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BIOCOLCHON SPACE GARDEN

Abstract

Food production for long-duration missions represents one of the greatest challenges in the space sector. The BioColchon Space Garden project was created to solve this problem, by incorporating biotechnological and agricultural techniques in the development of space technology that will enable diverse vegetable species for human consumption, to grow sustainably in microgravity conditions.

The BioColchon Space Garden system consists of a device that has on the outside a heat-insulating bag made of neoprene and denim. On the inside, it has a biodegradable bag that compacts the substrate and the specific nutritive solutions that each of the plant species that's being cultivated require. By compacting them, the system helps the plant to carry out the process of nutrient transport, while in microgravity conditions. The solutions previously mentioned are provided to the plant in an automatized manner, using temperature and humidity sensors that are contained inside the internal bag and that control the flow of specific liquids to the plant through hoses.

A "Continuous Control Drawer" (CCD) was developed as a housing of the BioColchon Space Garden system, with the objective of generating a safe environment for the plant species that's being cultivated in the device. The CCD is equipped with a ventilation system, a gas-monitoring system, different LEDs that produce light throughout different light ranges of the electromagnetic spectrum and walls that strengthen the heat insulation of the device, while absorbing any solution leaks that may take place.

One of the most important milestones of the project is the growth of potatoes (*Solanum phujera*), corn (*Zea mays*) and lettuce (*Lactuca sativa L.*) in our integrated system (composed by the BioColchon Space Garden system and the CCD), achieving not only the successful sowing and germination of their seeds, but also their complete development. In addition to this, vegetables from the species mentioned above have participated in experiments where fully-developed plants were exposed to adverse temperature and humidity conditions, with the objective of determining their research potential in Analog Mars Missions, where the BioColchon Space Garden team seeks to participate in order to put the integrated system to test. The results that we'll obtain from these missions will give us a better insight on what improvements will both the system and the CCD need, in order to work correctly during a future crewed mission to Mars.