Bio-contamination control for spacesuit garments – A preliminary study

Richard Rhodes, Adam Korona, Evelyne Orndoff, Dr. Mark Ott, Darwin Poritz

This paper outlines a preliminary study to review, test, and improve upon the current state of spacesuit bio-contamination control. The study includes an evaluation of current and advanced suit materials, ground and on-orbit cleaning methods, and microbial test and analysis methods. The first aspect of this study was to identify potential anti-microbial textiles and cleaning agents, and to review current microbial test methods. The anti-microbial cleaning agent and textile market survey included a review of current commercial-off-the-shelf (COTS) products that could potentially be used as future space flight hardware. This review included replacements for any of the softgood layers that may become contaminated during an extravehicular activity (EVA), including the pressure bladder, liquid cooling garment, and ancillary comfort undergarment.

After a series of COTS anti-microbial textiles and cleaning agents were identified, a series of four tests were conducted: (1) a stacked configuration test that was conducted in order to review how bio-contamination would propagate through the various suit layers, (2) a individual materials test that evaluated how well each softgood layer either promoted or repressed growth, (3) a cleaning agent test that evaluated the efficacy on each of the baseline bladders, and (4) an evaluation of various COTS anti-microbial textiles. All antimicrobial COTS materials tested appeared to control bacteria colony forming unit (CFU) growth better than the Thermal Comfort Undergarment (TCU) and ACES Liquid Cooling Garment (LCG)/EMU Liquid Cooling Ventilation Garment (LCVG) materials currently in use. However, a comparison of fungi CFU growth in COTS to current suit materials appeared to vary per material. All cleaning agents tested in this study appeared to inhibit the level of bacteria and fungi growth to acceptable levels for short duration tests. While several trends can be obtained from the current analysis, a series of test improvements are described for future microbial testing.

Mr. Richard Rhodes; email – Richard.a.rhodes@nasa.gov; phone - 281-244-6286 (work)