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Proposed Paper - Abstract

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Title: A Comparative Analysis of Phase-Change Wastewater Processing Approaches for Microgravity

Two phase-change wastewater processing candidates, the ISS Vapor Compression Distillation (VCD) System and the Cascade Distiller System (CDS), are compared based on dynamic modeling of both technologies. Differences in fluid handling and energy recovery for the technologies are described and contrasted. Model predictions are presented showing how temperatures, pressures, and compositions vary locally within each distiller. These dynamic variations are difficult to observe experimentally and have implications regarding non-condensable buildup and salt precipitation potential. Alternative architectures involving VCD and CDS components are analyzed in terms of predicted performance and equivalent system mass (ESM). The addition of a downstream brine processor to increase water recovery is also evaluated. Options for reducing overall ESM are discussed, including the possibility of developing a single precipitation-tolerant primary wastewater processor.