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STUDY OF BACTERIA AND FUNGI GROWTH ON DIFFERENT MATERIALS USED ON THE ISS WITH PORTABLE GAS SENSOR SYSTEM E-NOSE DURING THE SPACE FLIGHT

Abstract

During long-duration space missions including the remote missions in future, on-site microbiological monitoring of interior and equipment surfaces is vital because they endanger crew health and cause destruction of surface materials. Developed for this purpose, the portable research tool E-Nose detects volatile metabolites of microorganisms and quantifies bacterial and fungal contamination of structural materials removing the necessity to download samples. Russian members of ISS missions 34/35 used the E-Nose tool in the experiment of the same name. Objects were samples of materials (target book) and three surfaces inside the ISS Russian segment that were tested for microbial contamination in two and four months since delivery to the ISS, and on the final mission days. The memory card with the experimental data and the target book were then returned to the ground laboratory. Microbiological analyses of the samples and experimental data resulted in refinement of the novel quick-test for microbial

contamination of surfaces in long-term space missions. E-Nose demonstrated the capability to measure microbial contamination on the station. The tool showed reliably the presence or absence of microbes equally on material samples and interior surfaces and, detecting microbial species included in its database, identified their taxonomic rank correctly. The experimental results were reviewed in order to answer the question whether E-Nose, the portable gas sensing system, has the potential to become an onboard "microbiological laboratory" in future. To optimize this microbial contamination quick-test for immediate download of measurements in hard-to-reach locations, some minor modifications were made and the second part of the experiment (E-Nose 2) was performed. Implementation of this experiment required two years. Every two months a cosmonaut was to measure microbial contamination of five easily accessible and five hard-to-reach surfaces inside the ISS and downloaded the test data directly after each test session for analysis on ground. In a total of 12 test sessions the tool detected successfully both fungal and bacterial contaminants on the ISS surfaces.