



TECHNOLOGY SOLUTION

Environment



Pre-Treatment Solution for Water Recovery

Enhances water recovery in urinary water extraction systems by reducing precipitates

Innovators at NASA Johnson Space Center have developed a pre-treatment solution, currently being used aboard the International Space Station (ISS), that increases the amount of potable water recovered through the ISS's urine processor assembly (UPA). The solution acts to stabilize flushed urine chemically for immediate storage and later distillation in the UPA and increases water recovery without precipitation of minerals that clog urine-processing hardware.

Implemented by NASA aboard the ISS since 2016, the solution has increased the water recovery rate in the ISS's UPA from the prior 75% level to a steady 87%, which doubled the volume of feed processed per cycle, reduced the volume of waste brine by half, and eliminated the formation of precipitates.

The benefits extend to other steps in the urine treatment process. Less precipitate reduces the frequency of filter changes in the UPA and thus the number of filters used per gallon during the distillation stage. Furthermore, this pretreatment solution can prevent bacterial and fungal growth during storage of urine.

This technology is at a technology readiness level (TRL) 9 (flight proven through successful mission operations), and the innovation is now available for your company to license. Please note that NASA does not manufacture products itself for commercial sale.

BENEFITS

- Easy to implement
- Increased water recovery rate
- Diverse market applications
- Scalable to larger treatment volumes
- Proven and on-going spaceflight use (Technology Readiness Level 9)



THE TECHNOLOGY

The pre-treatment solution increases the solubility of calcium in urine brines by reducing the concentration of sulfates. When the solution is properly dosed, it enables biological, physical, and chemical stabilization of flushed urine for storage and distillation up to a steady 87% water recovery, as realized aboard the U.S. segment of the ISS, without precipitation of minerals such as gypsum.

Turning wastewater or seawater into potable water requires three important steps shared by the UPA and Water Recovery System (WRS) aboard the ISS: 1) pre-treatment, 2) distillation or membrane filtration, and 3) transport and storage of potable water and brine. Added during the first step, the pre-treatment solution improves the efficiency of the UPA by reducing the formation of solid precipitates caused by urinary calcium, sulfate ions, and sulfuric acid. This reduction in-turn creates less acidic brines which means more water can be recovered along with less surface scaling and clogging, further increasing recovery. As an added benefit, the solution contains a biocide that prevents the growth of bacteria and fungus, thereby increasing storage time of the treated urine.

Although the pre-treatment solution was developed for the ISS's UPA, the technology can potentially be used on Earth to pretreat contaminated water from organic-laden, high-salinity wastewaters. Adding the solution is a simple process that can be scaled to fit demand. It has the potential to improve water recovery in many applications such as: desalination plants, brackish water treatment, mining water treatment, hydraulic fracturing operations, and more. The pre-treatment solution may also lend itself for use in the transport and storage of wastewater due to the solution's ability to prevent microbial growth.



NASA's pre-treatment solution has several potential applications such as wastewater treatment, mining water treatment, desalination plants, hydraulic fracturing operations, and more.

APPLICATIONS

The technology has several potential applications:

- Desalination plants
- Brackish water treatment
- Mining water treatment
- Solvent for surface scaling caused by gypsum and sulfate minerals
- Urinary water extraction
- Oil and gas exploration and production water supply
- Transportation and storage of concentrated wastewater products
- Pre-treatment for membrane-filtering water treatment systems used in space

PUBLICATIONS

Patent No: 9878928

More Information

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