

Microbial Monitoring in the EDEN-ISS Greenhouse, a Mobile Test Facility in Antarctica

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Abstract

The EDEN-ISS container is a mobile test facility in Antarctica used to investigate new plant cultivation techniques for future space programs. Manned missions to Mars are already planned and still need a reliable food production system.

The EDEN-ISS container was used from January 2018 to December 2018 for fresh food production for the overwintering Neumayer III crew. During the nine month operation time, samples from the different plants, from the nutrition solution of the planting system and from diverse surfaces within different areas of the container were taken (greenhouse, service section, cold porch). Quantity as well as diversity of microorganisms was examined. The microbial burden on different surfaces in the container and on the plant samples was generally lower than expected. In case of the latter, microbial quantities were in a range of 10^2 and 10^4 colony forming units (CFU) per gram plant material. Compared to purchased plants from German groceries, the produce hosts much more microorganisms. The EDEN-ISS plant samples showed mainly moulds and a few, most probably harmless bacteria. The CFU/mL in the nutrition solutions increased constantly over time but never reached marginal results. The surface sampled revealed high differences in the microbial burden between the greenhouse part of the container and the service section. However, the numbers of CFU found in the planted greenhouse were still not critical. For identification, all isolated bacteria were sent for sequencing. The most abundant phyla were Firmicutes, Actinobacteria and Proteobacteria. These phyla all include plant- and human-associated bacterial species.

In general, there is a low risk of hazard due to microbial contamination according to the results of this study.