5. Siphon Desalination System

Recently IISc Bengaluru unveiled a siphon-powered desalination technology.

Siphon Desalination System Overview

The siphon desalination system is an innovative solar-based technology designed to convert seawater into clean, potable water faster, more efficiently, and at a lower cost than traditional solar stills. It addresses the limitations of conventional solar desalination, such as salt buildup, low throughput, and scalability issues, making it particularly useful for coastal, water-scarce, and off-grid regions.

Key Features

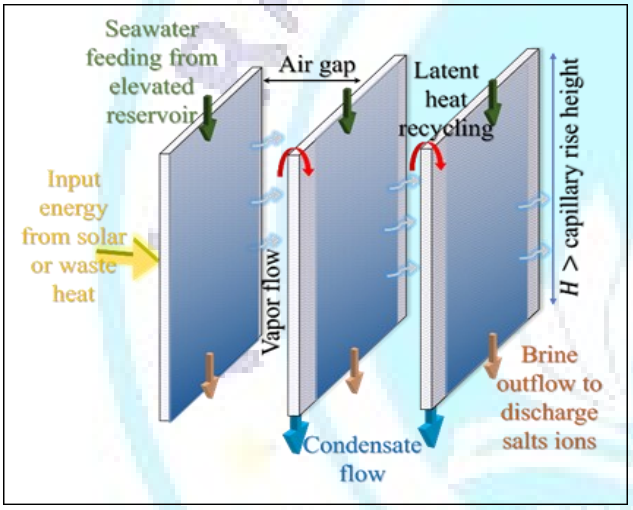
High Efficiency & Capacity - The system can produce over 6 litres of potable water per m² per hour under direct sunlight.

Scalability - Multi-stage stacking allows scaling up without reducing efficiency; effectively prevents salt crystallisation that limits conventional systems.

Energy Source - Operates on solar energy or waste heat. Requires no electrical pumps, leveraging gravity and low-cost materials.

Salt Tolerance - Can handle highly saline water (up to 20% salt concentration), overcoming a major limitation of typical solar stills.

Low-Cost Construction - Uses aluminium, fabric, and other low-cost materials, making it economically viable for large-scale deployment.



Key Components

Composite Siphon - Fabric wick integrated with a grooved metallic surface. Facilitates water transport and evaporation simultaneously.

Evaporator–Condenser Pairs - Multi-stage stacking enables heat recycling and higher water production.

Ultra-Narrow Air Gap - Only 2 mm wide, allowing efficient condensation and preventing heat loss.

Working Mechanism

1. **Water Draw -** Fabric wick draws saline water from the reservoir.
2. **Salt Management -** Gravity flushes out salt before it crystallizes, avoiding blockages.
3. **Evaporation -** Thin water film spreads over heated metal surfaces and evaporates.
4. **Condensation -** Vapour condenses on cooler surfaces across the narrow air gap.
5. **Heat Recycling -** Evaporated heat is transferred across stacked stages to improve overall efficiency.

About the Siphon Principle

A siphon is an inverted U-shaped tube that moves liquid from a higher reservoir to a lower point without using pumps.

Mechanism - Liquid rises along the short "inlet" leg into the atmosphere, then flows down the longer "outlet" leg under gravity to the discharge point. In siphon desalination, this principle allows continuous water flow without external energy input for pumping, making the system energy-efficient and low-maintenance.

Advantages of the Siphon Desalination System

High Water Yield - Much faster production compared to conventional solar stills.

Cost-Effective - Low-cost materials and passive design reduce construction and operational costs.

Sustainable - Runs on renewable solar energy or waste heat.

Resilient - Can treat highly saline water and reduces scaling/salt clogging issues.

Scalable - Multi-stage stacking allows larger deployment for community-level or industrial use.

Applications

Coastal Communities - Provides potable water in regions dependent on seawater.
Off-Grid Areas - Suitable for remote or island regions without electricity.
Emergency & Disaster Relief - Can be rapidly deployed in water-scarce disaster zones.
Industrial Use - Treats high-salinity water for process and cooling applications.
Source - https - //www.pib.gov.in/PressReleasePage.aspx?PRID=2172767