Copper kills microbes - the microbial struggle addressed in the upcoming ESA space experiment BIOFILMS

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Abstract:
To achieve many of the goals of ESA's and NASA's space programs, an enduring human presence in space is required. For those long-term missions, sustaining the crews' health and safety is essential. Here, the development of improved spaceflight-suitable methods for microbiological monitoring and decontamination are of great importance. The microflora of humans and habitat varies in response to changes in environmental conditions aboard the International Space Station (ISS). Changes in the microflora may result in an increased health risk for the crew. Furthermore, microbial biofilms are considered a risk in space flight since they are known to cause damage to equipment from polymer deterioration, metal corrosion and bio-fouling. Various studies have shown that certain metals reduce the number of contact-mediated microbial contaminations. Antimicrobial surfaces are defined as materials that inhibit or reduce microbial growth. Examples for antimicrobial metal surfaces are silver, copper and their respective alloys. The introduction of antimicrobial surfaces for medical and industrial purposes has shown their unique potential for reducing and preventing microbial contamination. The ESA project BIOFILMS ("Biofilm Inhibition on Flight equipment and on board the ISS using microbiologically Lethal Metal Surfaces", No. ILSRA-2014-054) is going to examine effects of microgravity on biofilm formation on tailor-made nanostructured metallic surfaces by human-associated microorganisms such as Staphylococcus sp. and Acinetobacter sp. The selected BIOFILMS surfaces differ in their antimicrobial properties based on chemical composition and/or geometric nanostructures, which can be generated by Direct Laser Interference Patterning (DLIP). These surfaces are supposed to be tested on biofilm formation rates under different spaceflight relevant gravitational regimes (e.g., moon, Mars, ISS and Earth control). In the experiment, microbial growth will occur under optimal biofilm-inducing conditions conducted in the KUBIK incubator inside ESA's Columbus laboratory. Data generated will be of immense importance for understanding the influence of gravitation and the ISS environment on biofilm formation. Furthermore, the different antimicrobial materials can be evaluated and be applied in present and future astronaut-/robotic-associated activities in space exploration. Here, an overview on current and upcoming activities of the ISS spaceflight experiment BIOFILMS is presented.