

Comparison of four strong acids on the precipitation potential of gypsum in brines during distillation of pretreated, augmented urine

Abstract Submitted by Dean Muirhead for ICES 2012

Two batches of nominally pretreated and augmented urine were prepared with the baseline pretreatment formulation of sulfuric acid and chromium trioxide. The urine was augmented with inorganic salts and organic compounds in order to simulate a urinary ionic concentrations representing the upper 95 percentile on orbit. Three strong mineral acids: phosphoric, hydrochloric, and nitric acid, were substituted for the sulfuric acid for comparison to the baseline sulfuric acid pretreatment formulation. Three concentrations of oxidizer in the pretreatment formulation were also tested. Pretreated urine was distilled to 85% water recovery to determine the effect of each acid and its conjugate base on the precipitation of minerals during distillation. The brines were analyzed for calcium and sulfate ion, total, volatile, and fixed suspended solids. Test results verified that substitution of phosphoric, hydrochloric, or nitric acids for sulfuric acid would prevent the precipitation of gypsum up to 85% recovery from pretreated urine representing the upper 95 percentile calcium concentration on orbit.