Growth and biofilm formation of *Penicillium chrysogenum* in simulated microgravity

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Penicillium sp. are one of the main fungal genera detected on board the Russian Space Station (MIR) and the International Space Station (ISS), demonstrating its ability to grow on the space stations´ walls and to maintain growth under microgravity (1-3). As a spore-forming microorganism, *Penicillium* sp. poses a concern for planetary protection and to human/astronaut health, as its spores, associated with respiratory diseases, can be dispersed through the air (4). Fungal growth on the ISS has shown to promote biodegradation of the spacecraft materials, compromising their integrity. Biofilms are groups of organisms adhered to each other by self-synthesized extracellular polymeric substances, and are ubiquitous in industrial and natural environments (5). It has been reported that *Penicillium* sp. forms biofilms, which are associated with higher tolerance/resistance to adverse conditions (6). Therefore, biofilm formed on the ISS may have deleterious effects on astronaut's health and/or on ISS materials.

To gain valuable knowledge to control biofilm during long duration spaceflight missions, the NASA-funded project "Characterization of Biofilm Formation, Growth, and Gene Expression on Different Materials and Environmental Conditions in Microgravity" is currently being prepared. Pre-flight testing include: defining and optimizing the growth medium and culturing conditions of *P. chrysogenum* DSM 1075*;* characterizing the morphological response of *P. chrysogenum* growth under simulated microgravity; assessing biofilm formation by *P. chrysogenum* under different conditions.

The study of this fungal strain represents the beginning of a new line of research on board ISS. The knowledge gained can be applicable to a) the safety and maintenance of crewed spacecraft, b) planetary protection, c) mitigation of biofilm-associated illnesses on the crew, as well as on the Earth. Besides, *P. chrysogenum* is of major medical and historical importance, as it presents the original and present-day industrial source of the antibiotic penicillin, and as an important producer of antifungal proteins and other relevant enzymes.

References

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