

China Power Plant Installs Advanced Integrated Membrane System (IMS) to Reduce Capital Costs and Decrease Energy Use

For many years Double-pass RO + EDI systems have been a widely used water treatment combination to produce ultra-pure water. However, as engineers come under increasing pressure to reduce maintenance and operating costs, alternative system designs are being considered. Integrated Membrane Systems (IMS) have come to the forefront of the industrial water treatment industry. An Integrated Membrane System is an industrial water treatment system that combines multiple membrane-based water treatment processes into a single system.

A heat and power plant in Northeast China selected an Integrated Membrane System (IMS) design over a conventional system for its water treatment process. The conventional design option incorporated both membrane and non membrane technologies into the system and used a double-pass RO design before Electrodeionization (EDI). (See figure 1.)

The Liqui-Cel Membrane Contactors used in this system are microporous Hollow Fiber membrane devices that remove dissolved gasses from liquids. Gas flows across one side of the membrane and liquid is on the other side. Because the membrane is hydrophobic only the gasses can pass through the pores.

Lowering the partial pressure of the gas allows the dissolved gasses in the liquid to easily transfer through pores in the membrane wall of the Hollow Fiber.

System Configuration

Flow rate: 2 x 80 m³/h Integrated Membrane Systems

- 1) UF flow rate: 120 m³/h
- 2) RO system flow rate: 90 m³/h;
- 3) Liqui-Cel CO₂ removal technology flow rate: 90 m³/h;
- 4) EDI flow rate: 80 m³/h

Liqui-Cel® Membrane Contactor Operating Conditions

- 90 m³/h water flow
- Two 14 inch contactors in parallel
- X-50 membrane
- Operating mode: combo with air sweep and vacuum
- Vacuum pump: 360 m³/h at vacuum level: -0.094 Mpa (55 mmHg)

Water Quality Summary

RAW WATER QUALITY ANALYSIS

TDS	406 - 600 mg/l
pH	7.5 - 7.7
Total Alkalinity	280 mg/l (as CaCO ₃)
SiO ₂	5.5ppm

RO PERMEATE ANALYSIS

Conductivity	6.8 µs/cm
CO ₂ Concentration	10 - 12ppm

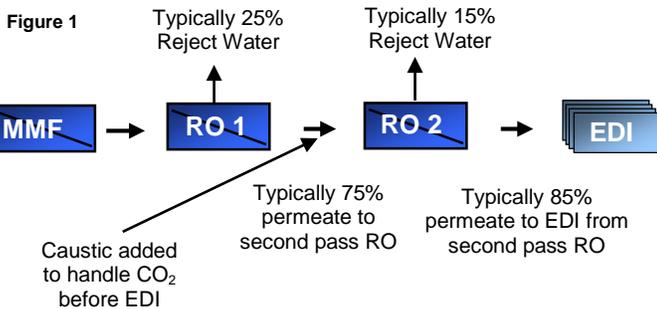
LIQUI-CEL MEMBRANE PERMEATE WATER QUALITY

Outlet CO ₂ Concentration	1 - 2ppm (actual result)
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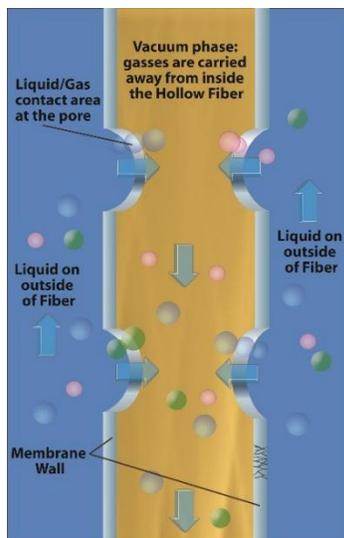
EDI PERMEATE WATER QUALITY

Conductivity	0.071 - 0.06 µs/cm (14 - 16.7 MΩ)
SiO ₂	5ppb

Conventional System Design – Double Pass RO



The IMS design selected for this plant incorporated membrane-based technologies for all four of the major system components: Ultrafiltration (UF), single pass Reverse Osmosis (RO), Liqui-Cel® Membrane Contactors (LMC) for CO₂ removal, and Electropure™ Electrodeionization (EDI).

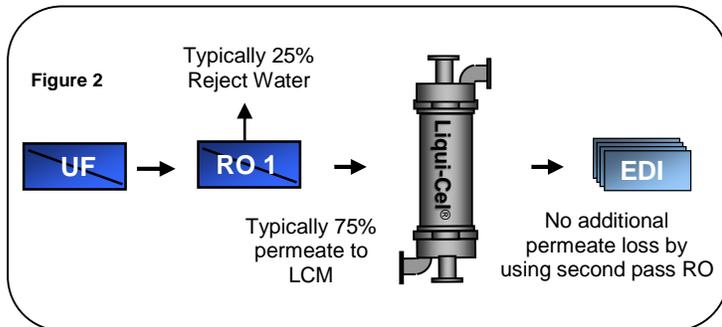


The IMS design (see figure 2) was selected over the conventional system because it lowered capital and operating costs. Additionally, the water reclaim rate was greatly improved compared with the traditional MMF process.

Benefits of Integrated Membrane Systems Compared with Conventional Processes

- The RO + Liqui-Cel® Contactor system eliminates the need for a second pass RO and an RO pump. This reduces capital costs and lowers the power required to operate the system because there is no longer a need for a second RO pump.
- Water is saved as the reject water from the second pass RO in the conventional double-pass RO system is no longer lost. (See Figure 2.)
- Since Liqui-Cel Membrane Contactors remove the CO₂, chemical consumption at the plant is reduced due to the elimination of caustic formerly required to increase pH before the second pass RO. (Compare figure 1 to figure 2.)
- The Liqui-Cel Membrane Contactor system also has a smaller footprint compared to the system utilizing a second pass RO.
- Dissolved CO₂ and SiO₂ compete for EDI capacity. By removing free CO₂ from the EDI feedwater, silica removal efficiency may be improved.

IMS Design with Single Pass RO and Membrane Degassing



The Liqui-Cel Contactor system offers other unique benefits. This system can remove both carbon dioxide and oxygen at the same time. If the water is used for other applications, such as boiler feed water, the system can deliver water with a high resistivity and low levels of dissolved oxygen.

For more information and system sizing, please contact your Membrana representative or visit us online at www.Liqui-Cel.com.

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