

CHLORELLA VULGARIS AS A MODEL ORGANISM FOR MICROGRAVITY CULTIVATION IN A CUBESAT

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Abstract

Chlorella is one of the most investigated and characterized algae genus with several applications, including carbon sequestration, biofuel, food production and wastewater treatment. *Chlorella sp.* are considered suitable to be used as model organisms in space research due to their cultivation flexibility and striking stability. Over the years, many studies have been carried out to ensure better conditions for supporting human life on long-term missions in deep space or on planetary surfaces, minimizing the need for resupplies. Regardless of the resilience of the genus *Chlorella* to space conditions has already been demonstrated, model organisms are useful in the improvement of new technologies. This research aimed to develop the culture conditions and a monitoring system for *C. vulgaris*, under microgravity, using an image capture device for CubeSats. The image acquisition system consisted of a digital microscope, with remote access, a Single Board Computer, a monitoring computer, and an image processing algorithm. Three microalgae colonies, under laboratory conditions, were evaluated in real time (every 30 minutes) using the size of the colonies as a parameter for evaluating growth rates. The highest microalgae biomass production for the three monitored colonies was: increase of 28% for C1 after 90 h; 21% for C2 after 84 h; and 36% for C3 after 120 h. The results indicated that the system was able to monitor the growth of microalgae colonies, although some modifications are necessary for a better quality of image acquisition. A specific support is being developed, which allows the installation of this image acquisition system for algae cultivation in a CubeSat, for future studies of algae growth in real microgravity conditions. The development of an image capture device may also allow the observation of different extremophile microorganisms under microgravity conditions, expanding the knowledge of biotechnology applications in space cruises.

Keywords: *Chlorella vulgaris*, Extremophiles microorganisms, Microgravity, Image processing, Remote monitoring, CubeSat.