

Mycospace: novel mycotic materials for future space missions

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Abstract:

In the last years the installation of permanent lunar bases and the human exploration of Mars have apparently become realistic near future options for the main space agencies. The existing related projects are nevertheless facing technological challenges mainly connected to transportation and in-situ creation of goods and tools necessary for the development of human settlements.

The introduction of plants is an important step as it would provide primary vital factors such as atmosphere and food, essential for the development of a functional environment for human life especially in the long term. These aspects are subjected to research with important developments perspectives.

Fungal species meet several requirements of the necessary living species; mushrooms feed on organic substances previously processed by other living beings, plants or animals. They can thus be part of an additional step in the life cycle of the biomaterial with respect to food and oxygen generation from plants.

Most fungal species are composed by chitin, chitosan, glucans and glucosanes. These substances have already been extracted in various ways from insects, shells and other living organisms.

The fungal structure is formed by an hyphae network: very thin tangled fibrils that give structural solidity to the fungus and keep it compact. By selecting the right fungal species, the growing substrate, the growth rate and the subsequent manufacturing, interesting and alternative materials can be employed to obtain common products.

The development of these materials in space could lead to many advantages: they can grow without a big effort and with a small quantity of original substances, they are very light and hence easy to transport, and the raw material cost is very low. Their applications are wide, and their in-situ development could be effective during the space mission in which they are intended to be used. Furthermore, no toxic substances are generated during production and there is a high chance of recycling, a real need during space missions, where usually the materials must be frequently changed.

It is possible to create peculiar growing conditions for fungi adapting temperature, humidity and atmosphere in a specific environment as space. An important question, however, is whether fungi can survive in environments with a high radiation level; in this case the growth ability in harsh conditions should be analysed.