Astronaut-Powered Laundry Machine

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ABSTRACT

Researchers at the University of California, Davis have developed a closed-loop laundry system that integrates human-powered exercise with textile washing and water recycling, designed for resource-constrained environments including space habitats.

FULL DESCRIPTION

This technology provides a gravity-independent, water- and energy-efficient laundry solution combining a human-powered exercise device with a closed-loop laundering system. It includes a flexible bladder wash unit, an agitation mechanism powered by user exercise, and a sophisticated water treatment subsystem that recycles laundry water through filtration, ion exchange, and carbon treatment. Designed for spaceflight and terrestrial off-grid environments, it minimizes water consumption, reduces waste, and eliminates reliance on continuous fresh water supply or municipal utilities.

APPLICATIONS

- Crewed spaceflight missions and space habitats.
- Planetary surface habitats and off-grid installations.
- Military and emergency shelters with limited water and power resources.
- Remote terrestrial locations requiring compact and water-efficient laundry.
- Commercial or residential laundry equipment focused on water reuse and sustainability.
- Fitness centers integrating equipment with auxiliary functions.
- Recreational vehicles and mobile living environments.

FEATURES/BENEFITS

- Combines exercise with laundering to cut crew time and shrink equipment footprint.
- Recycles wash water in a closed loop to conserve water and minimize wastewater discharge.
- Operates independently of gravity to support microgravity and partial-gravity use.
- Adapts the wash chamber (flexible bladder) to varied textile loads to improve agitation and cleaning.
- Removes contaminants via multi-stage treatment to maintain safe, reusable water.
- Scales modularly to deploy across spacecraft, off-grid sites, and emergency shelters.
- Uses human-powered mechanical input to reduce electrical power demand.
- Reduces consumables and waste by limiting textile resupply and disposal needs.
- Reduces excessive water and energy use compared with traditional laundry systems.
- Eliminates gravity-dependent laundering constraints to enable reliable operation in microgravity and partial gravity.
- Avoids reliance on continuous freshwater supply and bulky wastewater infrastructure by recycling water on-site.
- Prevents odor and hygiene issues by reducing long-term storage of contaminated textiles in enclosed environments.
- Avoids spacecraft angular-momentum and vibration issues by eliminating rotating-drum dynamics.
- Mitigates long-duration mission logistics by decreasing textile resupply requirements.
- Enables effective in-process control by supporting real-time water quality monitoring during laundering.

INVENTORS

- Arends, Andrew
- Robinson, Stephen K

OTHER INFORMATION

KEYWORDS

activated carbon, exercise-powered, flexible bladder, human-powered, laundry water treatment, microgravity, oscillatory agitation, wastewater recycling, water conservation, water sensors

CATEGORIZED AS

- **Environment**
  - Other
  - Remediation
- **Engineering**
  - Engineering
  - Other
- **Sensors & Instrumentation**
  - Analytical
- **Transportation**
  - Aerospace

RELATED CASES

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ADDITIONAL TECHNOLOGIES BY THESE INVENTORS

- Efficient UAV Flight Mechanism with Vertical Take-Off and Landing (VTOL) Capability

▶ Passive Mechanical Exoskeleton to Reduce Hand Fatigue for Astronauts

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