

Membrane Business

# Water—A Prerequisite for Life on Earth

The depletion of the world's energy resources is no longer the only global resource concern that we are facing. The rapid depletion of our global water resources has become a very real and worrying problem. The Nitto Denko Group's polymer separation membrane technology contributes to finding a solution to the problem of fresh water shortages through its ability to convert seawater to freshwater. It is through such technological advances that the Nitto Denko Group is able to directly contribute to the protection of our beautiful Earth.

### The Earth is a Water Scarce Planet

Global water consumption has increased approximately six times within the last century compared to that of the early 20th century. This rapid increase can largely be attributed to the population explosion that has occurred in developing countries and the mass increase in consumption of water that has occurred in advanced countries. The Earth is often described as being a "watery planet," said to have approximately 1,400,000,000 cubic kilometers of water on its surface. Whilst this may be true, only approximately 2.5% of this is fresh water. In addition, 70% of this freshwater is in the form of glaciers, leaving only 0.01% as usable freshwater.

According to United Nations estimates, by the year 2025, 48% of the world population will be "water stressed." Water stress is experienced when a regions annual consumption of water per capita is less than 1,700 cubic meters. "Water scarce" is experienced when a regions annual consumption of water per capita reduces further to below 1,000 cubic meters.

It is through the use of Nitto Denko Group's technology that we will be able to convert ocean water which now accounts for 97.5% of the water on the planet, into usable freshwater.

### The Nitto Denko Group Producing Freshwater

There are a variety of methods that can be used to convert seawater to freshwater, one of which is the distillation method. This method whilst effective is not so energy efficient as it requires a lot of energy to heat seawater. Using the membrane separation method requires less energy expenditure than the distillation method. The Nitto Denko Group's Reverse Osmosis (RO) membrane is used for desalination of seawater.

In 2007 desalination plants with installed RO membrane systems will begin operating at the Escombreras plant in Spain. It is expected that this plant will be able to desalinate seawater at a rate of 64,000m<sup>3</sup>/day. At the Los Cabos plant in Mexico, through the use of the same filtration system, it is expected that 17,300m<sup>3</sup>/day of seawater will be desalinated. In 2008 we are scheduling to open large scaled plants in Algeria, which through utilizing our latest SWC5, seawater desalination RO membrane will be able to produce approximately 300,000m<sup>3</sup>/day of freshwater.

It is expected that when our Algerian operations begin the Nitto Denko Group will be the largest manufacturer of seawater desalination RO membrane in the world and will be producing approximately 2,500,000m<sup>3</sup>/day of desalinated water.

### The Nitto Denko Group's "Membrane" Taking an Active Role in China

In China the market for RO membrane module used to produce industrial pure water has grown as a result of China's general industrial development. Raw water in the form of groundwater or water from rivers is commonly used to produce industrial pure water. Such raw water is used in China as well. Raw water in China however has a higher concentration of various substances such as saline compared to other countries. Given this it is necessary to remove salinity in order to produce pure water. The aforementioned substances can foul RO membrane elements. "PROC10" (Powerful Reverse Osmosis Composite) has four special characteristics that assist in counteracting fouling from occurring. PROC10 is a quality product that the Nitto Denko Group feels will serve our customers well.

The first characteristic relates to PROC10's high salt rejection capability of 99.75% (at our standard test conditions), which boasts the highest level of performance out of any RO membrane-like element being used for the purposes of desalinating groundwater or water from rivers.

The second is fouling resistance. Applying RO membrane to raw water may result in the membrane fouling resulting in a performance decline. Through using a uniquely structured and patented feed spacer, feed channels are secured making it difficult for foulants to remain trapped in the membrane thereby causing fouling of the RO elements. Owing to this useful modification, RO membrane elements become less fouled, and do not require frequent cleaning.

The third characteristic relates to its endurance against chemicals. Once RO elements become fouled they need to be cleaned with chemicals to remove foulants. PROC10 features improved chemical membrane

resistance allows for cleaning using stronger chemicals than those typically used.

The fourth characteristic relates to RO elements and the improved ATD (Anti-Telescoping Device) and air vent mechanism. RO elements are usually installed in pressure vessels. In cases where the air between the elements and the vessels is not adequately purged, the elements can be badly damaged. This improved ATD allows air to pass through the recessed vents from between the elements and vessels thereby preventing damage.

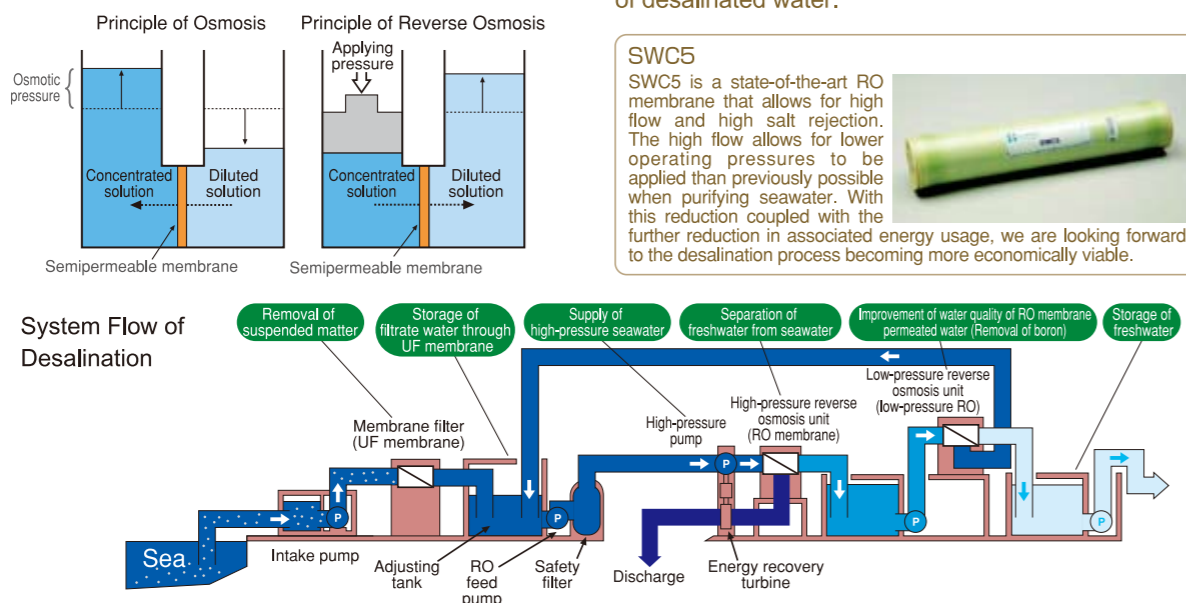
Hydranautics in the U.S.A., part of the Nitto Denko Group specializes in the separation membrane business and has globally developed its business through the production of membrane products. In China there are membrane element production plants and sales bases of another subsidiary company of Nitto Denko Corporation. The Nitto Denko Group aims to strengthen its presence in China along with these overseas sites.

### Worldwide Business of Diversified Separation Membrane

In the world of membrane applications, two other main membranes exist, these being the ultrafiltration membrane (UF membrane) and the micro filtration membrane (MF membrane). They are used in the processing of dairy products, in adjusting fruit juice and in refining treatment processes associated with both alcoholic beverages and seasoning production.

UF membrane consists of a skin and a sponge layer, through which high-molecular-weight substances like viruses are not permeable, but water, ion and low-molecular-weight substances are. The pores of the MF membrane are larger than those of the UF membrane and are able because of this to separate fine particles of bacteria in liquid solutions of between 0.05~10µm.

The Nitto Denko Group established a joint venture company with Mitsubishi Rayon Co., Ltd. in 2007. Through combining technology from both Mitsubishi Rayon Co., Ltd. and the Nitto Denko Group we are confident that we will continue to provide total solutions to customers in the water treatment membrane field. This joint venture is sure to give our membrane business a new market advantage.



**SWC5**  
SWC5 is a state-of-the-art RO membrane that allows for high flow and high salt rejection. The high flow allows for lower operating pressures to be applied than previously possible when purifying seawater. With this reduction coupled with the further reduction in associated energy usage, we are looking forward to the desalination process becoming more economically viable.

