Terrestrial Testing of the CapiBRIC, a Microgravity Optimized Brine Processor

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Utilizing geometry based static phase separation exhibited in the radial vaned capillary drying tray, a system was conceived to recover water from brine. This technology has been named the Capillary BRIC; abbreviated CapiBRIC. The CapiBRIC utilizes a capillary drying tray within a drying chamber. Water is recovered from clean water vapor evaporating from the free surface leaving waste brine solids behind. A novel approach of optimizing the containment geometry to support passive capillary flow and static phase separation provides the opportunity for a low power system that is is not as susceptible to fouling as membranes or other technologies employing physical barriers across the free brine surface to achieve phase separation in microgravity. Having been optimized for operation in microgravity, full-scale testing of the CapiBRIC as designed cannot be performed on the ground as the force of gravity would dominate over the capillary forces. However, subscale units relevant to full-scale design were used to characterize fill rates, contianmnet stability, and interaction with a variable volume reservoir in the PSU Dryden Drop Tower (DDT) facility. PSU also using tested units scaled such that capillary forces dominated in a 1-g environment to characterize evaporation from a free-surface in 1-g upward, sideways and downward orientations. In order to augment the subscale testing performed by PSU, a full scale 1-g analogue of the CapiBRIC drying unit was initiated to help validate performance predictions regarding expected water recovery ratio, estimated processing time, and interface definitions for inlets, outlets, and internal processes, including vent gas composition. This paper describes the design, development and test of the terrestrial CapiBRIC prototypes.

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