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Challenges of Life Support/Medical Support for Human Missions (8)
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THE RELEVANCE OF TACKLING FILAMENTOUS FUNGI IN AEROSPACE SETTINGS – UNRAVELLING MOLD GROWTH IN EXTREME AND CLOSED-BUILT ENVIRONMENTS

Abstract

Microorganisms such as archaea, bacteria, viruses, yeast, and filamentous fungi (known as "mold") are an integral part of our human body and our natural environment on Earth. When human space exploration started at around 1961, microbial life has been brought along with astronauts across terrestrial borders and to our space stations Mir (Russian Space Station) and ISS (International Space Station). Filamentous fungi are one of the most abundant pathogens on earth. They emit mycotoxins to our environment, causing allergies and various disease patterns, especially in immunosuppressed humans, which lead to up to over 300 Million fungal infections worldwide. The well-known "black mold", is a filamentous fungus called Aspergillus niger and one of the main contaminants on the ISS. It is able to spread its spores easily under microgravity and can survive under extreme and seemingly sterile conditions. Since one of the main sources of fungal infections is due to the uptake of spores via contaminated food or inhalation, a closed built environment like a space station is a major risk factor for our astronauts. We aim to understand fungal growth under extreme environments to find possibilities for efficient decontamination on one hand and targeted preventions against mold on the other hand. We perform investigations to understand the resistance potential of A. niger spores against environmental extremes like radiation (X-ray and heavy ions), microgravity and different atmospheres (vacuum or mars-gas). Here, full black pigmented wild-type and less pigmented mutant spores of A. niger were exposed to the different types of radiation. UV and X-rays, heavy ion exposure (Fe and He in performed at the QST-NIRS (HIMAC) Chiba, Japan) or plasma treatments (argon gas, at the Ruhr-University Bochum, Germany). Corresponding results indicate the essential role of pigmentation as a fundament of spore resistance. Additionally, to investigations leading to an understanding of fungal growth under extreme environments, we aim to find possibilities for efficient decontamination on one hand and targeted preventions against mold on the other hand. For that, the biofouling effects of A. niger towards space relevant built materials, e.g. insulation materials made of inorganic silica aerogels are being tested. Additionally, we characterize the effects of antimicrobial laser-patterned metal surfaces on black mold. To conclude, fungal spores can be a major threat to humans inside a constraint living environment and research addressing this health hazard is still underrepresented. Relevant countermeasures against fungal growth and fungal growth prevention need to be developed.