

A decorative graphic on the left side of the slide, consisting of a network of light blue lines and small circles, resembling a circuit board or a data network. The lines are vertical and horizontal, with some diagonal connections, and the circles are placed at various points along these lines.

DESALINATION

THE TABLE GIVEN BELOW IS THE LISTS OF THE CONCENTRATIONS OF SEVEN SUBSTANCES THAT TOGETHER COMPRISE MORE THAN 99 PERCENT OF THE DISSOLVED CONSTITUENTS OF OCEAN WATER.

Ions	g/kg of sea water
Chloride (Cl^-)	19.35
Sodium (Na^+)	10.76
Sulfate (SO_4^{2-})	2.71
Magnesium (Mg^{2+})	1.29
Calcium (Ca^{2+})	0.41
Potassium (K^+)	0.39
Bicarbonate (HCO_3^-)	0.14

ADVANTAGES / USES OF DESALINATION

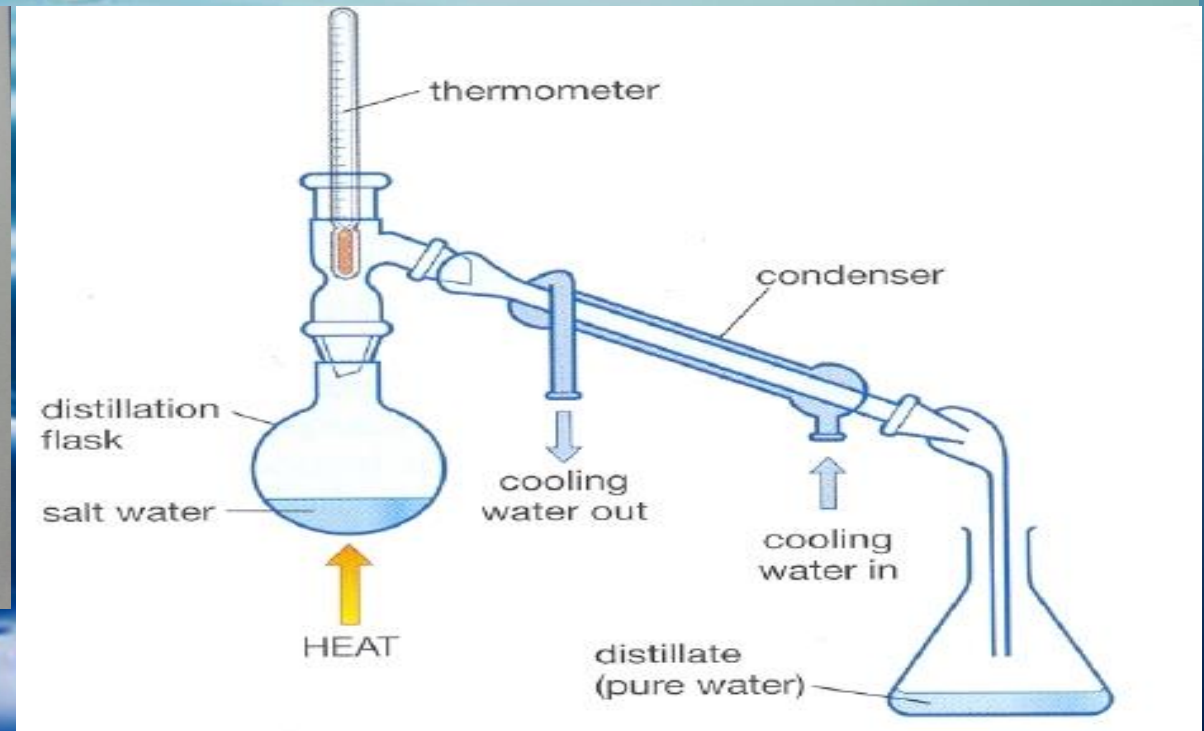
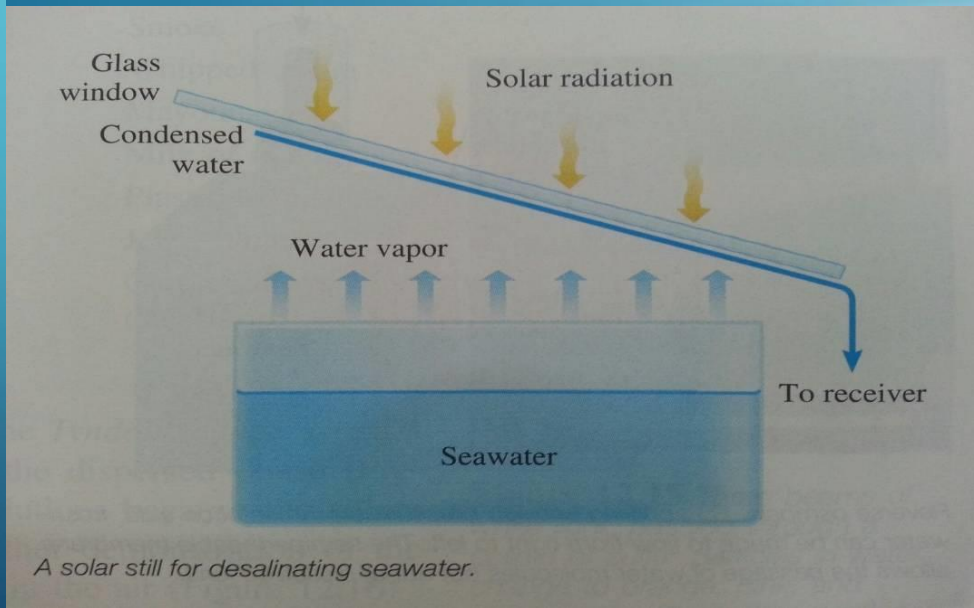
- Availability of water in areas of drought.
- Alternative source of water.
- Production of high yield water.
- Desalinated seawater is produced primarily for municipal/potable use and for agricultural irrigation but is also used extensively in many other applications where high quality water is required.



DISTILLATION

- Distillation is the process of heating a liquid (sea water) to create vapor which is collected when cooled separate from the original liquid.
- It is the oldest method of desalination.
- Other Applications: Laboratory scale
Industrial scale

DISTILLATION





DISTILLATION

Advantages

- Removes a broad range of contaminants.
- Reusable.

Disadvantages

- Some contaminants can be carried into the condenser.
- Requires careful maintenance to ensure purity
- Consumes large amounts of energy
- System usually takes a large space on counter

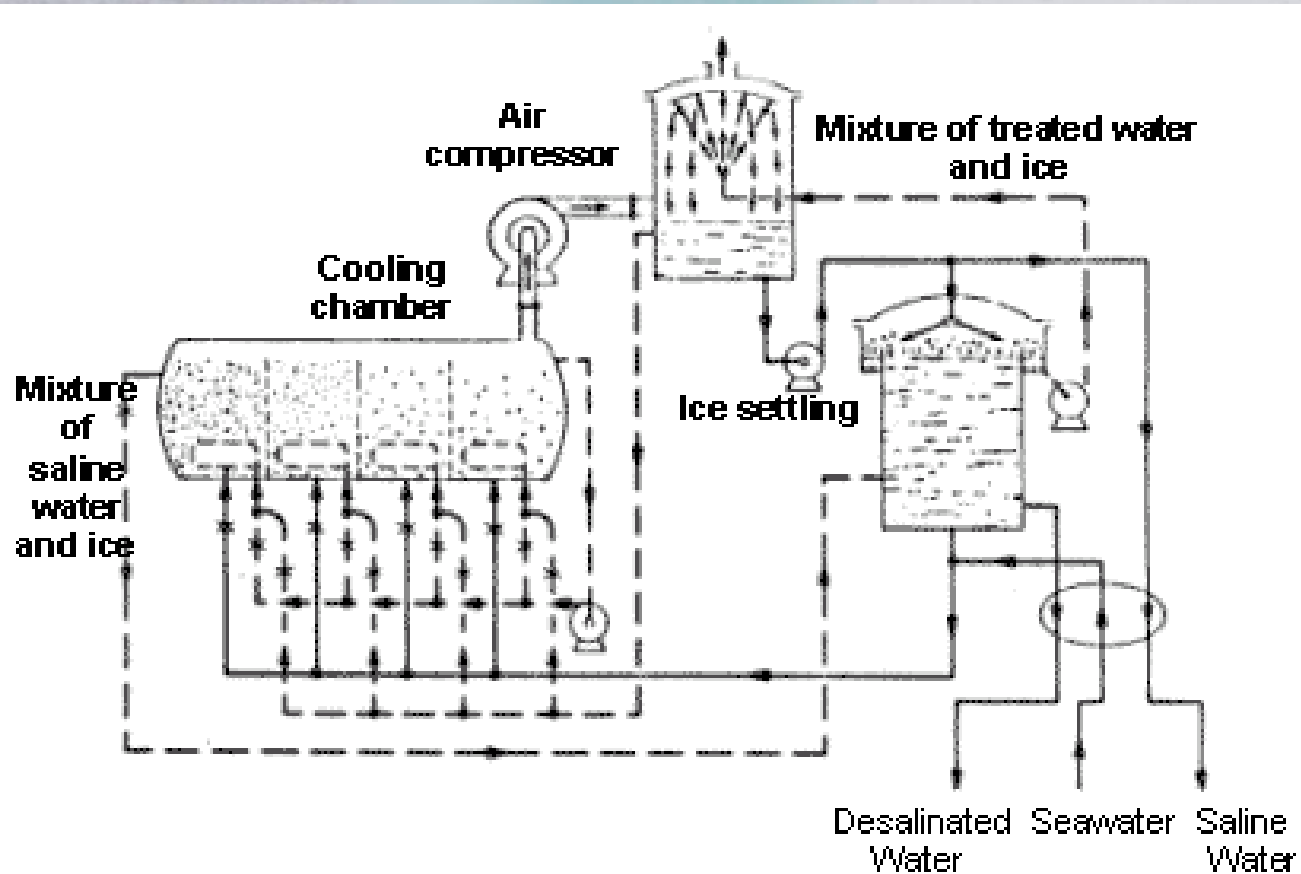
FREEZING

- This method is based on the fact that when an aqueous solution (seawater) freezes, the solid that separates from solution is almost pure water. Thus, ice crystals from frozen seawater at desalination plants could be rinsed off and thawed to provide usable water.

Advantages: the main advantages of freezing is its low energy consumption as compared with distillation. The heat of vaporization of water is 40.79 KJ/mol, whereas that of fusion is only 6.01 KJ/mol.

Disadvantages: the major disadvantages of freezing are associated with the slow growth of ice crystals and with washing the salt deposits off the crystals.

FREEZING

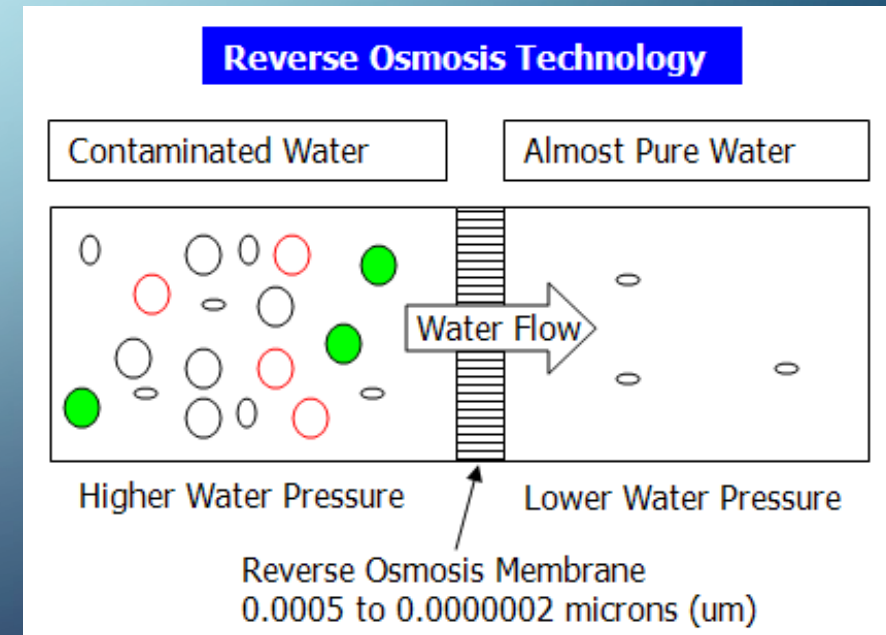


Sketch of freeze-desalination unit

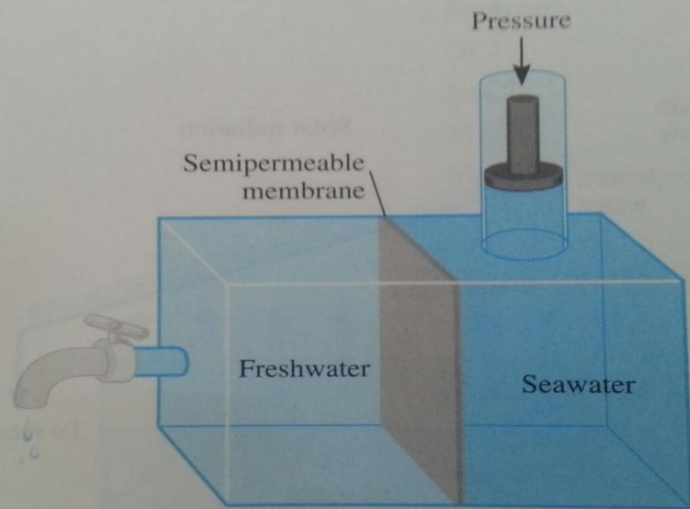
Source: ACSAD/AFESD (1985)

REVERSE OSMOSIS

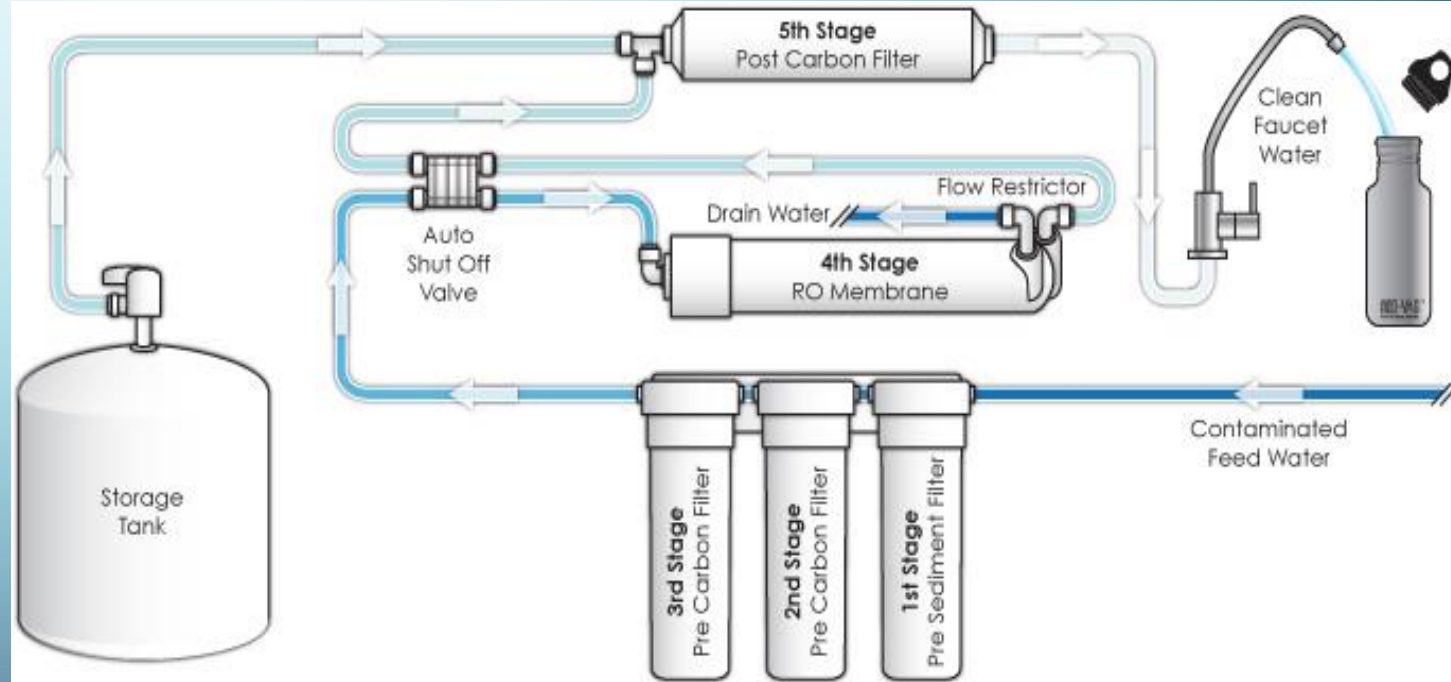
- Reverse osmosis (RO) is a water purification technology that uses a semipermeable membrane.
- Also called membrane desalination process.
- Saltwater is forced through membrane sheets at high pressures.
- Membrane sheets are designed to catch salt ions.
- Process produces clean water and brine.



REVERSE OSMOSIS



Reverse osmosis. By applying enough pressure on the solution side, freshwater can be made to flow from right to left. The semipermeable membrane allows the passage of water molecules but not of dissolved ions.



REVERSE OSMOSIS



- Desalination by reverse osmosis does not involve a phase change and is economically more desirable.
- Reverse osmosis uses high pressure to force water from a more concentrated solution to a less concentrated one through semipermeable membrane.
- The osmotic pressure of sea water is about 30 atm – this is the pressure that must be applied to the saline solution in order to stop the flow of water from left to right. If the pressure on the salt solution were increased beyond 30 atm, the osmotic flow would be reversed, and freshwater would actually pass from the solution through the membrane into the left compartment.

REVERSE OSMOSIS

Advantages:

- RO performs a separation without a phase change. Thus, the energy requirements are low.
- They are friendly to the environment, as they do not produce or use any harmful chemicals during the process.
- Reverse osmosis systems work well in home filtration systems because they are typically small in size.
- It is considerably cheaper than distillation.



