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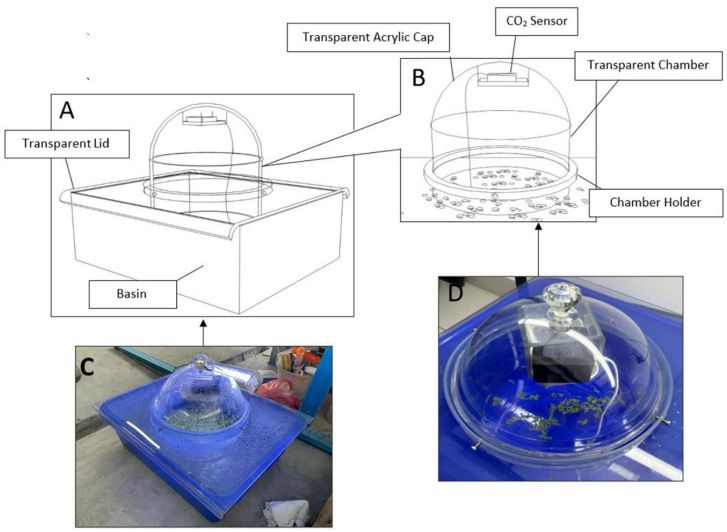
QUANTIFICATION OF CARBON DIOXIDE SEQUESTRATION BY DUCKWEED: PROMOTING CIRCULAR ECONOMY IN TILAPIA AQUACULTURE

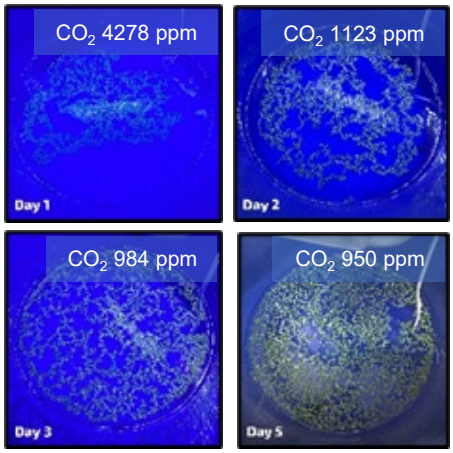


Static chamber assembly

The global demand for fish is predicted to double by 2050. Tilapia is a commonly farmed species because of its nature, which produces high yields. However, high-density farming can lead to increased greenhouse gas emissions due to respiration and poor water quality. Introducing a circular economy in the farming line can greatly reduce emissions, contributing to a more sustainable aqua environment. CO_2 can be sequestered using biological methods such as photosynthesis by macrophytes like duckweed, which are fast-growing plants. Duckweed, with its leaf-stem structure and roots, can take up more CO_2 than other plants. Ambient conditions between 20°C to 30°C are ideal for their growth.

Our study focuses on investigating the effectiveness of Lemna minor duckweed, which is used to treat tilapia water in sequestering CO_2 from the atmosphere. A laboratory-scale duckweed pond was built using a 55 L basin. The CO_2 flux was measured using the static chamber method. A transparent chamber was placed in the middle of the basin. CO_2 concentration in the chamber was collected periodically under constant luminosity and temperature.

The investigation results by our student, Muhammad Aikhal Azmy, in his final year project indicated that the duckweed population increased while the peak CO_2 concentration decreased by days. Tilapia pond effluent naturally contains high amounts of organic matter and microorganisms. Other than tilapia respiration, the decomposition of the organic matter by the microorganism also produces CO_2. In addition to the CO_2 consumption as an influencing factor to the duckweed population growth, the latter is also dependent on nutrient consumption, where increased concentrations of nitrogen (N) and phosphorus (P) correspond to a gradual increase in duckweed biomass yield. The results of our simple experiment suggest that the duckweed culture effectively sequestered CO_2 from the atmosphere, supporting the potential of duckweed as a tool for carbon sequestration.



Duckweed population growth effectively reduces CO_2 release over time, demonstrating its potential for CO_2 sequestration.

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