

CO₂ Scrubber

Bhavya Patel, Glenn Dauphinee, Nathan Johnson

What is a CO₂ Scrubber?

A CO₂ scrubber is a device which absorbs carbon dioxide. To date, CO₂ Scrubbers have been utilized for applications such as rebreathers, submersible craft, spacecraft and exhaust gas treatment of industrial plants. With the growing concerns about climate change more and more focus is being put into researching carbon-capture methods; these methods would employ CO₂ scrubbers to capture carbon from sources of pollution or from ambient air.



Toa555. (n.d.). Photobioreactor in Lab algae Fuel biofuel Industry. stock image - image of sustainable, Research: 44191169. Retrieved March 30, 2021, from <https://www.dreamstime.com/stock-photo-photobioreactor-lab-algae-fuel-biofuel-industry-algal-alternative-to-fossil-uses-as-image44191169>



Toa555. (n.d.). Photobioreactor in Lab algae Fuel biofuel Industry. stock image - image of sustainable, Research: 44191169. Retrieved March 30, 2021, from <https://www.dreamstime.com/stock-photo-photobioreactor-lab-algae-fuel-biofuel-industry-algal-alternative-to-fossil-uses-as-image44191169>

Operating Principles

During the day when energy is available in the form of sunlight, algae absorbs carbon dioxide in through the process of photosynthesis which is endothermic and requires the sunlight to occur.



The Design

The system makes use of a bioreactor containing an algae culture where atmospheric air is pumped into the reactor at a monitored and measured rate depending on the pump output. This allows for the system to be monitored for the quantity of CO₂ being captured as well as the optimization of the process of photosynthesis. As the algae culture grows biomass will collect in the reactor and would be periodically removed and could be used for biofuel, or biochar, or disposed of via geological sequestration on a larger scale.

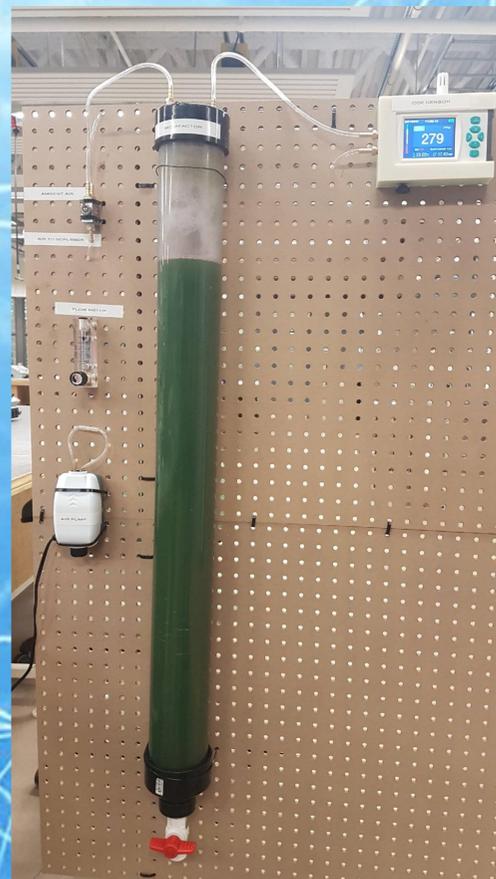
A non-dispersive infrared (NDIR) analyzer is used to measure CO₂ concentration in both the ambient air and scrubbed air. A rotameter is used to measure air flow. Absorption can then be calculated with these known values.

Bio sequestration

Bio sequestration is the capture and storage of carbon dioxide by the natural biological process of photosynthesis, which can be enhanced and optimized for maximum carbon capture. Bio sequestration as a natural process has occurred in the past and was responsible for the formation of the extensive coal and oil deposits which are now being burned for our ever-growing energy requirements.

Why Algae?

Algae is one of the most effective organisms at capturing CO₂, making it a good candidate for a bioreactor system. Algae cultures in optimal conditions can double its biomass within 24 hours giving it a large absorption potential due to the high growth rate.



$$\text{Mass Removed (g)} = \text{concentration diff. (ppm)} * \text{Flow (L/min)} * 0.002337984$$