

Title: Results of the Alternative Water Processor Test, A Novel Technology for Exploration Wastewater Remediation

Biologically-based water recovery systems are a regenerative, low energy alternative to physiochemical processes to reclaim water from wastewater. This paper summarizes the results of the Alternative Water Processor (AWP) test conducted over one year. The AWP recovered 90% of water from four crewmembers using (4) membrane aerated bioreactors (MABRs) to remove carbon and nitrogen from an exploration mission wastewater, including urine, hygiene, laundry and humidity condensate. Downstream, a coupled forward and reverse osmosis system removed large organics and inorganic salts from the biological system effluent. The system exceeded the overall objectives of the test by recovering 90% of the influent wastewater processed and a 29% reduction of consumables from the current state of the art water recovery system on the International Space Station (ISS). However the biological system fell short of its test goals, failing to remove 75% and 90% of the influent ammonium and organic carbon, respectively. Despite not meeting its test goals, the BWP demonstrated the feasibility of an attached-growth biological system for simultaneous nitrification and denitrification, an innovative, volume and consumable-saving design that doesn't require toxic pretreatment. This paper will explain the reasons for this and will discuss steps to optimize each subsystem to increase effluent quality from the MABRs and the FOST to advance the system.