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VIABLE: A CURRENT FLIGHT EXPERIMENT ON ISS TO INVESTIGATE BIOCONTAMINATION AND HUMAN LIFE SUPPORT IN SPACE

Abstract

The issue of biocontamination in manned space modules is crucial for the safety of the International Space Station (ISS) as well as for future planetary bases. We have previously carried out research work concerning biofilm metabolic activities of some reference bacteria on materials commonly used for aerospace industry. The latter are also particularly interesting because currently under investigation to build space greenhouses. The effect of a mixture of emulsifiers produced by *Pseudomonas* strain AD1 and recently characterized by chemical methods was previously evaluated on the following materials: Kevlar, Nomex, Betacloth, aluminized and conventional Kapton, Combitherm, Mylar, copper foil, Teflon, carbon fiber composite, aluminium (panel, tape, and thermo-dissipating textile), Zylon, Ergoflex, and Vectran. Results showed a diverse affinity of materials for bacterial biofilm formation and occasionally sessile colonization was rejected. Pre-conditioning with the emulsifying extract led in some cases to a diminish of biofilm dehydrogenase activity and development compared to untreated materials, taking into account both concentrations and experimental parameters. Moreover the enzymatic level was also related to both physical traits of materials and development of bacterial biofilm under the applied conditions. Currently we are involved on a 4 years flight experiment (VIABLE) concerning the exposure of space materials inside the FGB module of the ISS. The payload was represented by 4 nomex pouches, bearing the experimental materials outside the covers as well as on an inner mount. The main purpose is to investigate microbial biofilm development on aluminium, Betacloth and Armaflex that were experimentally treated by hydrogen peroxide 6%, biosurfactants mixture, and a chemo-physical coating based on silver and silica. Moreover, 2 plastic (PET) vials containing space potable water supplied by SMAT (Torino, Italy) were inserted inside each pouch with the aim to evaluate sessile bacterial growth on the vial inner surface. The payload was transferred to the ISS during the Shuttle mission STS-134, placed inside the US module for about 15 days, and then moved to the FGB module. The crew activity on the VIABLE payload implies monthly touching of experimental material surfaces and blowing over them. Moreover, every 6 months, photographs of the whole experimental setup inside the locker plus of each pouch cover are taken. Once the experiment are downloaded, data will be useful to select appropriate materials for manned space

modules. This may contribute to decrease the risk of surface biocontamination and health problems, a great challenge for both biological and medical research on space.