Paper ID: 51809
oral

IAF/IAA SPACE LIFE SCIENCES SYMPOSIUM (A1)
Life Support, habitats and EVA Systems (7)

Author: Mrs. Sandra Podhajsky
OHB System AG-Bremen, Germany

Dr. Klaus Slenzka
OHB System AG-Bremen, Germany
Dr. Daniela Knickmann
OHB System AG, Germany
Mr. Martin Kopp
OHB System AG-Bremen, Germany
Dr. Ben Tiller
OHB System AG-Bremen, Germany

MEDIA RECYCLING SENSOR DEVELOPMENT FOR PHOTOBIOREACTORS

Abstract

Within the scope of ModuLES (Modular Life Support and Energy Systems), initiated and funded by the German Space Agency, DLR, a photobioreactor (PBR) with the unicellular microalgae Chlamydomonas reinhardtii was selected as the starting point of this research. The PBR and its subsystems were designed to understand the behavior and physiology of Chlamydomonas in a closed system - in regards to the production of oxygen under a given supply of carbon dioxide, nutrients and light energy.

On ground, Chlamydomonas is the most researched unicellular algae around the globe, but when considering cultivation in an exploration environment over a long duration of time, several areas show up, which have never been researched. In general, research on ground is conducted in an open system, but for spaceflight application, a closed system is a basic requirement. Thus, the importance to understand the general behavior and physiology is a prerequisite for successful operation of a PBR in space.

Additionally, it is important to allow a community of algae, bacteria and fungi to develop and coexist within the closed system of the PBR, because in future steps of ModuLES, the PBR will be connected to other modules to slowly build up a life support system. Latest when connecting the PBR to a second module it will not be operating under sterile. Thus, the ModuLES-PBR will be filled with a sterile algae solution, but under non-sterile conditions, allowing contamination to occur, already during the last steps before closure of the reactor.

The design is based on a constant algae concentration, allowing the investigation of environmental impacts on the microalgae-community, with a set of sensory devices and a sampling unit supporting the physiological research. With these results the next step to a turbidostatic performance can be completed.

It showed, that due to the varying community in the PBR, the media recycling needs a constant monitoring and adjustment of resupply constituents. Due to the lack of commercially available sensors, custom made Lab-on-a-Chip solutions are under development and testing to optimize and improve the recycling capabilities for long duration operations of a Chlamydomonas-community PBR.