



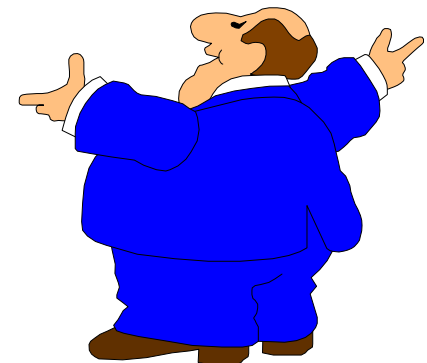
Latest Trends in Reverse Osmosis Desalination

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Available Technologies in the world

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❖ Thermal

- Multi Stage Flash Distillation (MSF)
- Multi Effect Distillation (MED)
- Vapor Compression (VC)
- Freezing Process

❖ Membrane Processes

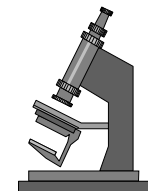
- Electrodialysis
- Reverse Osmosis

Available Sources of Water

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- **Well Water – Salinity up to 3,000 ppm**
- **Brackish Water – Salinity from 3,000 up to 30,000 ppm**
- **Sea Water – Salinity from 30,000 up to 45,000 ppm**



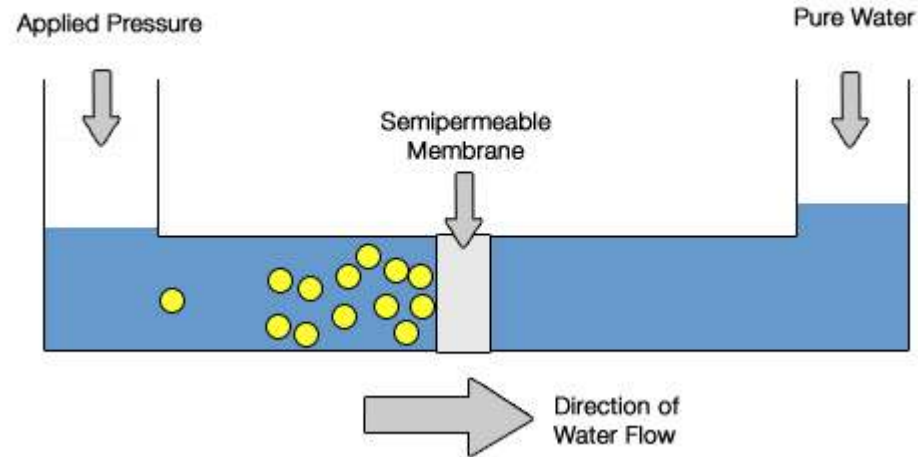
Reverse Osmosis

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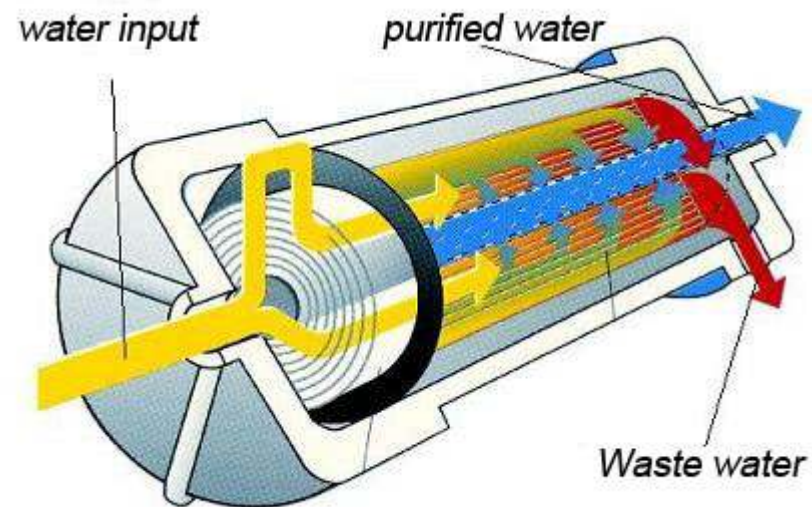


Reverse osmosis (RO) is a membrane-technology filtration method that removes many types of large molecules and ions from solutions by applying pressure to the solution when it is on one side of a selective membrane. The result is that the solute is retained on the pressurized side of the membrane and the pure solvent is allowed to pass to the other side. To be "selective," this membrane should not allow large molecules or ions through the pores (holes), but should allow smaller components of the solution (such as the solvent) to pass freely.

Reverse Osmosis

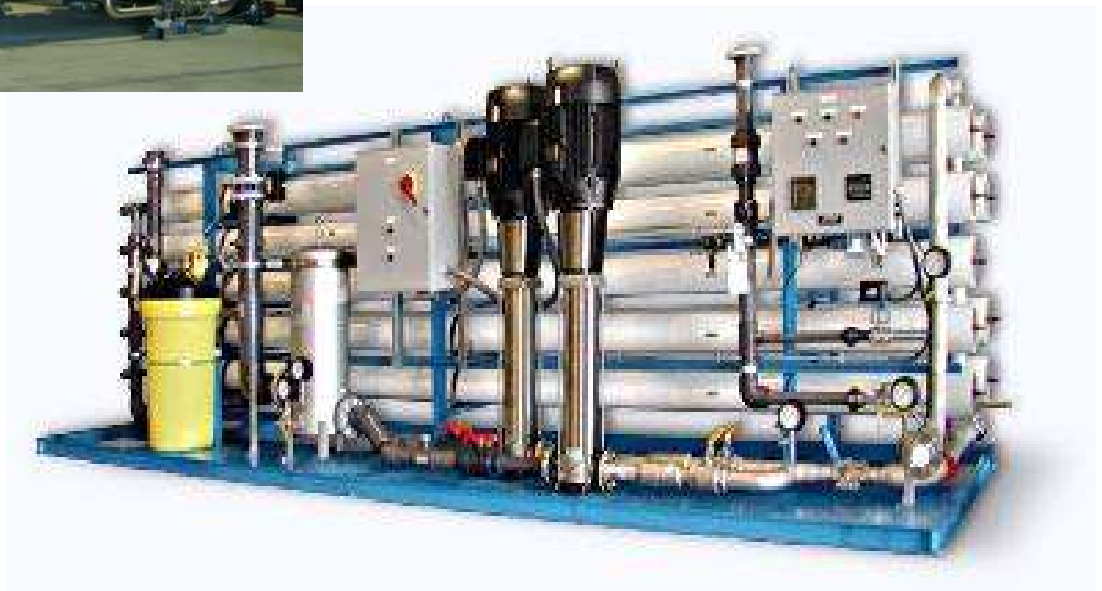


Reverse Osmosis, also known as Hyper-filtration by the industry, represents state-of-the-art in water treatment technology. Reverse Osmosis (RO) was developed in the late 1950's under U.S. Government funding, as a method of desalinating sea water. Today, reverse osmosis has earned its name as the most convenient and thorough method to filter water. It is used by most water bottling plants, and by many industries that require ultra-refined water in manufacturing. Now this advanced technology is available to homes and offices for drinking water filtration.

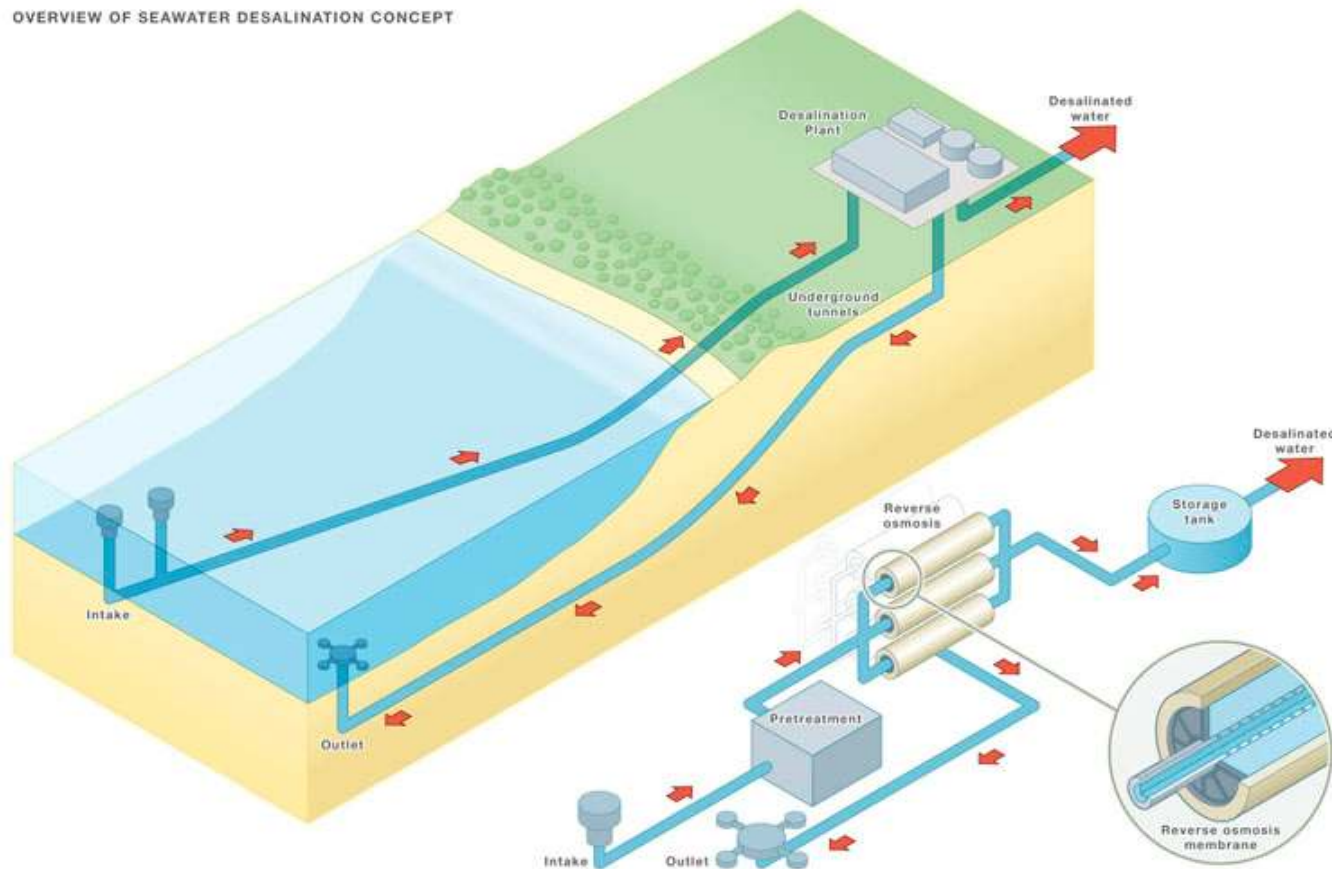


How does reverse osmosis work?

Basically, your homes incoming water pressure, whether from your municipal water supply, or your well, forces water molecules through a very fine membrane leaving contaminants behind which are flushed down the drain.



OVERVIEW OF SEAWATER DESALINATION CONCEPT



The New Trends in Reverse Osmosis

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Types of Pretreatment Systems

Depending on the raw water quality, the pretreatment process may consist of all or some of the following treatment steps:

- Removal of large particles using a coarse strainer.
- Water disinfection with chlorine.
- Clarification with or without flocculation.
- Clarification and hardness reduction using lime treatment.
- Media filtration.
- Reduction of alkalinity by pH adjustment.
- Addition of scale inhibitor.
- Reduction of free chlorine using sodium bisulfite or activated carbon filters.
- Water sterilization using UV radiation.
- Final removal of suspended particles using cartridge filters.

Types of Pretreatment Systems



Multi Media
Filtration



Pressurized
Multi Media



Membrane Filtration
(UF, MF or NF)

Types of Pretreatment Systems

Major Parameter for consideration:

- **Capital Cost**
- **Energy Requirements**
- **Footprint**
- **Chemical Cost**



The New Trends in Reverse Osmosis

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Energy Recovery Systems:

- ❖ ERT – Energy Recovery Turbine
 - ❖ Pelton - Pistones
 - ❖ PX
 - ❖ Dweer
- Efficiency ~ 85 – 87%
- Efficiency ~ 95 – 98%



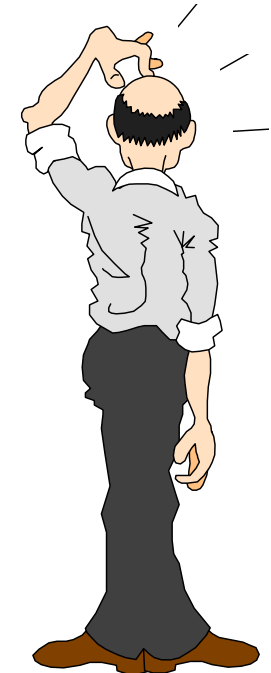
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Membrane Performance:

- Salt Rejection
- Higher Flux
- Energy Consumption
- Life expectancy
- Lower foot print
- Cost



The New Trends in Reverse Osmosis

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8 inch membranes are most commonly used in sea water reverse osmosis plants.

Presently 16 inch membranes are introduced to the market.

There are a number of advantages of using 16 inch membranes, these include:

- The membranes are manufactured from the same materials, in the same manner and by the same manufacturers as the more common 8 inch membrane;
- The 16 inch membrane has 4.3 times the active area as the standard 8 inch membrane;
- The behavior of the 16 inch membrane is believed to be identical to the 8 inch membrane in terms of salt rejection but has 4.3 times the flow rate;
- The 16 inch membrane has far fewer “o” rings then the 8 inch one and therefore far less likely to need to be replaced;
- Reduced cost (both capital and operating costs) therefore providing lower cost desalinated water.



Thank you for the attention!!!

