Studying the wastewater treatment efficiency and carbon sequestration capabilities of duckweed and water hyacinth.

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Abstract

This experimental science project aimed to study the efficiency of Wolffia spp. in treating wastewater from pig farms and to evaluate its potential for carbon sequestration in the form of biomass. Wolffia spp. was cultivated in pig farm wastewater for a period of 28 days. Water quality was measured before and after the experiment, including pH, dissolved oxygen (DO), and nitrogen concentration in the wastewater.

The results showed that Wolffia spp. effectively improved wastewater quality, as indicated by an increase in dissolved oxygen levels and a significant reduction in nitrogen concentration. In addition, the biomass of Wolffia spp. increased markedly, demonstrating its ability to sequester carbon through the process of photosynthesis.

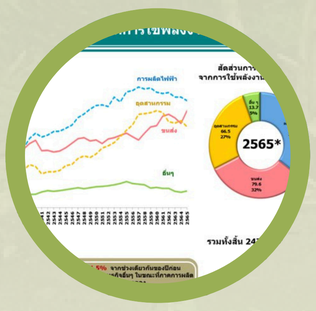
In conclusion, Wolffia spp. is an aquatic plant with high potential for treating pig farm wastewater and for carbon sequestration. This approach represents a simple, low-cost, and environmentally friendly method for sustainable environmental management and can be applied in the future.

Keywords: Wolffia spp., pig farm wastewater, wastewater treatment, carbon sequestration, aquatic plants

Introduction

Pig farm wastewater

Using Wolffia spp. and Lemna perpusilla for wastewater treatment and carbon sequestration



Carbon dioxide levels increase

RESEARCH QUESTION

1. Do Wolffia and duckweed differ in their ability to treat wastewater from pig farms? If so, how?
2. Do Wolffia and duckweed differ in their carbon sequestration ability? If so, how?

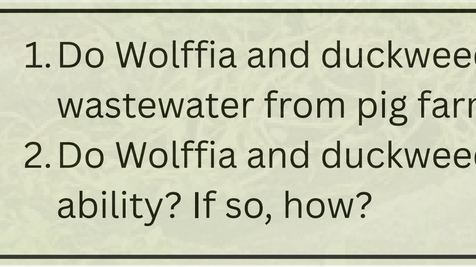
RESEARCH HYPOTHESIS

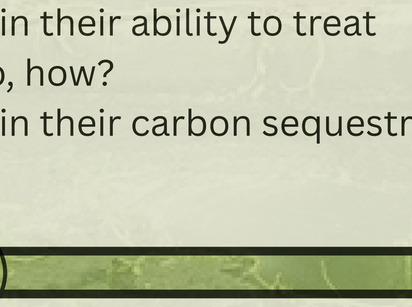
1.Wolffia and duckweed differ in their ability to treat wastewater from pig farms.
2.Wolffia and duckweed differ in their carbon sequestration ability.

Methodologys

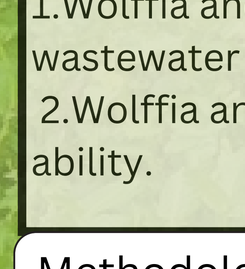
Study sites

Pigfarm
7°59'09"N 99°37'51"E



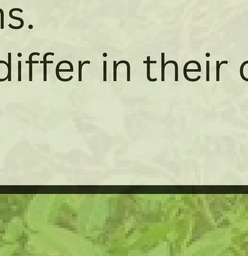


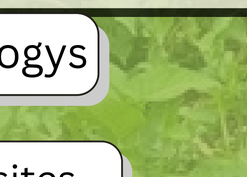
Methods



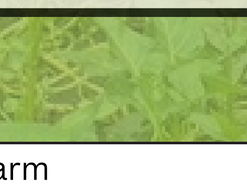
Wolffia was cultured in plastic basins.

record the water parameters





calculate carbon sequestration

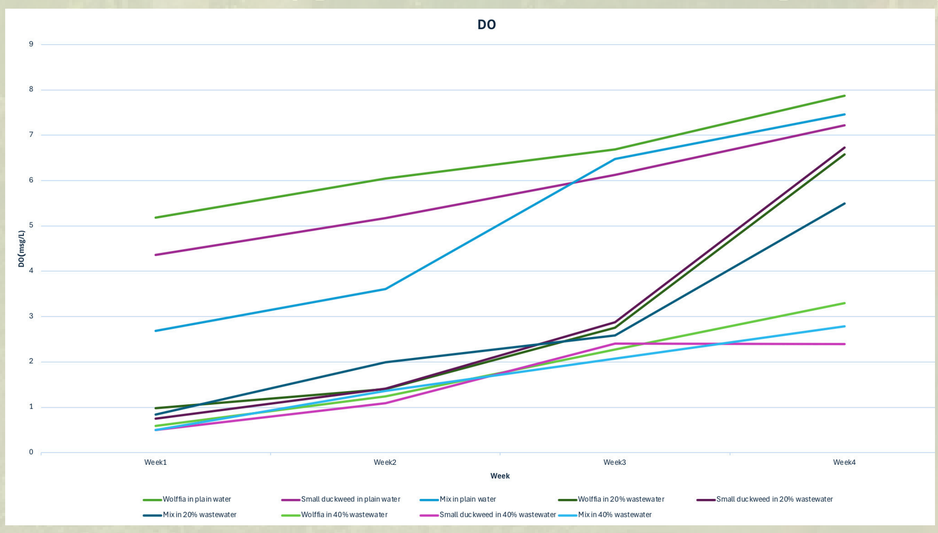


data collection

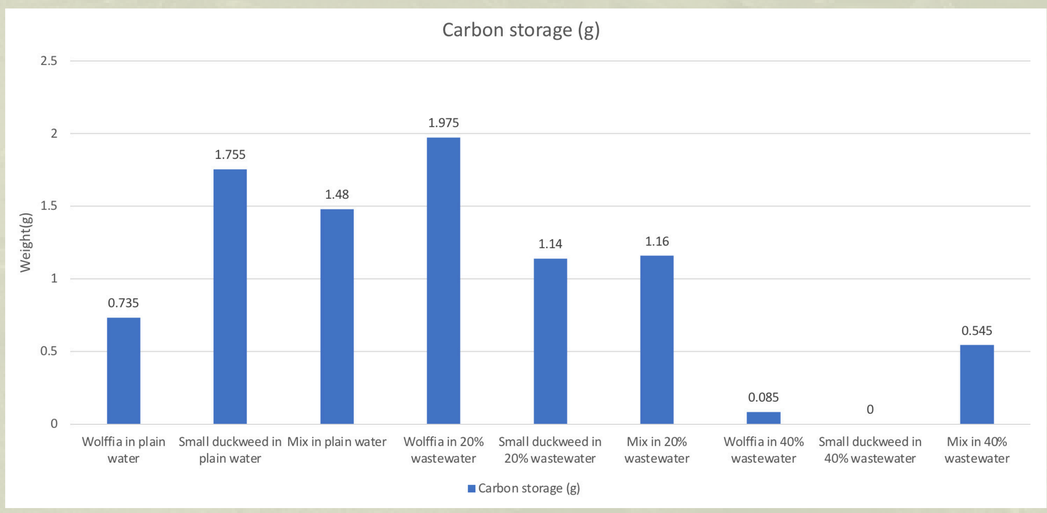
Analyze statistical data in Microsoft excel.

Result

The dissolved oxygen (DO) level increased significantly.



carbon storage (gram)



Discussion and Conclusion

Increase in DO (Dissolved Oxygen)

The increase in dissolved oxygen (DO) is mainly due to the photosynthesis of aquatic plants. Wolffia is particularly effective under pig farm wastewater conditions because of its extremely small size, which gives it a high surface area–to–volume ratio, allowing efficient gas exchange and oxygen release into the water.

In addition, pig farm wastewater has a high biochemical oxygen demand (BOD). By rapidly absorbing nutrients such as nitrogen and phosphorus for growth, Wolffia reduces microbial decomposition activity and oxygen consumption, resulting in higher DO levels in the water.

References

Chatchamni, B. (2013). Treatment of swine farm wastewater using watermeal as a supplementary animal feed. Retrieved January 22, 2025, from Journal of Graduate School, Sakon Nakhon.

Winyai Mahamat. (2024). Watermeal (Wolffia): A high-protein aquatic plant. Retrieved January 22, 2025, from the Kasetsart University Library. https://www.lib.ku.ac.th/2024/article/view/556

Kasetsart University Library. (2024). Watermeal: A tiny plant packed with nutrients. Retrieved January 23, 2025, from https://www.lib.ku.ac.th/2024/article/view/556

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