

Broad Compatibility Study of Polymeric Materials with Ionic Silver Biocide, Part I

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NASA is considering ionic silver as a residual biocide for use in potable water systems being planned for future exploration spacecraft. Compatibility of the biocide with the system's wetted-materials of construction remains a challenge. Due to the relatively inert nature of plastics, their use in varied water system applications may offer unique opportunities to address many biocide compatibility issues. A 2020 ICES paper described a "Stage 1" assessment of several polymeric materials, in which coupons having a 2 cm⁻¹ surface to volume ratio were exposed to solutions of 400 parts per billion (ppb) aqueous silver fluoride (AgF) for one week. In this current paper, additional Stage 1 test results are presented for select epoxies and lubricants applied on silver-inert substrates. The coupon exposure studies were also expanded to a duration of 5 weeks for the "well-behaved" Stage 1 plastics previously reported: those exhibiting silver losses above 10% and less than 50%. For this type of Stage 2 testing, silver biocide solution samples are taken from three separate (and not previously-sampled) coupon containers after 3 days, and 2, 3, 4, and 5 weeks of exposure. "Very well-behaved" Stage 1 plastics will be tested in the same manner over one year, with longer sample intervals; early-period results are included here. In addition, for select materials, the coupons were "aged" by refilling test containers with fresh AgF and observing the respective silver uptake over similar Stage 2 test durations. For all test series, Inductively Coupled Plasma Mass Spectrometry (ICP-MS) and ion-selective electrode (ISE) analyses were used to determine total and ionic silver (Ag⁺) concentrations, respectively. Additional sample analyses for Stage 2 tests includes total organic carbon (TOC), pH, conductivity, and oxidation-reduction potential (ORP). Ultimately, these early compatibility studies will be used to guide future material selections for developing silver biocide-compatible spacecraft water systems.

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