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

Gaiser, Kara (School: Oregon Episcopal School)

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