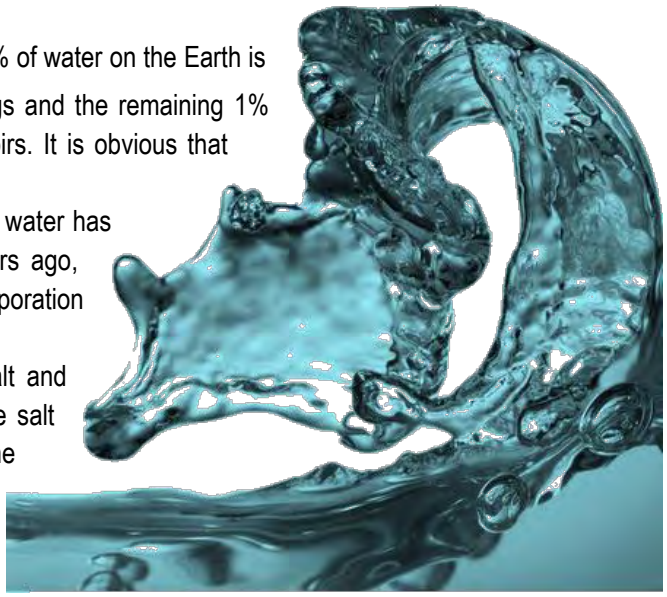


Looking at the nature, it can be observed that about 97% of water on the Earth is cumulated in the oceans; 2% is in arctic oceans and icebergs and the remaining 1% consists of sea water, lakes, rivers and underground reservoirs. It is obvious that only a negligible portion of this remaining water is consumable.

Man's effort to convert impure/salty water to desalinated water has been extended throughout his long history. About 2400 years ago, Aristotle announced the possibility of this conversion by evaporation and distillation.

This water is capable of dissolving various kinds of salt and mineral, amount of which varies in different regions, thus the salt amount of water differs depending on the place due to the quantity and kind of salt and minerals in the soil. According to the World Health Organization, the standard amount of dissolved solids in potable water is 500 PPM, in which the chloride ion must not exceed 250 PPM. However, in some arid regions, water with 3000-5000 PPM of impurity is currently used as potable water.

200 years ago, developments in marine industry led to construction of simple versions of evaporation desalination units. The primitive commercial desalination units were constructed about 100 years ago. After the discovery of oil in the Middle East in the 1930's, a few small desalination units were installed in that region.

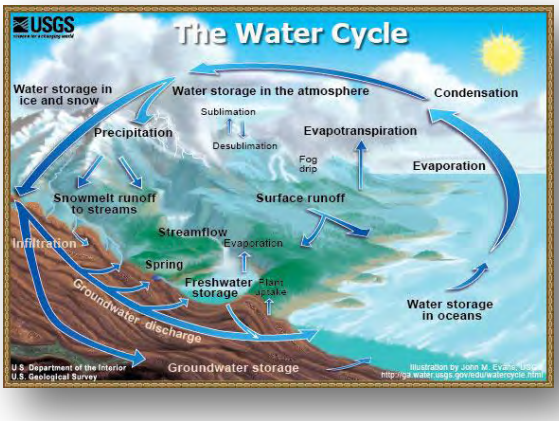
The oil industry developments in Persian Gulf increased the world growth of desalination industry in the 1940's. In these years the majority of desalination plants were fabricated by countries which did not require desalinated water in their own countries. In the 1950's the world's largest desalination plant of that time, with capacity of 2200 m3/day came into service.

The world's total desalinated water product in those days is estimated to be about 10,000 m3/day.

In 1960 the total capacity of desalination plants in the world reached 38000 m3/day. In 1970 it came up to 1,000,000 m3/day and in 1980 this amount exceeded 7,300,000m3/day. This increase was due to the rapid growth of industrial demand, which led to the universal expansion of desalination industry and caused the rush of money from consumer countries towards developed countries that produced desalination plants.

In 1960, a desalination unit using reverse Osmosis process method

A suitable method for desalination of brackish waters such as wells and rivers-was developed. In recent years many efforts have been made to utilize RO desalination process for desalination of sea water, which has not achieved results better than evaporation methods and the use of waste heat from optimality, and water quality point of view.



In 1980, about 75% of desalinated water was produced by evaporation methods, 20% by Reverse Osmosis, 4.7% by electrodializing method and 0.3% by other methods.

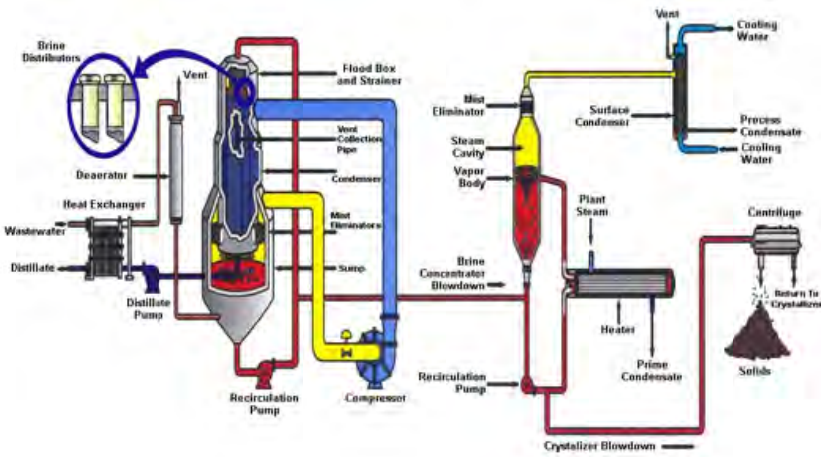
Nowadays desalinated water is more expensive than oil, and therefore the growth of desalination technology should be considered as a strategic industry. Having the MED type design and manufacturing Know-how, **FAN NIROO Co.** is delighted to solve the drinking and industrial water problems.

Fan Niroo
Desalination & Water Solutions

Zero Liquid Discharge (ZLD) Systems

Modification of Water treatment and desalination technologies and development of new technologies for reducing the inevitable production of byproducts, namely wastewater, have preoccupied experts for years. New technologies produce fewer wastewaters and use residual salts as a byproduct. Water crisis, recycling limitation, economic parameters and effluent disposal problems such as footprint limitation or environmental preventions justify utilization of zero liquid discharge (ZLD) systems. ZLD systems capacity is 25 to 5000 m3/d.

Having conducted comprehensive studies on the ZLD systems and negotiations with companies active in this field around the world, our company is proud to develop water treatment and desalination technologies as the only possessor of technical know-how in design and construction of ZLD systems in Iran.



ZLD System Applications

- Treatment of wastewater from NF/RO,
- Treatment of wastewater from boilers, cooling towers, softeners,
- Treatment of wastewater from oil, gas, refinery and petrochemical industries,
- Treatment of wastewater from power plants and FGD industries,
- Treatment of wastewater from pharmaceutical and chemical industries,
- Treatment of wastewater from mines,
- Treatment of wastewater from different industries (pulp and paper, textile, etc.),
- Very high TDS wastewater treatment.

ZLD System Features

- Drinking and industrial water production,
- Effluent flow and disposal cost reduction,
- High recovery and simple performance,
- Fewer footprints for effluent disposal especially in the case of evaporation ponds,
- Effluent conversion to marketable products and cost reduction.

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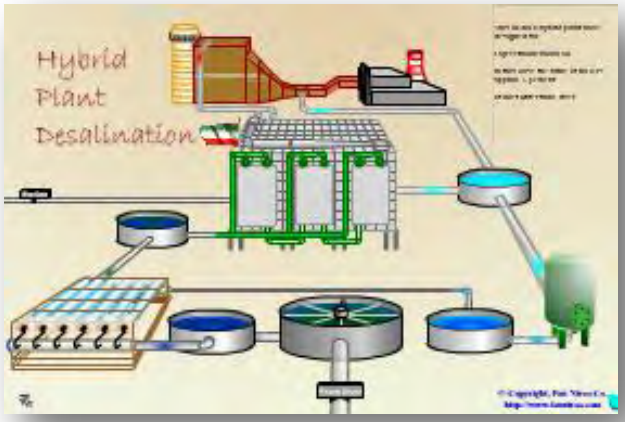
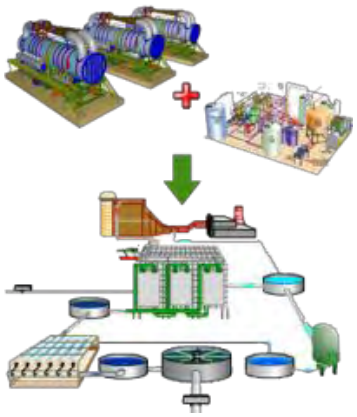
Hybrid



The hybrid desalination concept is the combination of two or more processes in order to provide a better product than either.
There have been various arrangements of subsystems introduced as hybrid systems, but they usually consist of two or more choices from below branches:

- Thermal processes (MED, MSF, MVC)
- Membrane processes (RO, NF, ED)
- Power generation systems and their supplements (Gas turbine, HRSG, Photovoltaic…)

We have investigated an especial in which the brine discharge of BWRO units is recovered by a MED system. The hybrid elements are illustrated in the diagram above. This figure shows the main components and the connections between these elements.



Advantages

- Optimization of RO Feed Water temperature
- High Pure Water Production
- Higher energy performance (up to 95% for brackish water)
- Reduction of waste water discharge to environment
- Extending the range of product water quality

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