TOYOBO

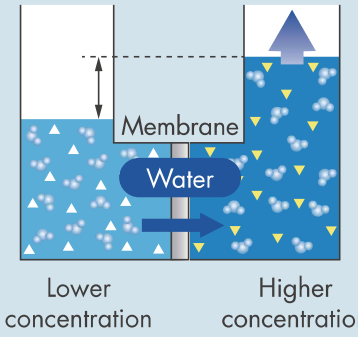
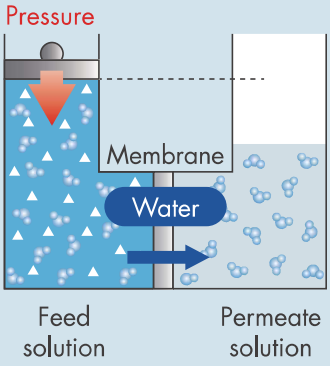
TOYOBO MC Corporation

FO

TOYOBO MC Membrane Module for Forward Osmosis

•Contents on this catalog will be changed without any announcement.

1 Concept and application of FO

	Forward Osmosis	Reverse Osmosis
Principle		
Driving Force	Osmotic Pressure	Hydrostatic Pressure
Application	**Seawater desalination, Pressure retarded osmosis,** Wastewater treatment	Seawater desalination, Wastewater treatment

2 Advantages of TOYOBO MC's FO

Higher surface area for efficient operations

X10 area compared to Flat Sheet membranes

Superior biofouling control

Chlorine-tolerant membrane material

Reliable and stable operation

Less frequent chemical cleaning
Less frequent membrane replacement

Uniform flow of feed and draw solution

Less channeling and pressure loss

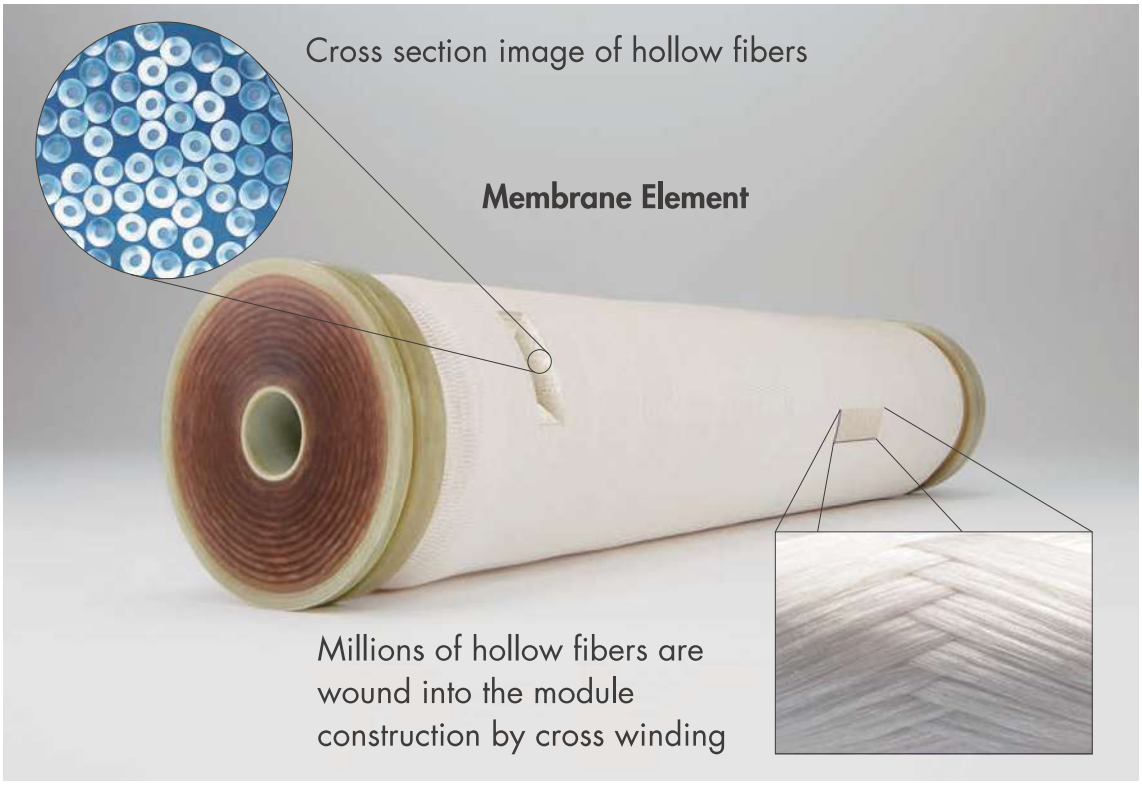
Small wall thickness

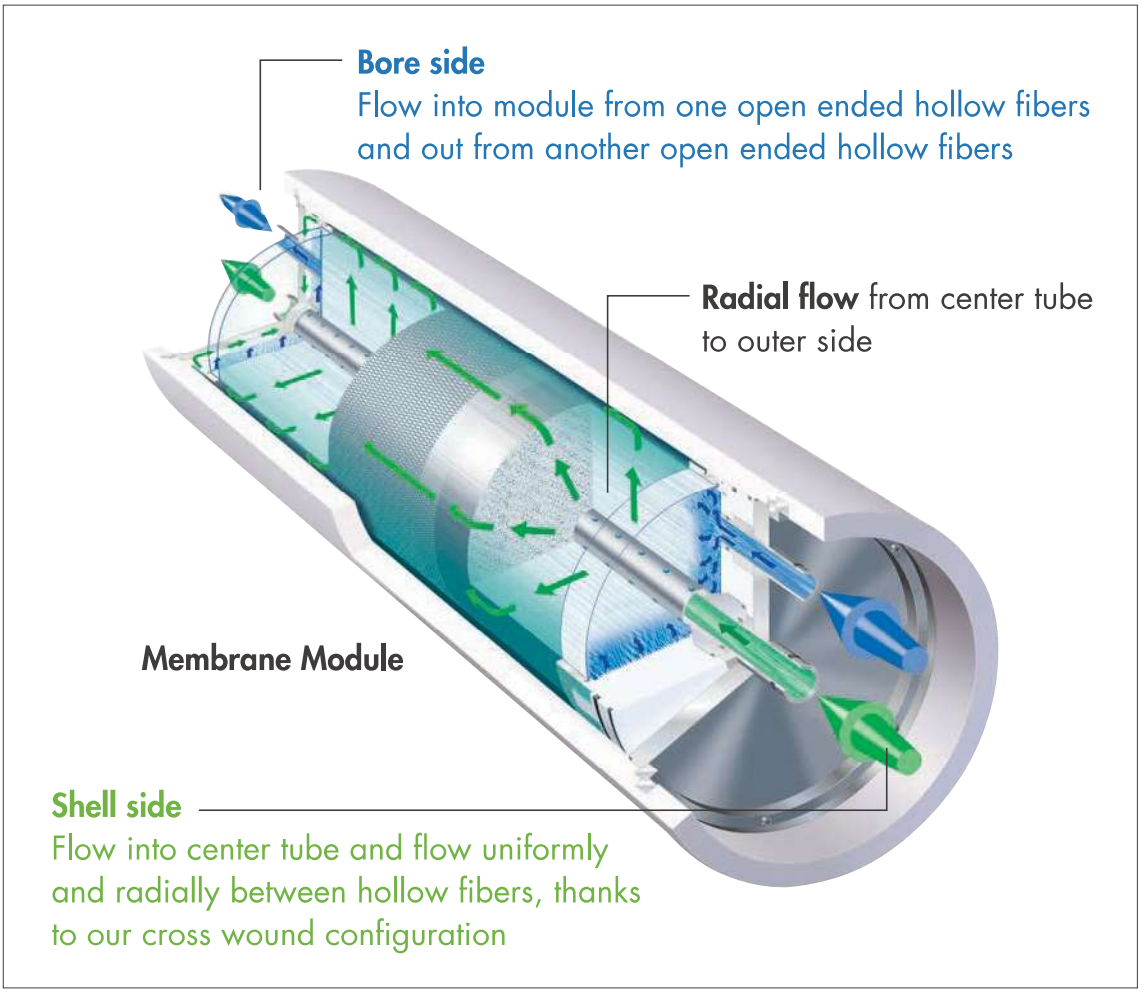
Larger effective osmotic pressure difference

High salt rejection

Low back diffusion

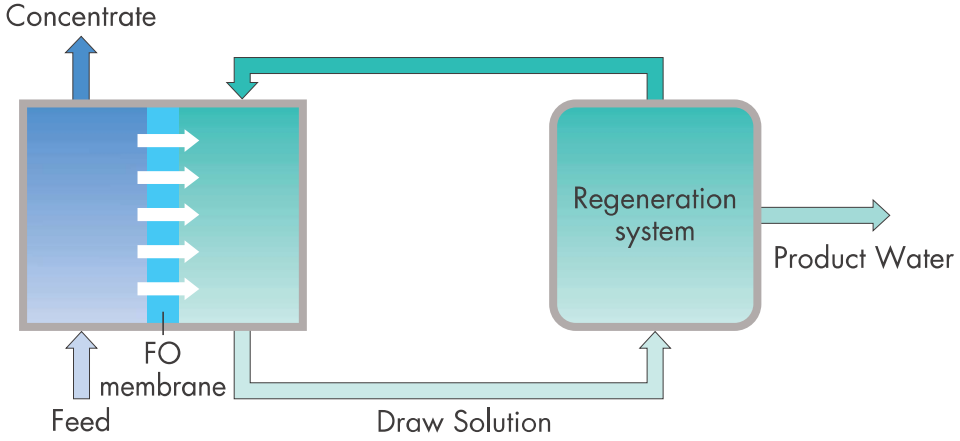
3 TOYOBO MC's FO membrane element & module





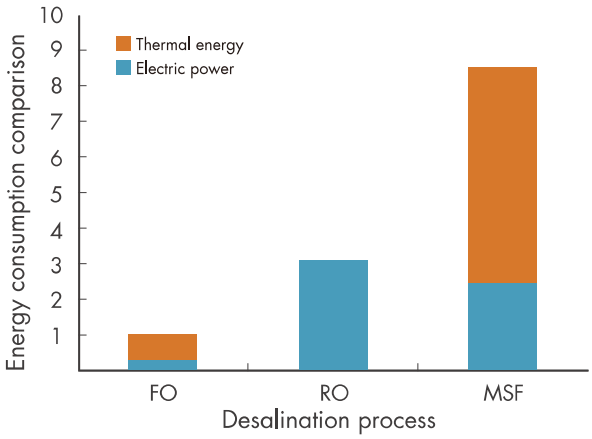
4 FO sea water desalination

Extensive pre-treatment, high pressure pump and piping are not necessary



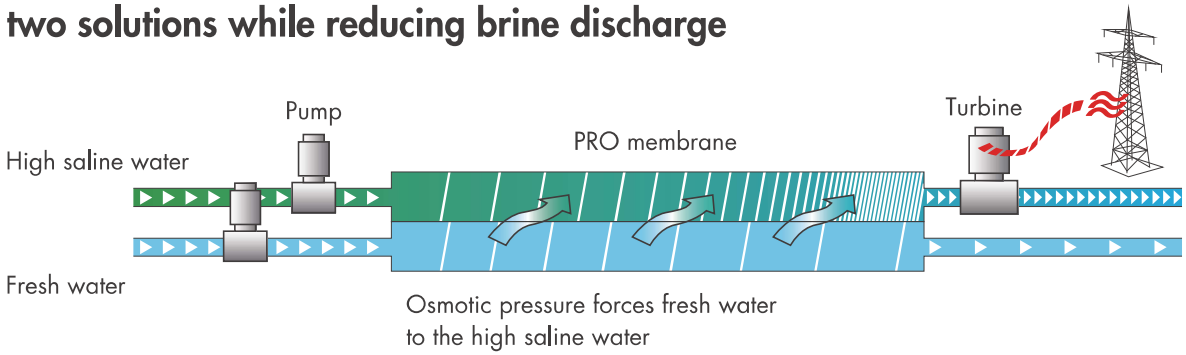
- ✓Less fouling potential
- ✓No or little pretreatment and chemicals
- ✓No high pressure pumps

FO is an efficient alternative to RO



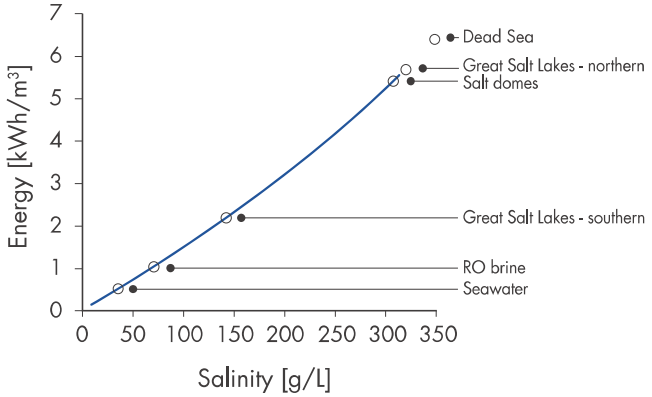
5 PRO power generation

Stable power generation by using the concentration difference between two solutions while reducing brine discharge



- ✓No heat emission
- ✓No chemical reaction
- ✓Stable under any weather condition

PRO has already been considered applicable to commercial-scale plant



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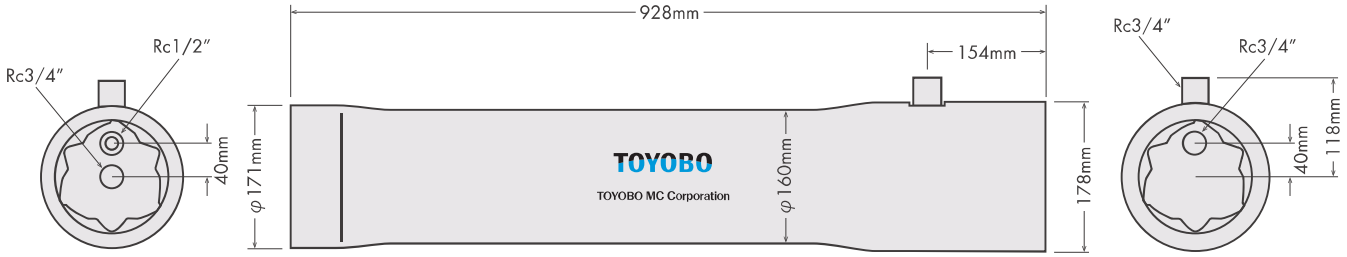


Product specification

Material	Cellulose triacetate(CTA)
Type	Hollow fiber membrane
Fiber outer diameter	200 μm
Fiber inner diameter	105 μm
Membrane surface area	60 m^2

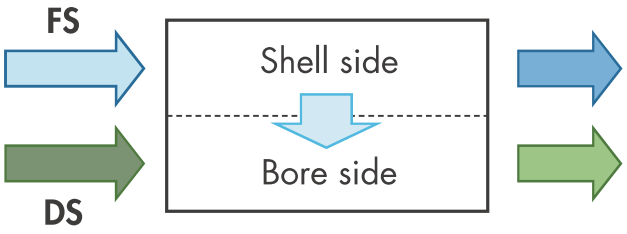
· Cleaning solution

2 wt% citric acid pH 4 (pH adjustment with NH_4OH)

· Preservation solution

500 mg/L SBS +1,000 mg/L SBA solution

*SBS: Sodium Bisulfite , SBA: Sodium Benzoate



Operating conditions

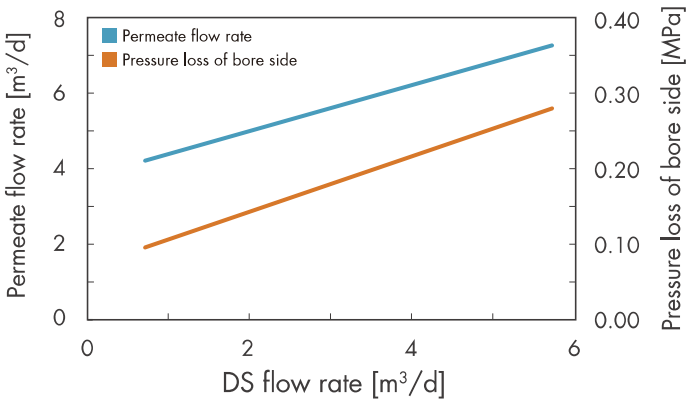
	Shell side	Bore side
Pressure	~3 MPa	~1 MPa
Temperature	5-40 ℃	
pH	3-8	

Performance example of AL-FS operation

Conc. of DS : 1 M

Conc. Of FS : DI water

Recovery rate : 50 ~ 60 %



*Pressure on bore side should be lower than pressure on shell side

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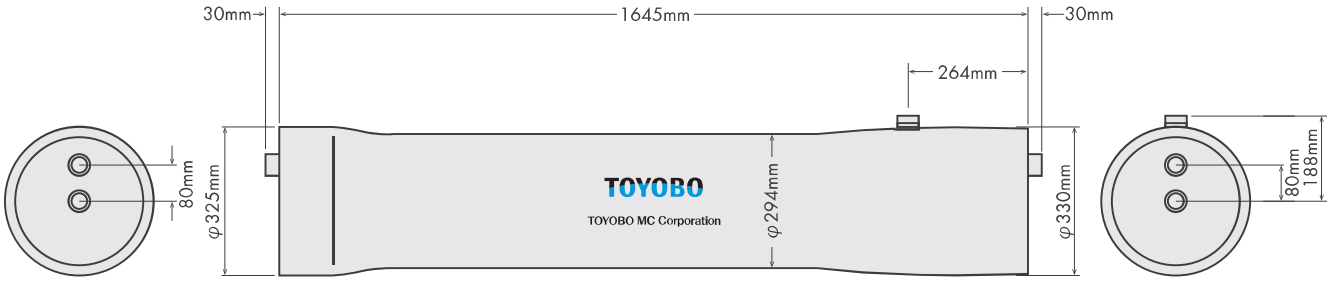

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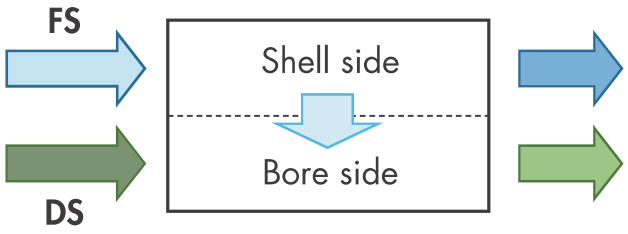

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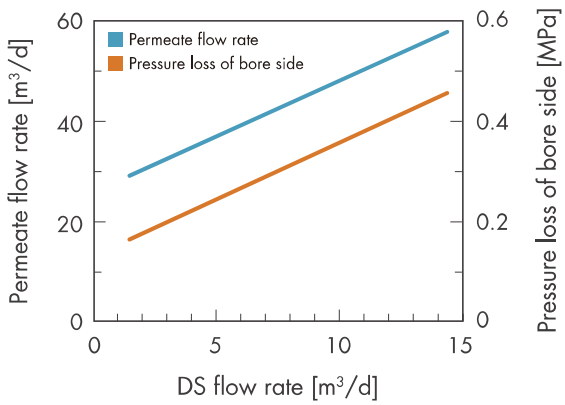
Performance example of AL-FS operation

Conc. of DS : 1 M

Conc. Of FS : DI water

Recovery rate : 55 ~ 70 %



*Pressure on bore side should be lower than pressure on shell side

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