Using Chlorella vulgaris and Spirulina major To Create an Open System Bioreactor Generating Electricity While Running an Air Purification and CO2 Sequestration System (A 3rd Year Study)

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Air pollution, from the burning of fossil fuels, is associated with health issues and CO2 emissions linked to climate change. “Clean energy” sources reduce fossil fuel consumption but have other negative impacts. Recently, algae has been used to develop closed system photobioreactors. The goal of this experiment is to use an established air purifying consortium of Spirulina major and Chlorella vulgaris, to create a modular open system bioreactor that generates enough voltage run an LED light. The long-term goal is to develop a modular, point source, air pollution mitigation system that could power street lamps. Initial tests determined the best electrodes, copper-cathode and magnesium- anode, generating a voltage of 1.7V. This system, 200 mL consortium in a beaker with a coiled anode and cathode at each end, was replicated, connected in series, and tested for four things; long-term viability (powering an LED light over time), power, maintained air purification ability, and CO2 sequestration. Two systems; one 9 beaker system (12 V) and one 3 beaker system (4 V), kept the LED light on throughout data collection, 21 days, and maintained air purifying properties. CO2 sequestration was significantly improved in the aerated system against a static system or control. Maximum power was achieved with 270 ohms resistance. Data suggests that a “proof of concept” was achieved; a modular bioreactor was produced that could power external illuminators while sequestering CO2 and purifying the air. Further research will be necessary to reduce evaporation, stabilize electrodes, and generate sufficient power to run the aerator.

Awards Won:
Fourth Award of $500