Reinventing Photobioreactors: Eliminating Industrial Emissions While Producing Energy

Matos, Kevin

A photobioreactor is used for cultivating multiple phototrophic microorganisms to generate a biomass that can be utilized for energy or biofuel refinement. The objective of this project was to develop a closed, tubular photobioreactor that is economical and efficient in biomass production, industrial emission absorption, and controlled Nannochloropsis algae cultivation. The initial use of algae is innovative and idealistic, yet it has not been capable of becoming integrated into emission reduction and clean energy in industries. Based on the collection of data over a 5-hour period of time, cell density increased from 7 ohms until max saturation point was reached at 13 ohms (NTU). 10-psi pressure was maintained over the full length of time. The total amount of calcium sulfate produced from the desulfurizer was 20L. The total cost of the system is $2,689.77 and the total power consumption is 3487.25 watt-hours. Total energy production is 142.72 kWh, amounting to 685.06 kWh per day. At an industrial scale, the system is able to save an industry approximately $196,313 and absorb 3312.68 metric tons per month. The engineering goal was fully-met, based on experimentation and research done on algae cultivation, controlled-systems, nutrient concentration, desulfurization, and biomass extraction. The pressurized enclosed system was beneficial to the cultivation of the algae by providing optimal LED light energy, atomized coal emissions, and minimized possibility of contamination and mutation. The scrubbing of the sulfur dioxide also prevents harm towards the algae, as well as added profit, with the creation of calcium sulfate. The system is economical and efficient since it requires significantly less energy to operate than it produces.

Awards Won:

Third Award of $1,000