

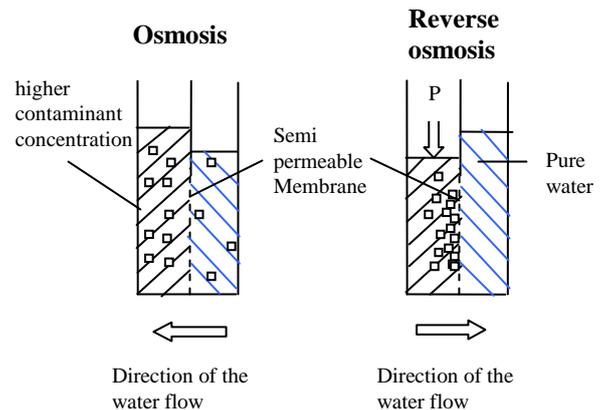
SEA WATER DESALINATION

Basics

Reverse osmosis (RO) is a pressure driven membrane separation process that separates dissolved and suspended substances from water. The basic principle of the reverse osmosis is the permeation through a semi permeable membrane. The membrane acts as a selective barrier separating unwanted substances such as salt, e.g. from seawater, from the water flow, producing drinking water. This diversion is absolutely physical, since the components are not changed.

The background of this treatment is the reversal of the naturally occurring osmosis, a fundamental scientific principle. When two different concentrations of liquid are within one system, both want to reach equilibrium. The only way to accomplish this is for pure water to permeate through the membrane and dilute the liquid until equilibrium is reached. The water level of the diluted side rises during this procedure. This stops when the force of the diluted water reached its maximum. The pressure against the membrane at this equilibrium point is called osmotic pressure. The reverse osmosis applies a pressure in the same order as the osmotic pressure to reverse this reaction. With a semi permeable membrane, only pure water can permeate through it, concentrating salts on one side of the system and pure water on the other side. The following figure

shows the principle of osmosis and reverse osmosis.



Principle of osmosis and reverse osmosis

Problem

On the membrane within the system scaling can occur, if sparingly soluble salts like calcium sulphate, calcium carbonate, silica or barium sulphate are concentrated beyond their solubility limits.

Solution

DELTA Umwelt-Technik GmbH uses approved and reliable ideal solutions adapted to the individual security requirements. In this case an antiscalant dosing station to inhibit the crystallisation of those salts is used.

System Description

The reverse osmosis plants planned by DELTA Umwelt-Technik GmbH mostly contain the following devices, adapted to the local conditions.



Reverse osmosis plant in Romania

Filtration and Pre-treatment Unit

The water is fed through a pre-filtration system, designed as inline multimedia filter in parallel operation.

Dosing Station

Two chemical dosing systems treat the incoming raw water. Following chemicals are used: H_2SO_4 (after pre-filtration), anti scalant (after pre-filtration) and flocculants/inhibitors (before pre-filtration). Each dosing system is supplied with one pump and storage tanks with all necessary equipment to prepare the chemicals for injection.

Fine and Police Filtration

After the gravel filtration, one fine filter stage with a filter finesse of $5 \mu m$ is installed inline. The filters are designed as cartridge-filters.

Reverse Osmosis Plant

The reverse osmosis plant can be designed as a desalination unit with an energy recovery turbine. Whereas the incoming seawater will be desalted with a recovery of 35 %, the product (permeate) is fed to a permeate storage tank. The seawater stages are

equipped with spiral wound reverse osmosis elements. The permeate quality has a TDS of less than 500 ppm and responds therefore to the WHO requirements.

Post Treatment

The post treatment consists of two chemical dosing systems: $Ca(OCl)_2$ to add free chlorine for chlorinating and caustic soda to adjust the pH-value of the product to a level of approximately 7.5.

Cleaning Device

The plant is equipped with one cleaning device to clean the spiral wound elements if needed.

Electrical Control Panels

An electrical control panel controls the whole plant including all necessary equipment. The control is fully automated, but a manual start and stop is also possible. The electrical panel equipment is also including overload protection and protection against variations in incoming voltage or phase loss.

Experience

The experience of DELTA Umwelt-Technik GmbH together with the expertise of reliable partners offer the possibility for optimal applications and economic reverse osmosis plants, also for seawater reverse osmosis with high flow rates.