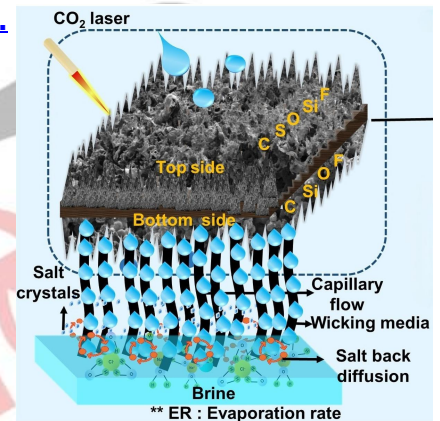




Solar Water Desalination

Why in News?

[Indian Institutes of Technology \(IIT\)- Bombay](#) scientists have developed a new material to enable [water desalination](#) and address [global freshwater scarcity](#).



Key Points

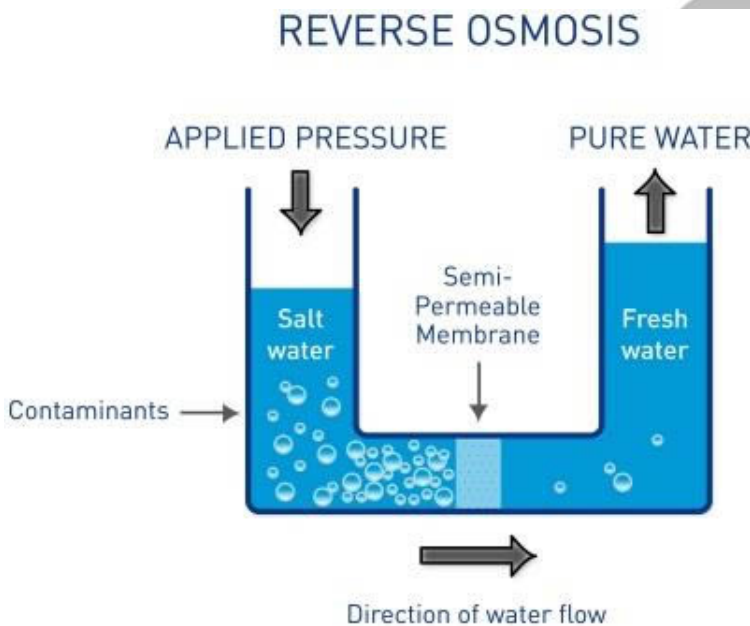
- **About the Innovation:**
 - Researchers have developed a **Dual-Sided Superhydrophobic Laser-Induced Graphene (DSLIG) evaporator**.
 - The DSLIG **addresses limitations of traditional evaporators** and shows promise for large-scale desalination and wastewater treatment.
 - **The Freshwater Challenge:**
 - Only **3% of Earth's water is freshwater**, and **less than 0.05% is easily accessible**.
 - [Desalination of seawater](#) and brackish water is a **key solution** to this scarcity.
 - However, desalination produces **brine, a concentrated salt byproduct**, which poses **disposal challenges**, especially in landlocked areas.
 - Industries now aim for **zero liquid discharge systems** to avoid environmental harm.
- **Solar Desalination:**
 - Solar energy-based desalination offers a **low-carbon solution**.
 - Yet, sunlight variability and poor light absorption reduce efficiency.
 - Interfacial evaporation systems help by **heating a thin surface layer of water instead of the whole volume**, enhancing efficiency.
 - **Challenges in Interfacial Evaporation:**
 - **Cloud cover** and fluctuating **solar intensity** hamper consistent performance.
 - Evaporation peaks around 2 pm, when solar radiation is highest.
 - Salt deposition on the evaporator surface blocks water contact, reducing long-term efficiency.
 - **DSLIG Overcomes the Challenges:**
 - DSLIG allows **dual heating—solar and Joule heating (electric)**—ensuring performance even in low sunlight.

- **Superhydrophobic properties (lotus effect)** prevent salt from sticking to the evaporator surface.

▪ Fabrication of DSLIG:

- Researchers coated **PVDF (polyvinylidene fluoride)** on one side of **PES (polyether sulfone) polymer**.
 - PDVF are **polymers** that can generate electric charges on the surface under pressure/strain thus **converting mechanical energy into electrical energy**.
 - PES is a thermoplastic polymer known for its high **thermal stability, excellent chemical resistance, and biocompatibility**.
- They used **laser engraving to inscribe graphene** onto the PVDF layer.
 - PES ensures mechanical strength, while PVDF contributes to dual-sided water repellency.
- The result is a durable, superhydrophobic surface effective in both electric and solar modes.
- **Applications:**
 - It is suitable for **treating industrial wastewater and brine** from desalination plants.
 - Researchers observed **improved performance by stacking multiple evaporators**.
 - DSLIG is **low-cost, non-toxic, and sustainable**, making it ideal for large-scale applications.

Desalination



- A **desalination plant** turns salt water into water that is fit to drink.
 - **Desalination** is the process of **removing salts from water** to produce water that meets the quality (salinity) requirements of different human uses.
- The most commonly used **technology** for the process is **reverse osmosis**.
 - An external pressure is applied to push solvents from an area of high-solute concentration to an area of low-solute concentration through a semi-permeable membrane.
 - The **microscopic pores** in the membranes allow water molecules through but leave salt and most other impurities behind, releasing clean water from the other side.
- These plants are mostly set up in areas that have access to **sea water**.

