

Algae Harvester and Dehydrator

Team BioSep



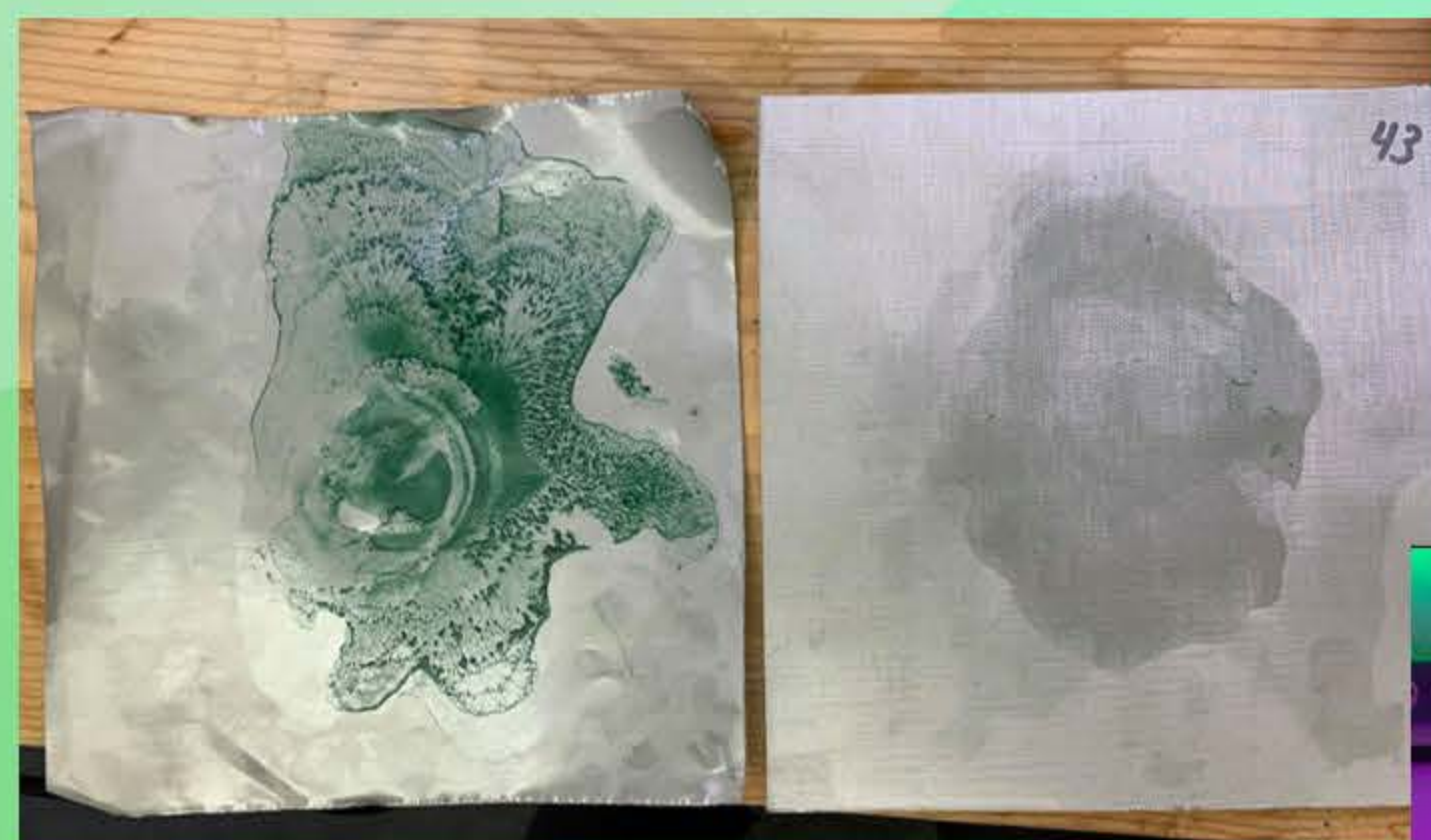
Problem

Microalgae is a great source of biomass for biofuel production. More specifically, it can be used for biodiesel due to the organism's high lipid content. This alternative fuel source is essentially carbon neutral and has an oil yield of 1,600 gallons/acre. This feedstock has the potential to revolutionize the energy industry but there are several issues that need to be addressed first:

- Expensive and energy intensive harvesting processes
- Ineffective drying of the microalgae for easier lipid extraction
- High water input for cultivation
- Batch processing systems commonly used

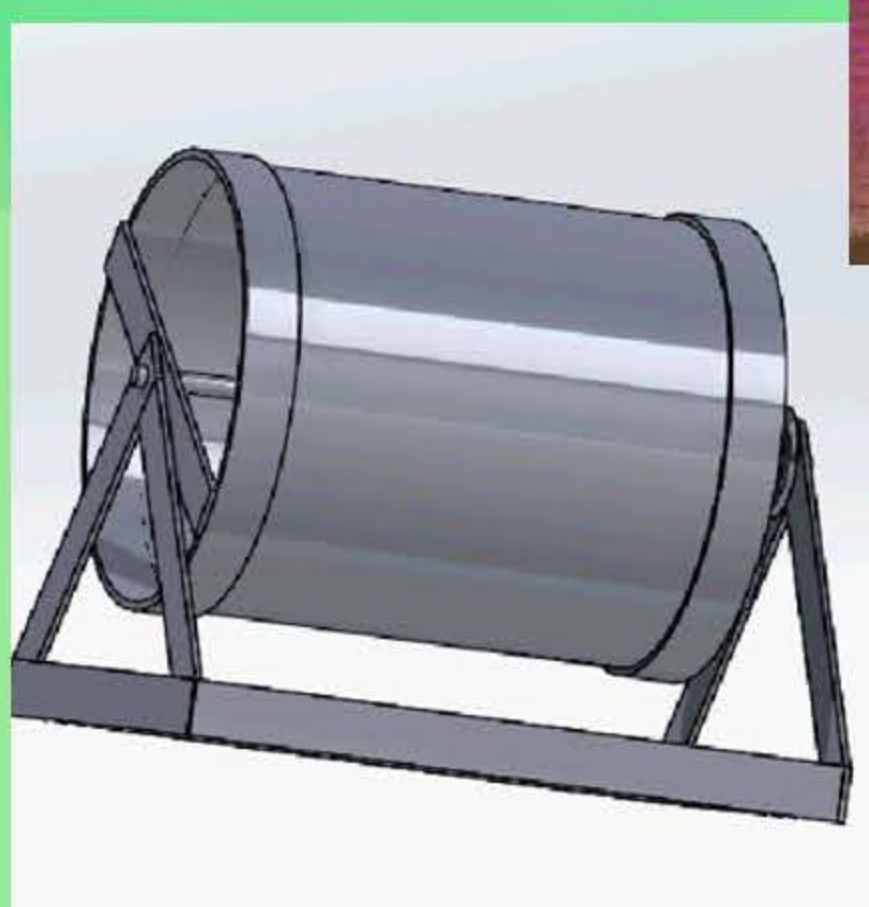
Project Learning

Various methods of dewatering and dehydrating were explored. Testing needed to be done to determine the best method to achieve dry algae. Growing algae also required testing different methods.



(Left) Initial testing of different sized filters. The 5 micron filter was the best option.

(Right) One of the more promising designs, the rotary drum dryer. Works like a clothes dryer.



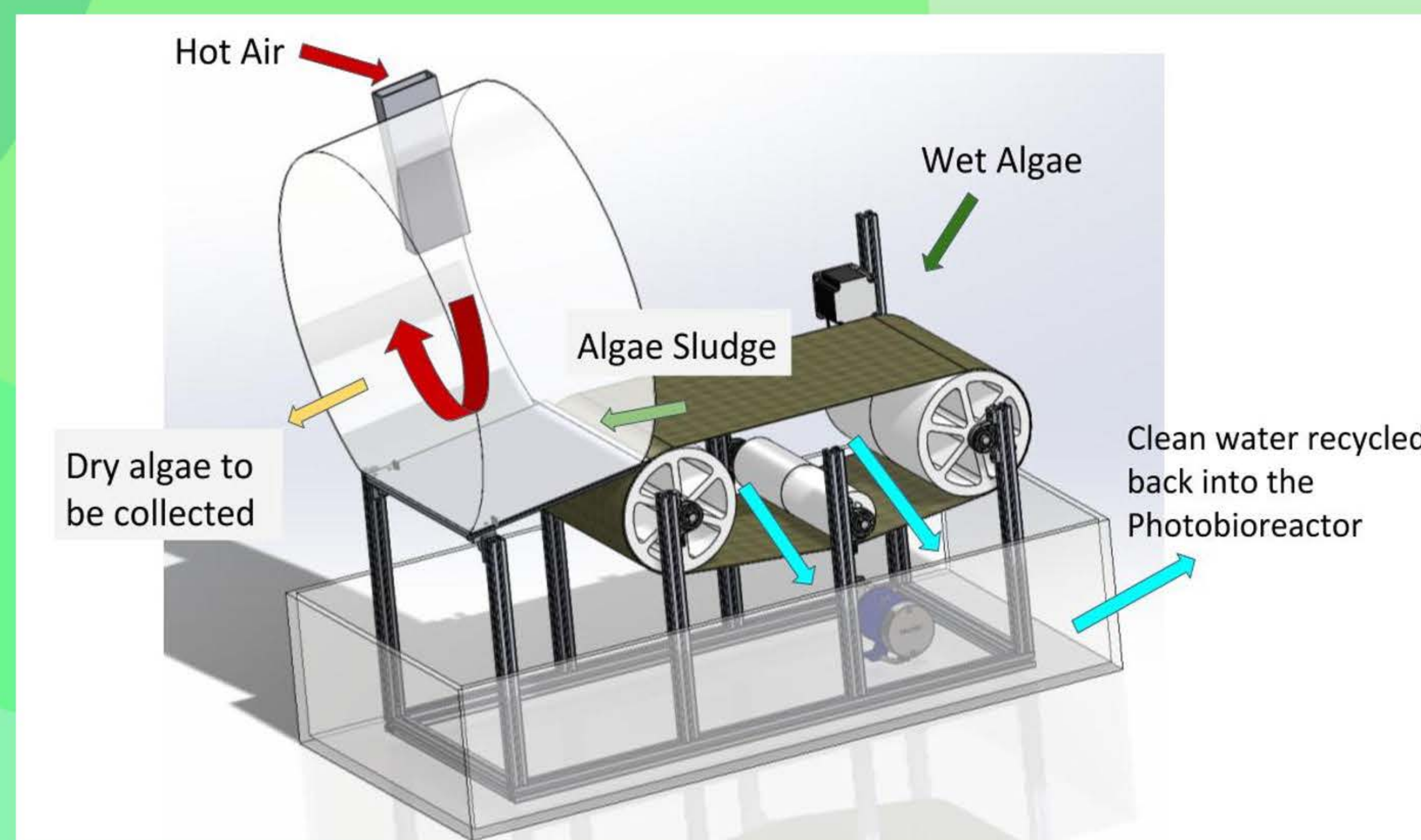
(Above) The tub used to grow algae. The purple light was not ideal for algae growth. White light worked better.



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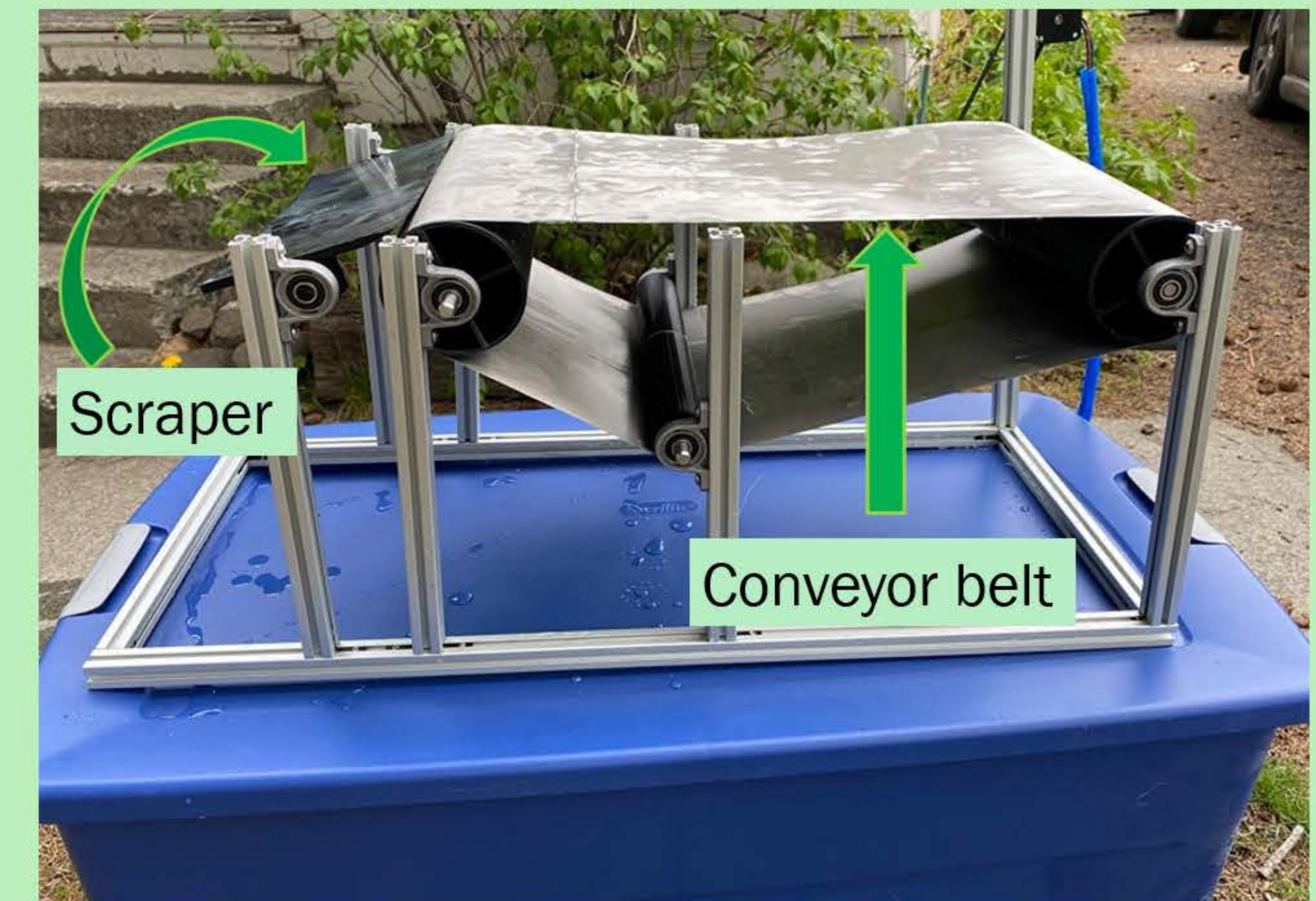
Design



The preliminary final design is based on a conveyor belt filter. Green algae water flows onto the belt and is filtered as the belt rotates. The algae sludge is scraped off of the belt into a modified rotary drum filter. Hot air is blown into the compartment while wet algae tumbles inside until it is dry. The dry algae is then collected from the other side.

Thank you to The Charles and Julianne Peterson Engineering Design Endowment, Dev Shrestha, and Chad Dunkel for making this project possible

Solution



The built final design is a slightly modified version of the hot air tumbler design. The conveyor belt idea remains, but instead of an air tumbler is a horizontal cross flow dryer. It is not shown in the image above, but the cross flow dryer would be a long tube coming off of the left side with hot air blowing in over the top of the algae sludge scraped off the filter. This final product has a base of 14x32 inches and stands at 17 inches tall. All rollers, the scraper, and the base were 3D printed. The conveyor belt is a 15-micron filter that is 12 inches wide.

Project Goal

Design, fabricate, and test a continuous system for harvesting wet microalgae and drying it to at least 15% moisture content in an energy efficient way.