# Utilizing a Consortium of Haematococcus, Spirulina, and Chlorella vulgaris to Create an Open System Photobioreactor That Generates Electricity, Reduces Galvanic Corrosion of the Electrodes, and Maintains the Ability of the System to Purify Air (A 4th Year Study)

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Pollutants, from sources like fossil fuels to furniture, are associated with health and environmental issues. Previous experiments have established that a photobioreactor made from Spirulina and Chlorella vulgaris was reliable at both generating electricity and purifying air of said pollutants. This experiment aims to improve the design and add Hematoccocus algae to slow the corrosion of the electrodes and increase efficiency. The long-term goal is to create panels that can be implemented in buildings as a source of clean energy and air pollutant mitigation systems. Initial tests determined that adding Hematoccocus to the preexisting consortium improved the lifespan of the copper electrode but not the magnesium electrode. This was tested using 3 3-beaker systems set up in series with 10cm coiled copper cathodes and magnesium anodes: negative control (salt water), positive control (Spirulina and Chlorella vulgaris), and experimental (Spirulina, Chlorella vulgaris, and Hematoccocus). A similar system was then set up to compare the experimental groups' ability to purify air compared to the positive controls. P-values of 0.98 and above for all changes in pollutant concentrations indicated that the Hematoccocus made no changes to the effectivity of the system in air purification. Then, optimal electrode distance and volume were determined at 10cm between electrodes and a volume of 200mL based on voltage output. Finally, a panel prototype was created and tested for voltage output, indicating that a panel model would be able to generate electricity, and a "proof of concept" was established to determine that the system would also be able to mitigate air pollution. Further research will be required to stabilize electrodes further, reduce evaporation, and improve the prototype.

**Awards Won:**