

Development of Optimum Design Parameters for an Algae Based Martian Oxygen Production System

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The current mainstream idea for oxygen production on Mars is an electrolysis system, which produces a dangerous byproduct of hydrogen and relies on water which is scarce in space. Alternatively, photosynthesis here on Earth is a very reliable oxygen generation system. Being able to utilize the in situ carbon dioxide, that is naturally abundant in the Martian atmosphere, photosynthesis could be a more sustainable option. Since Mars has vastly different environmental conditions in comparison to Earth, this project aims to develop temperature, ultraviolet, light level, and pressure parameters for an independent photosynthesis-based system using *Chlorella vulgaris* algae. This system produces the optimal amount of oxygen, utilizes the natural Martian resources, and produces no harmful byproducts- all while making the least amount of changes to the overall Martian environment. These experiments show that *Chlorella* is extremely sensitive to each parameter in its own way. The ideal parameters to produce an optimal amount of oxygen from *Chlorella vulgaris* are held at a temperature above 11.3 degrees Celsius, a pressure as close to 1000 kpa as possible, 24-hour 100+ lux exposure, and as close to 0 ultraviolet exposure as possible. A future oxygen generator system, using *Chlorella*, needs to consider each parameter for a most efficient containment design.

Awards Won:

Third Award of \$1,000