TOYOBO

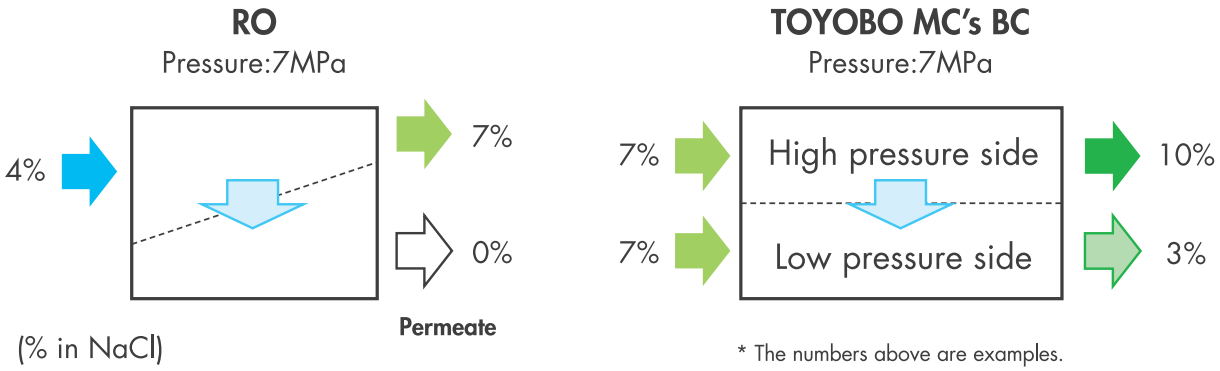
TOYOBO MC Corporation

BC

TOYOBO MC Membrane Module for Brine Concentration

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

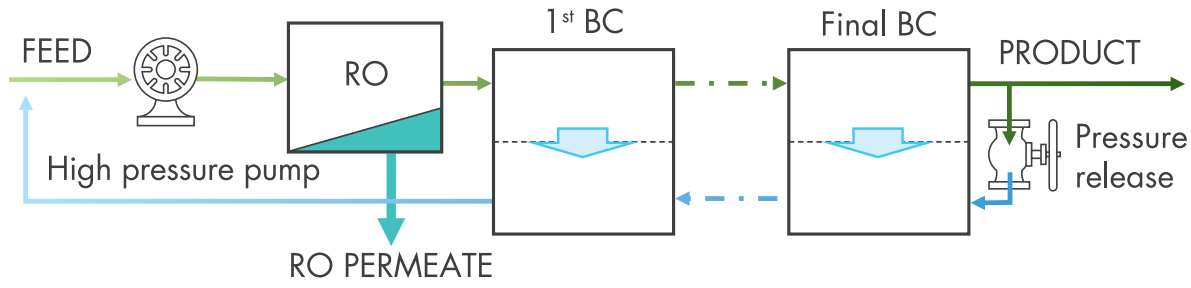
1 Concept of TOYOBO MC's BC (Brine Concentration)



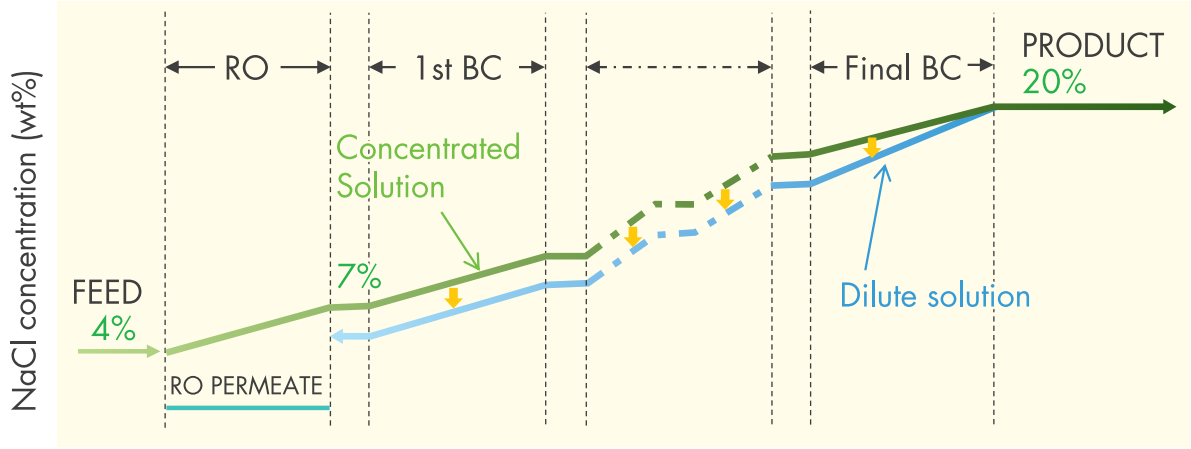
The same or similar concentrated solutions are applied to both shell side and bore side and a certain pressure is applied to one side, **the same osmotic pressure difference as applied hydraulic pressure** can be obtained

Higher concentration rate than RO membrane is available

2 Stage Configuration of BC Process



Concentration change in series arrangement

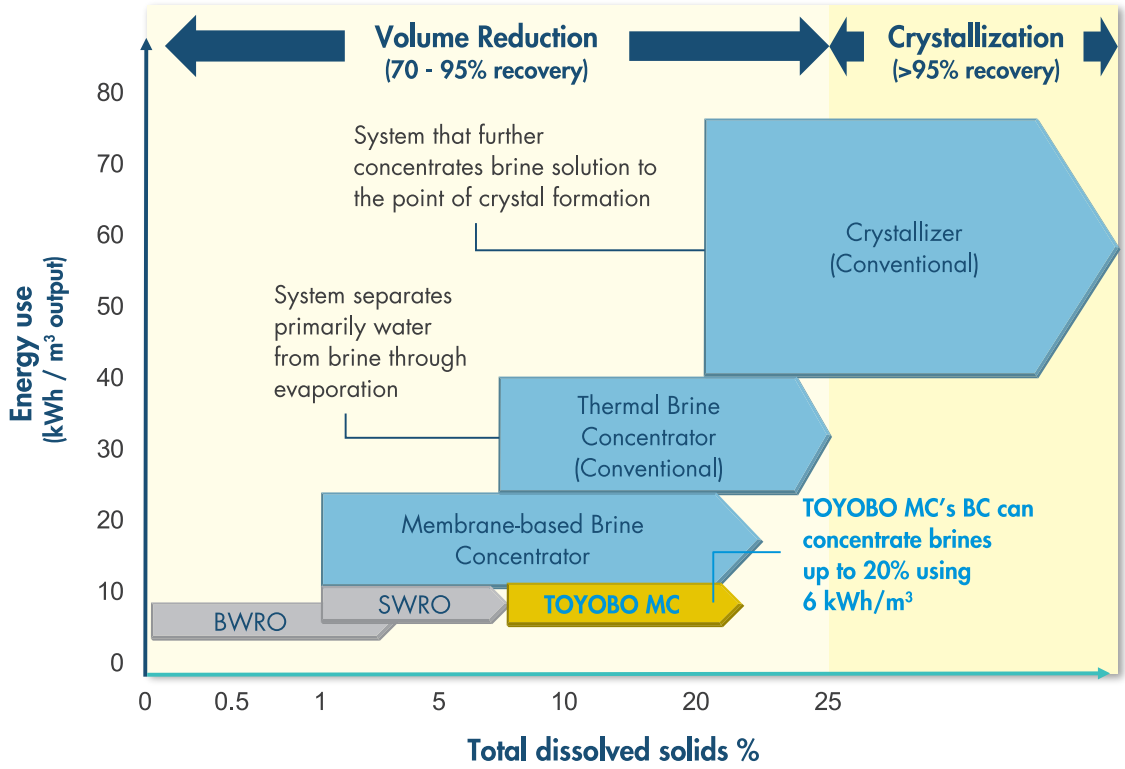


Lower concentration gap between inlets of both sides enables you to achieve 20% NaCl with minimum energy inputs using only one high pressure pump

3 Applications of TOYOBO MC's BC Process

- **Reduce CAPEX and OPEX** in thermal evaporator and crystallizer ZLD systems
- **Minimize the volumes** of difficult-to-treat wastewater
- **Deliver higher recovery** for desalination
- **Increase wastewater reuse rates** for various industries
- **Recover valuables** from wastewater

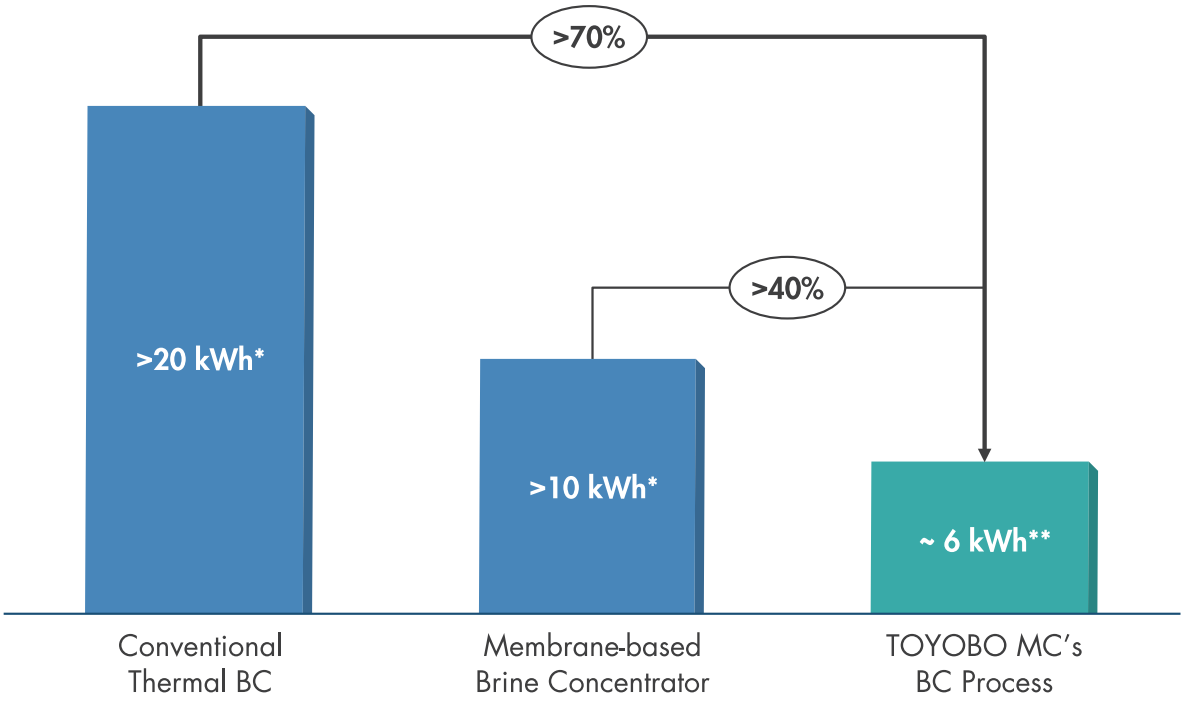
4 Energy Intensities of BC/ZLD Process



Note: Low-grade waste heat is not included in the energy consumption

Sources: GWI, Amane Advisors

5 Energy Consumption Comparison



NOTE:

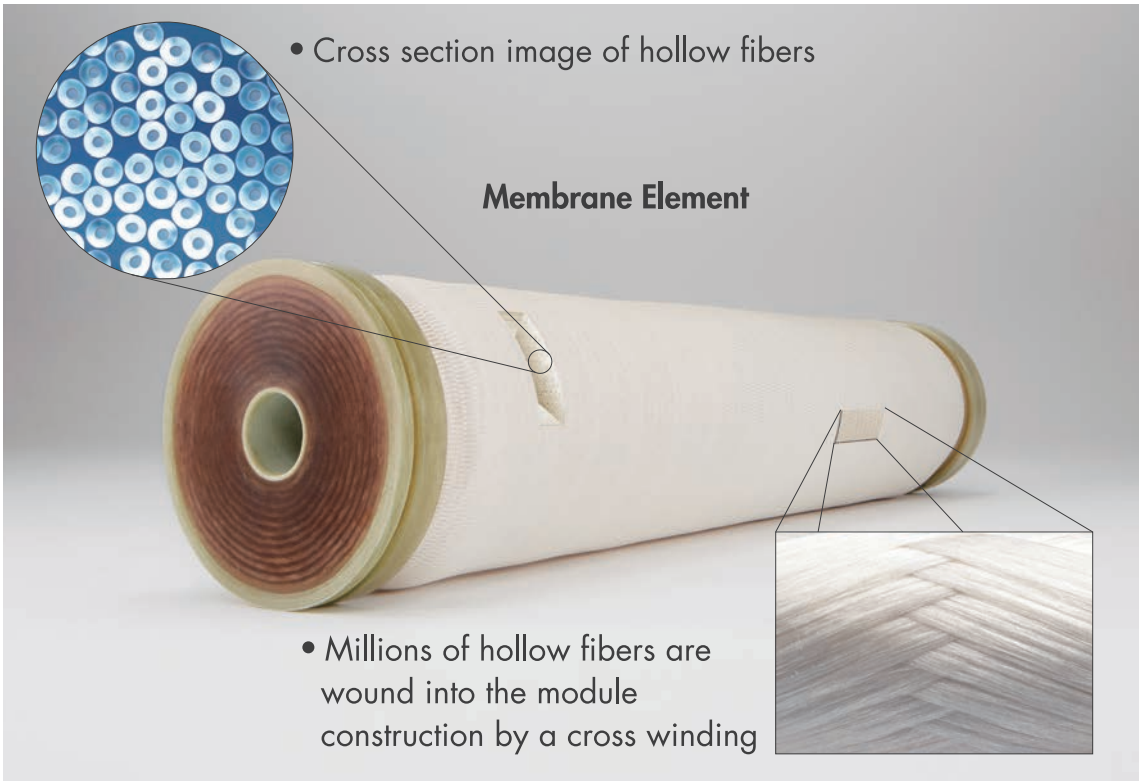
*Literature review and expert inputs on a typical energy requirement to achieve NaCl 20%

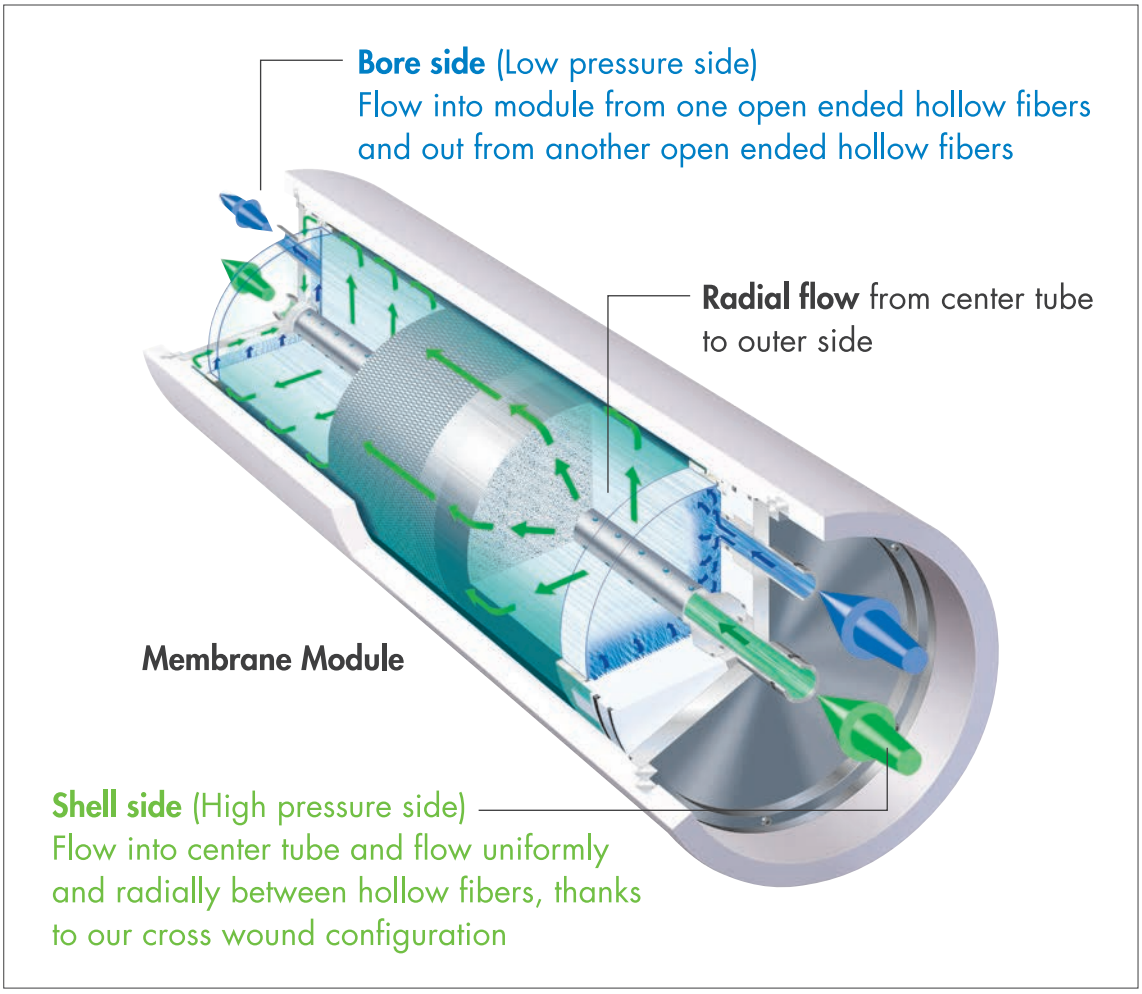
**TOYOBO MC's process is based on NaCl 4% feed solution at a capacity of 100m3/day, operated at the pressure of 7MPa to achieve NaCl 20% Low-grade waste heat is not included

6 Advantages of TOYOBO MC's BC Process

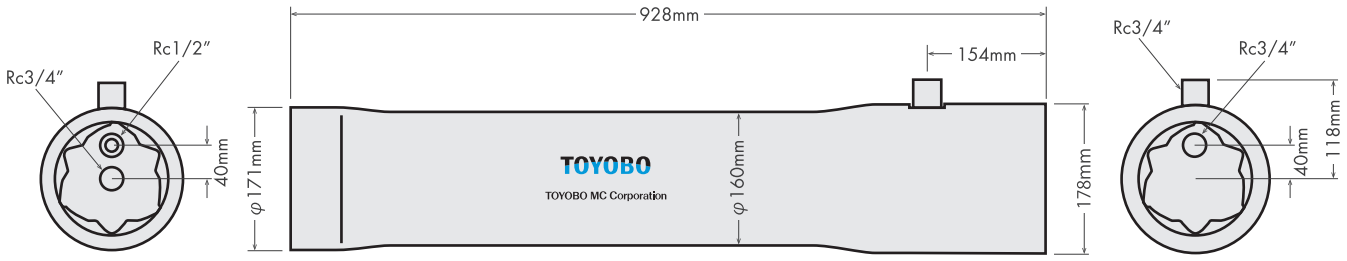
- **Only supplier of Hollow Fiber CTA membranes**
- **Capable of achieving higher concentration levels** (20% NaCl) using less energy (7MPa)
- **Max.70% energy savings** compared to other process
- **Chlorine-tolerant membrane material** minimising biological fouling
- **No need for draw solution** like Forward Osmosis
- **High membrane surface area** for efficient operations and reduced fouling
- **Greater pressure resistance,** enabling applications for various usages

7 TOYOBO MC's BC Membrane Element & Module





FB5255S series



Product specification

Material	Cellulose triacetate(CTA)
Type	Hollow fiber membrane
Fiber outer diameter	200 μm
Fiber inner diameter	90 μm
Membrane surface area	60 m^2

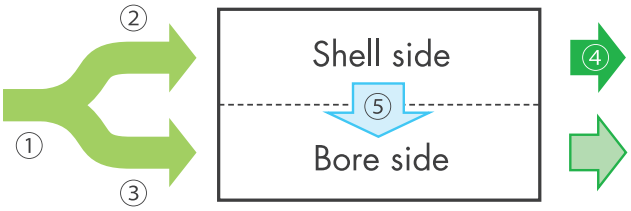
· Cleaning solution

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



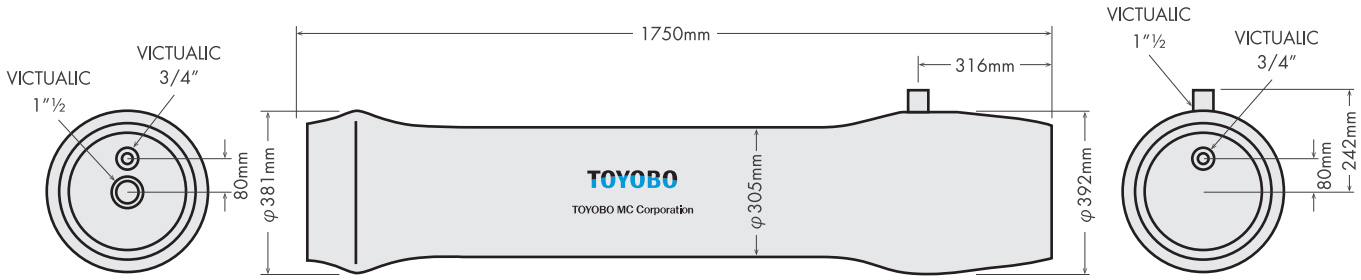
Operating conditions

	②	③
Pressure	~ 7 MPa	~ 3 MPa
Flow rate	1-14 m^3/d	Dependent on condition
Temperature	5-40 ℃	
pH	3-8	

Performance example

①	②		③		④	⑤
Conc. [wt%]	Pressure [MPa]	Flow rate [m^3/d]	Pressure [MPa]	Flow rate [m^3/d]	**Conc. [wt%]**	Flow rate [m^3/d]
7.0	7.0	3.0	0.3	2.0	**10.0**	0.9
10.0	7.0	3.0	0.3	2.0	**12.4**	0.6
15.0	7.0	3.0	0.3	2.0	**16.7**	0.4

FB10155S series

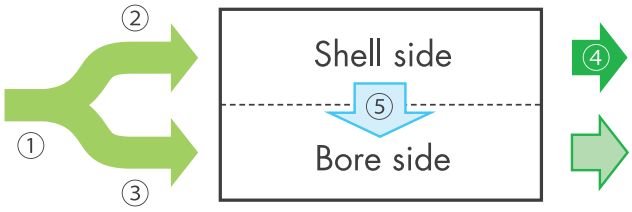


Product specification

Material	Cellulose triacetate(CTA)
Type	Hollow fiber membrane
Fiber outer diameter	200 μm
Fiber inner diameter	90 μm
Membrane surface area	600 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

	②	③
Pressure	~ 7 MPa	~ 3 MPa
Flow rate	15-140 m^3/d	Dependent on condition
Temperature	5-40 ℃	
pH	3-8	

Performance example

①	②		③		④	⑤
Conc. [wt%]	Pressure [MPa]	Flow rate [m^3/d]	Pressure [MPa]	Flow rate [m^3/d]	**Conc. [wt%]**	Flow rate [m^3/d]
7.0	7.0	30.0	0.7	17.0	**10.6**	10.7
10.0	7.0	30.0	0.7	17.0	**12.9**	7.1
15.0	7.0	30.0	0.7	17.0	**17.0**	4.0

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