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IMPORTANT ASPECTS OF CONDUCTING AEROPONIC CULTIVATION IN MICROGRAVITY

Abstract

Plant cultivation in the future extraterrestrial outpost is granted. In order to conduct maximally optimized process, choosing the right cultivation system is essential. Although conventional soil cultivation was tested in some extraterrestrial colony analogs (e.g. Biosphere 2), another type - soilless cultivation is also popular. It could be divided in two main types. The first one is widely hydroponic, where plants are cultivated in an aqueous medium filled with nutrients. The latter, aeroponic, although less popular, is also beneficial in regard to deep space mission. In this system plants are kept in the air. The nutrient solution is delivered by sprinklers directly to the root system. Hydroponic experiments were widely tested on Earth in research not related with space industry, but also in habitat analogs (e.g. BIOS-3, the Integrated Life Support System Test Facility (ILSSTF)) and even on International Space Station (Veggie). However, more complicated aeroponic system has some advantages in comparison to the hydroponic system. This type of cultivation is characterized by lower water and energy consumption, lower Equivalent System Mass (ESM), and also much more efficient plant growth yield. Taking these benefits into account aeroponic cultivation might be suitable solution in regard to space travel. To ensure efficient and sustainable aeroponic cultivation in the future extraterrestrial colony, main research problems must be examined. In regard to the microgravity or lower gravity behavior of droplets released from sprinklers is unknown. While droplets behavior is influenced by many factors, extensive study in microgravity condition should be considered. Such aspects as: droplets sizes, droplets movement, droplets velocities to ensure sticking to the root are described in this paper. This paper has two main aims. Firstly, to provide a broad description of essential factors, which must be considered in development process of the aeroponic system and further examination of such a process in microgravity condition. It shows how some factors might influence the aeroponic system and also how to manage them so that the system's work is efficient. Secondly, to show a concept of the experimental platform to investigate the mentioned above problems in programs such as Fly your thesis or Drop your thesis.