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Life Support and EVA Systems (6)

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CULTIVATING CHLORELLA VULGARIS FOR NUTRITION AND OXYGEN PRODUCTION DURING LONG TERM MANNED SPACE MISSIONS

Abstract

During long term space missions the crew faces a harsh environment. Considering the extreme distance from Earth, supply is limited. Physicochemical environmental and life support systems (ECLSS) provide air and water but advanced bio regenerative life support can satisfy more than just the basic needs. By cultivating photoautotroph microalgae in photobioreactors (PBR), carbon and oxygen cycles can be closed by utilizing the products (biomass and oxygen) for the astronauts. Microalgae are non complex organisms with simple needs and high growth rate possessing valuable ingredients like protein and secondary plant compounds. To make microalgae useable in future ECLSS, proper growing conditions and simple harvest and downstream processing (DSP)-methods have to be developed. For about two years, the Institute of Space Systems at the University of Stuttgart cultivates *Chlorella vulgaris* successfully in photobioreactors under controlled conditions. Though just reaching moderate yields, it is possible to run it long term in partly continuous mode which is necessary in ECLSS. The flat panel airlift-PBRs in use have volumes of 6.5 and 25 L in which pH is between 7.0 and 8.7. Temperature is controlled by water cooling (between 26-31 C) and "Distilled Water Seawater Nitrogen" (DSN)-medium is used for cultivation. Although microbiological standards concerning aseptic work cannot be met, the microalgae culture is viable. Analyses of microalgae content matched published values. To gain protein from microalgae and to benefit from their secondary plant compounds, different DSP-methods have been evaluated regarding the microgravity environment in space.