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REGENERATIVE ECLSS SYSTEM BASED ON ACCELERATED PLANT GROWTH AND
PROCESSING OF ORGANIC WASTE

Abstract

CLOSED-LOOP RECLSS SYSTEM FOR LONG DURATION MISSIONS The necessity to include all output elements (CO₂, human waste, non-edible parts of the plant, perspiration) back into the system will be indispensable in the future for long-duration missions outside of our planet. The goal of having a greenhouse module attached to every kind of mission is to permit long duration missions without the need for cargo resupply. A system that can be easily accommodated to any kind of scenario is the goal of this study. By using two kinds of systems actively used on the ground with great results, this module dimensions should be kept to a minimum and should be capable of being transported to orbit with actual launchers.

ACCELERATED PLANT GROWTH The increased uniform repartition of auxin inside the plant body is realized by rotating the plants around a central axis, a centrifuge in its concept. This rotating drum alleviates the need to have a complicated watering system in presence of gravity forces. This system has shown great results on the ground where amateur farmers increase by 2 their output and obtain strong and resilient plants. The effect of having mechanical stresses acted on them increases the plant growth and resistance to outside elements such as mushrooms or pest. The goal of this study is to prove that efficiency can be increased by simply changing the plant orientation in respect to the gravity vector. In microgravity, installing those drums in a yet bigger centrifuge allows the plants to detect gravity and therefore activate their auxin repartition.

WORM COMPOSTING OF ORGANIC WASTE Human waste and non-edible parts of plants will be used as compost for the plants, closing the loop on the system. Transportable bags connected to each other in the greenhouse will prevent the contact with dangerous material, this option was chosen as easier to put in place compared to an air/water circulation system. Worms will then transfer from bag to bag, again preventing the crew from accessing an active biomass that could be dangerous. After processing by the worms, the material will go through a microwave irradiation to become ready to be a growing medium for the plants.