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Life Support, habitats and EVA Systems (7)

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ASSESSMENT OF THE GROWTH AND QUALITY OF MICRO-ALGAE IN MICROGRAVITY CONDITIONS

Abstract

The dawn of the new space age has led to various developments in the field of manned space missions. For short term manned missions, food can be taken from Earth, but for long term manned missions such as to the Moon, Mars and Venus which are the current research destinations, astronauts must find other means, such as , growing plants or any other alternatives for their survival. Microalgae, particularly Chlorella and Spirulina, play a vital role in eliminating the requirement for continuous supplies of basic necessities such as food and oxygen, from Earth. When cultivated under controlled conditions in space stations, these algae, which require surplus of highly concentrated CO2 for photosynthesis, convert it to oxygen and plant matter- thus closing gaps in the life systems in space. Researchers estimate that about 30% of the edible biomass can be replaced by protein-rich microalgae. Numerous species are also reported to be rich in carbohydrates, vitamins {A, B1, B2, B6, B12, C and E} and minerals {potassium, iron, magnesium, calcium and iodine }which contribute for a balanced diet in space. Two specific challenges facing algae cultivation in space are the requirement of a large amount of water, and hence propulsion fuel and that most nutrient delivery mechanisms are gravity dependent. Other challenges include the selection of radiation and temperature-fluctuation resistant strains of the algae while simultaneously considering

their ability to photosynthesize efficiently with lesser water consumption as compared to terrestrial plants, and in lesser time. The paper addresses the above challenges, in particular, the effect of microgravity on the growth and quality of the micro-algae. It proposes that an experiment be conducted, on a satellite, in the lower earth orbit, on a sample of micro-algae. By providing appropriate wavelengths of light and a suitable substrate, photo bioreactors can help induce an environment required for the cultivation of micro-algae. The measurement of the optical density of this sample will provide the percentage of dead and living cells, and hence the growth rate. This can be compared with a sample grown on Earth. Microgravity is known to alter the composition and structure of the cell, hence, the possibility of increased growth rate and better quality of production can ensure a continuous supply of food and oxygen for long term manned missions, which require more supplies than how much a spacecraft is capable of carrying.