Mycelium Space Axe

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Figure 1: Off-earth concept habitation with martian regolith simulant based mycelium

Abstract

The fungus is a living being that rules in its own right. Fungians have been around for some time, for 2.4 billion years according to some estimates. Almost indomitable, this living being knows how to adapt remarkably to its environment. Necessary for life on Earth mushrooms are not close to us surprised by their characteristics and potential.

Having worked with this species in the context of scientific research around the design of non-animal leather, materials from mycelium to make objects, I have learned from this species and wonder how far these application capabilities are extended.

The potential of colonization, speed of execution and construction could lead to real advantages in space exploration, especially around Mars. How well can fungi grow in the Martian Regolith ?

During this study we will make sure to ask moral/ethical questions about the use of living being for useful purposes.

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1 Glossary

MRS : Mars Regolith Simulant
SB : Subtrat
IFT : Institut for Future Technologies
DW : distillied water

2 Introduction

The kingdom of fungi, long overlooked, fascinates with its diversity and remarkable adaptability. They are also valuable allies in the development of sustainable materials [1][7][2]. Mycelium, in particular, is proving to be a resource with diverse applications, ranging from the food industry to green construction [3][5], generating growing interest in the field of scientific research.

Throughout my work on this species, I have developed a curiosity for the range of potential applications of fungi, as well as a questioning of their role in space exploration. In this context, it is relevant to ask: How far can we go in exploiting the capabilities of fungi to support space exploration, particularly on Mars? The specific challenges posed by these extreme environments [2], raise crucial questions about the viability of fungi as a solution to space infrastructure needs [8].

One of the central objectives of this research is to explore the ability of fungi to grow in the Martian regolith [8]. The purpose of this paper is to examine the technical requirement to make an off-Earth construction with mycelium in MRS SB. Using an experimental protocol, including the creation of 3D molds and different mycelial substrate formulations, this study aims to demonstrate the potential of fungi to serve as building materials in a space colony[6], when we know that the cost of transportation of 1 kg of mass to Low Earth Orbit is up to $10,000 [4].

In short, this research aims to contribute to an innovative vision of space exploration, where fungi could provide not only building materials but also a sustainable and perhaps more ethical solution to promote the exploration and discovery, which are intrinsic human values.

3 Experiment

The purpose of the experiment is to reach the highest regolith concentration rate which allows us to create an efficient mycelium structure with fewer other components for the substrate than the regolith to achieve the perfect ratio to create the structure in an inhospitable place.

Inspired by the pioneering work of specialized company, I developed a Martian regolith simulant using readily available and cost-effective alternatives. This simulant was meticulously crafted to replicate the essential characteristics of Martian soil, including its mineral composition, pH levels, and moisture retention properties. By exploring economical substitutes, I aimed to create an efficient and accessible simulant that facilitates the study of mycelium growth in Martian Regolith.

Figure 2: Martian Regolith Simulant

3.1 Protocol

With a 3D printed mold, we created the mycelium object with different concentrations of MRS. We tested different concentrations 20%, 50%, 80% and 99% of MRS, and the rest is made of bread of mushroom.

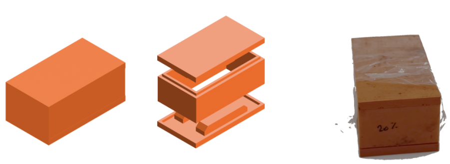

Figure 3: Mold

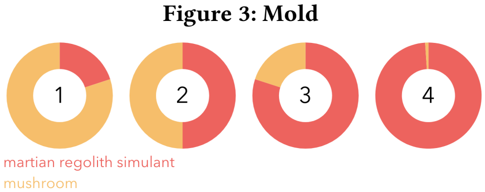

Figure 4: Concentration

3.2 Results

Experiments were conducted at various concentration levels to cultivate mycelium. At a concentration 20%, the object formed but lacked structural integrity. At 50%, an initial consolidation was observed within the structure. At 80%, mushroom growth was evident, but no consolidation occurred. At 99%, the mushroom adapted and began to grow, although it required significantly more time to attempt the formation of a solid object. As the MRS is very dry, the mushroom needed to adapt much to succeed in growing inside the mold and fixing the SB to make a solid object. The adaptation occurs and is a success; however, time and specialized condition are required to attempt in creating a solution to make off-Earth habitation.

Figure 5: Results

The mushroom is an impressive organism, demonstrating remarkable adaptability. However, it is important to recognize that it is a living being, and the ethical implications of utilizing it for human purposes must be carefully considered. This process raises questions about the exploitation of living organisms.

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