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INTRODUCING THE ESA SPACEFLIGHT EXPERIMENT BIOFILMS – ADDRESSING THE NEEDS AND POTENTIAL OF NOVEL INNOVATIVE ANTIMICROBIAL MATERIALS FOR HUMAN AND ROBOTIC SPACEFLIGHT

Abstract

To achieve many of the goals of ESA's and NASA's space programs requires an enduring human presence in space. Long term human missions require sustained crew health and safety. A research area that is important in sustaining crew health is the development of improved spaceflight-suitable methods for microbiological monitoring, as well as contamination control and reduction. The human and habitat microflora varies in response to changes in environmental conditions aboard the ISS. Changes in the microflora may result in an increased health risk for the crew. Microbial biofilms 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 infections. Antimicrobial surfaces are defined as materials that contain an antimicrobial agent (such as silver, copper and their alloys) that inhibits or reduces the ability of microorganisms to grow on the surface of a material. The introduction of antimicrobial surfaces for medical, pharmaceutical and industrial purposes has shown their unique potential for reducing and preventing microbial contamination. Within the ESA selected project - BIOFILMS ("Biofilm Inhibition On Flight equipment and on board the ISS using microbiologically Lethal Metal Surfaces", No. ILSRA-2014-054) - the effect of microgravity on biofilm formation of human-associated microorganisms (e.g., Staphylococcus sp.) on tailor-made nanostructured metallic surfaces will be tested. The BIOFILMS surfaces differ in their antimicrobial activity based on chemical composition and/or geometric nanostructures, patterned by Direct Laser Interference Patterning (DLIP). These surfaces will be tested for biofilm formation rates under different spaceflight relevant gravitational regimes (e.g., moon,

Mars, ISS and Earth control). Microbial growth will occur under optimal biofilm-inducing conditions conducted in the KUBIK incubator inside ESA's Columbus laboratory. The data generated will be of immense importance for understanding the influence of g and the ISS environment on biofilm formation as well as for the evaluation of different antimicrobial materials for present and future astronaut-/robotic-associated activities in space exploration. Here, an overview on the current and upcoming activities of the ISS spaceflight experiment BIOFILMS is presented.