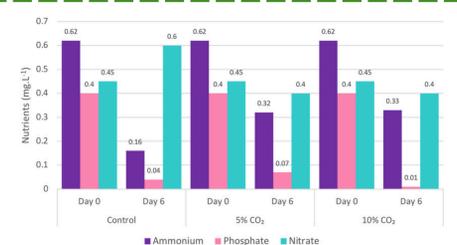


Fig. 6 Nutrients in mulberry paper wastewater cultivation. Shows that after cultivation in all three different concentrations of CO₂ conditions of *Acutodesmus* sp. AARL G090 there was a decrease in the amount of nutrients (NH₄⁺, PO₄³⁻ and NO₃⁻) because microalgae has been used. The increase in NO₃⁻ in control condition was due to the dead of microalgae.

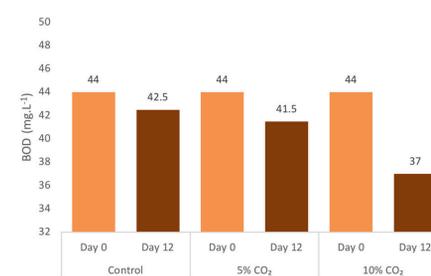


Fig. 7 BOD in coffee wastewater cultivation. Shows that in all three different concentrations of CO₂ conditions of *Acutodesmus* sp. AARL G090 there was a decrease in BOD in media after cultivation in coffee wastewater.

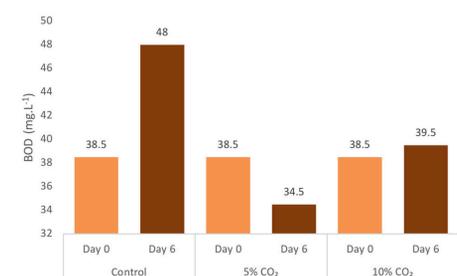


Fig. 8 BOD in mulberry paper wastewater cultivation. Shows the decrease in BOD in concentration of 5% CO₂ condition of *Acutodesmus* sp. AARL G090 cultivation. Therefore, the increase in BOD in other two conditions were due to the dead of microalgae.

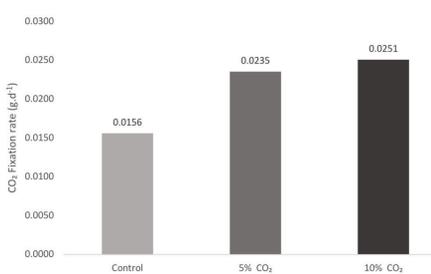


Fig. 9 CO₂ fixation rate in coffee wastewater cultivation. Shows that there was a higher rate of CO₂ fixation of *Acutodesmus* sp. AARL G090 cultivation in the condition with increased carbon dioxide concentration than in the control condition.

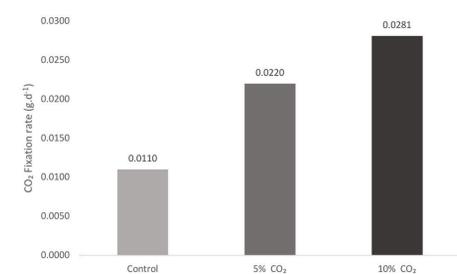


Fig. 10 CO₂ fixation rate in mulberry paper wastewater cultivation. Shows that there was a higher rate of CO₂ fixation of *Acutodesmus* sp. AARL G090 cultivation in the condition with increased carbon dioxide concentration than in the control condition.

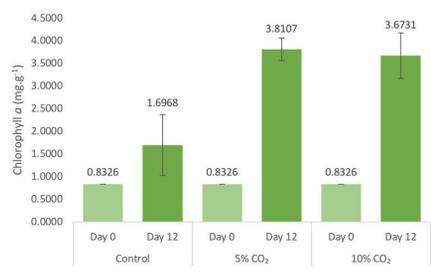


Fig. 11 Chlorophyll a in coffee wastewater cultivation.



Fig. 12 Chlorophyll a in mulberry paper wastewater cultivation.

Conclusion

Microalgae exhibit robust growth in wastewater due to the abundant nutrients available to support their development and can thrive under conditions with increased carbon dioxide concentrations, leading to an enhanced rate of carbon fixation.

Acknowledgement

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